COURSE DESIGN

Semester	Title	Course	Credit	Hours/week
First semester				
BA1CRT01	Principles and Methodology of Management	Core	4	6
BA1CRT02	Business Accounting	Core	4	6
BA1CMT03	Fundamentals of Business Mathematics	Complementary	4	4
BA1CMT04	Fundamentals of Business Statistics	Complementary	4	4
EN1CCT01	English Paper –I	Common	4	5
			20	**25**
Second semester				
BA2CRT06	Cost and Management Accounting	Core	4	6
BA2CRT07	Business Communication	Core	4	6
BA2CMT08	Mathematics for Management	Complementary	4	4
BA2CMT09	Statistics for Management	Complementary	4	4
EN2CMT09	English Paper –II	Common	4	5
			20	**25**
Third Semester				
BA3CRT11	Human Resource Management	Core	4	5
BA3CRT12	Marketing Management	Core	4	5
BA3CRT13	Research Methodology	Core	4	5
BA3CMT14	Business Laws	Complementary	4	5
BA3PRP15	Personality Development and Management Skills (Minor Project)	Core	4	5
			20	**25**
Fourth Semester				
BA4CRT16	Financial Management	Core	4	5
BA4CRT17	Managerial Economics	Core	4	5
BA4CRT18	Entrepreneurship	Core	4	5
BA4CMT19	Basic informatics for Management	Complementary	4	5
BA4CMT20	Corporate Law	Complementary	4	5
			20	**25**

Fifth Semester				
BA5CRT21	Organisational Behaviour	Core	4	6
BA5OPT22	Open Course	Open	3	4

BA5CRT23	Environment Science and Human Rights	Core	4	5
BA5CMT24	Intellectual Property Rights and Industrial Laws	Complementary	4	5
BA5CRT25	Operations Management	Core	2	2
BA5CRT26	Industrial Relations	Core	3	3
			20	25
Sixth Semester				
BA6OCT27	Optional-I	Optional (Core)	4	5
BA6OCT28	Optional-II	Optional (Core)	4	5
BA6CRT29	Strategic Management	Core	4	5
BA6CRT30	Communication Skills and Personality development	Core	4	5
BA6PRP31	Management Project	Core	4	5
			20	**25**
	Grand Total		**120**	**150**

Open course

BA5OPT22 (a). Brand Management

BA5OPT22 (b) Entrepreneurial Leaders

Optional

Optional I

BA6OCT27. (a) Healthcare Management

OR

BA6OCT27.(b) Introduction to Retail Management

OR

BA6OCT27. (c) Investment and Insurance Management

OR

BA6OCT27. (d) Event Management

Optional II

BA6OCT28. (a). Advertisement and Salesmanship

OR

BA6OCT28. (b). Supply-Chain Management OR

BA6OCT28.(c). Principles of Tourism Management

FIRST SEMESTER

BA1CRT01. PRINCIPLES AND METHODOLOGY OF MANAGEMENT

Core Course	
No. of credit	**4**
No. of contact hour	**6**

Aim of the course

Principles and Methodology of Management are the basic foundation for management studies. This course offers a methodological perspective about this subject.

Objective of the course

- Methodological Perspective of Management as a discipline
- Principles and functions of Management
- Process of decision making
- Modern trends in management process

MODULE I:

Nature and scope of management process, definition of management-management: a science, an art or profession?, scientific management, administrative management, human relations management. Contributions of Taylor, Fayol, Max Webber, Gilberth, Gantt, Chester Bernard, Elton Mayo, Peter Drucker

MODULE II: Planning

Definition, meaning, Importance, steps in planning, characteristics types of plans - objectives, strategies, policies, procedures, rules, programmes and Budgets, Relationship between planning and controlling, limitations of planning.

Decision making - definition, meaning, objectives, steps in rational decision making, Types of decisions, Difficulties in decision making

MODULE III: Organizing

Meaning importance, process of organizing, organizations structure, Types of organization structure - line organizations, line and staff organizations, Functional organization, committees.

Delegation of authority, significance of delegation, process of delegation. Centralisation& decentralisation of authority.

MODULE IV: Staffing

Meaning and importance only (This topic in covered in detail in HRM) Directing - Meaning, importance, elements of directing.

MODULE V: Controlling

Co-ordination, need for co-ordination, meaning and importance of controls, control process, budgetary and non-budgetary controls

Reference Books:

SI No.	Title	Author	Publishing & Year
1	Principles of management	P.C. TRIPATHI &P.N. Reddy	Tata McGraw Hill publishing co.
2	Essentials of management	Harold Koontz &Weihrich	Tata McGraw Hill Publishing co. 2015
3	Fundamentals of Management Essential concepts and applications	Stephen P Robbins, Sangamitra Bhattacharya & et al.	Pearson 8th edition 2015
4	Management Global Perspectives	Harold Koontz &Weihrich	Tata McGraw Hill Publishing co. 2015
5	Principles and Practice of Management	L M Prasad	Sultan Chand And Sons 8th Edition

BA1CRT02: BUSINESS ACCOUNTING

Core Course	
No. of credit	**4**
No. of contact hour	**6**

Aim of the course

To impart basic knowledge about the system of accounting

Objective of the course

On completion of this course students should be able

- To understand the basics of accounting
- To identify the basics principles of accounting
- To understand the systems /process for recording transactions
- To prepare the final accounts of sole trader
- To give a general awareness about depreciation accounting
- To know about the concept of bill of exchange in business

MODULE I

Introduction of accounting •Origin •meaning, definition-need importance-functions - limitations-accounting principles-Generally accepted accounting principles-accounting equation- double entry system.

MODULE II

Recording transactions •journal-ledger-trial balance-cash book (single column bank column, and with discount column) - bank reconciliation statement

MODULE III

Accounting for depreciation-meaning-importance-methods of providing depreciation (Straight line, diminishing, annuity)-reserves and provisions

MODULE IV

Final accounts of sole trader- manufacturing, trading, and profit and loss account and balance sheet

MODULE V

Bill of exchange •meaning, definition- importance promissory note-recording bill transaction (honouring, dishonouring, discounting)

***Note**: on course work every lecture should be complemented by an appropriate activity examples: practical problem collection of accounting data from sole proprietors, preparation of accounting records of a sole trader*

Core text:

Business accounting- Jain and Narang

Reference text

Advanced accounting -Jain and Narang

Advanced Accountancy, MA Arulanandam and KS Raman, Himalaya Publications, Mumbai

BA1CMT03 FUNDAMENTALS OF BUSINESS MATHEMATICS

NPC and logarithm tables permitted

Complementary Course No. of credit 4 No. of contact hour: 4	

Aim of the course

To develop analytical and critical thinking skills in students to prepare them to logically analyse and critically evaluate problem situation through basic mathematics.

Objectives of the course

- Develop scientific ability
- Critically evaluate mathematical problems
- To have fundamental touch with industrial and commercial problems
- To know about modern trends in mathematics
- To prepare them for management studies.

Course outline

MODULE-I: Set theory

Modern theory in mathematics, Definition, elements and types of sets, operations on sets and Cartesian product of two sets.

MODULE-II: Algebra-1

Number system-Natural numbers, prime numbers, integers, rational and irrational numbers, Ratio, proportion and variation Sequences

MODULE-III: Algebra-2

Permutations and combinations, Logarithm, Compound interest and depreciation.

MODULE-IV: Matrices

Matrices, matrix operations, Determinant of a square matrix (expansions only) and Rank of a matrix.

MODULE-V: System of linear equations

Inverse of square matrix (problems only). Solution of system of linear equations using matrices.

Note on course work.

This subject being pure science subject, this is taught directly in classrooms as lecture. Students are requested to give suggestion and ask doubt for critical evaluation. Proof of theorems and derivations are excluded, as it is beyond the scope of a B.B.A student. Basic mathematics is required for all subjects under commerce.

Ref.Texts: 1) Business Mathematics - S.Saha

2) Business mathematics -D.C. Sanchet& V.K Kapoor (Sultan Chand & Sons)

BA1CMT04 FUNDAMENTALS OF BUSINESS STATISTICS

(Use of scientific calculators is permitted)

Complementary Course No. of credit : 4 No. of contact hour: 4	

Aim of the course

To provide a reasonable idea of basic statistical methods needed for a statistical investigation and forecasting.

Objective of the course

On completion of the course, student should be able

- To present a broad overview of statistics as a subject.
- To organize a statistical survey.
- To understand the importance of summary measures to describe the characteristics of data set.
- To analyse the relationship between two variables.
- To use various forecasting techniques.

Course Outline

MODULE I: Introduction

Origin, Meaning, Scope and limitations of statistics. Relationship with business and industry.

MODULE II: Collection of data

Collection, classification and tabulation of statistical data. Pie diagrams. Graphic representation.

MODULE III: Measures of central tendency and dispersion

Mean, Median and Mode. Measures of dispersion- standard deviation. Coefficient of variation.

MODULE IV: Simple correlation and Regression.

Meaning, Karl Pearson's Correlation, Rank correlation, Computations. Uses, Regression equations - Forecasting.

MODULE V: Time series analysis:

Components of time series - Definition, Computation of Trend. Computation of seasonal variation (Simple average method only)

Note on course work:-

This course should not be taught is the conventional lecture method alone. It should be supported by a statistical study based on real life situations.

Texts:-

1. Statistical methods: - S.P. Gupta
2. Fundamental of Mathematical statistics - S.C. Gupta & V.K. Kapoor
3. Basic Statistics: B.L. Agarwal.
4. An introduction to statistical methods: - C.B. Gupta.
5. Gupta, S.C., Fundamentals of Statistics, *Himalaya Publishing House.*

BA1CCT05.ENGLISH PAPER I

Common Course	
No. of credit	**4**
No. of contact hour	**5**

SECOND SEMESTER

BA2CRT06. COST AND MANAGEMENT ACCOUNTING

Core Course	
No. of credit	**4**
No. of contact hour	**6**

MODULE I

Cost Accounting- Meaning, Definition, Scope, Objectives- Distinction between Cost and Financial Accounting- Preparation of Cost Sheets.

MODULE II

Material Cost- Purchasing Procedure- Stores Control- E.O.Q, Stock Levels- Pricing of Material Issues- Labour Cost- Labour Turnover- Methods of Wage Payment.

MODULE III

Overhead Cost- Allocation and Apportionment- Reconciliation of Cost and Financial Accounts

MODULE IV

Management Accounting- Meaning, Definition, Scope, Objectives-Management Accounting as distinct from Cost Accounting and Financial Accounting- Budgetary Control- Classification of Budgets(Emphasis on theory).

MODULE V

Cost- Volume- Profit Analysis- Standard Costing- Analysis of Material and Labour Variances.

Reference

Sl No.	Title	Author	Publishing & Year
1	Cost and Management Accounting	Debarshi Bhattacharyya(Ratul)	Pearson
2	Advanced Management Accounting	J Madegowda	Himalaya Publishing House, Mumbai

BA2CRT07 BUSINESS COMMUNICATION

Core Course	
No. of credit	**4**
No. of contact hour	**6**

Aim of Course

To understand the nuances of business communication

This course should be taught by providing group discussion and seminars.

MODULE- I Basis of communication

Meaning, importance & process, Need & objectives of communication,

7c's of communication, Barriers of communication, How to overcome communication Barrier. (Practical exercises in communication)

MODULE- II

Means /Media of communication - verbal &Non-verbal communication channel of communication formal & informal communication.

Types of communication. Downward, upward, Horizontal or lateral, Diagonal or cross

MODULE- III Listening as a communication Tool

Importance types of listening, Barriers to effective Listening. How to make listening effective.

MODULE- IV Groups

Business Letter Writing: - Need, Functions and kinds, Letters, Request Letters, Sales Letters, Complaints and adjustments, Departmental Communication: Meaning, Need and Types, Interview Letters, Promotion Letters, Resignation Letters, News Letters, Circulars, Agenda, Notice, Office Memorandums, Office Orders.

MODULE-V. New Trends in Business communication.

E mail, Teleconferencing, video conferencing, SMS

References

Sl No.	**Title**	**Author**	**Publishing & Year**
1	Business communication	R.C. Bhatia.	Ane Books Pvt. Ltd.
2	Business communication	R.K. Madhukar	Vikas Publishing House Pvt Ltd
3	Effective Technical communication	Ashraf Rizvi	McGraw Hill Education (India) Private Limited
4	Business communication essentials	Courtland Bovée And John Thill	Pearson,2015
5	Fundamentals of business communication	P D Chaturvedi, MukeshChaturvedi	Pearson, 2012

BA2CMT08 MATHEMATICS FOR MANAGEMENT

Complementary Course
No. of credit 4
No. of contact hour: 4

Aim of the course

To develop analytical and critical thinking skills and to analyse managerial problems in the light of mathematics and solving in such situations.

Objectives of the course

- To develop scientific ability
- To know about modern trends in mathematics
- To know about problems in industry and management and to learn how to solve the problem
- To have research in Managerial Sciences.

Course outline

MODULE I: Plane Analytic Geometry -1

This module consists of Cartesian coordinate system, Length of line segment, Section formulae, area of a triangle and collinearity of three points.

MODULE II: Plane Analytic Geometry -2

Gradient of a straight line, different equations of straight lines, parallelism and perpendicularity and concurrency of three lines.
(All derivations in analytic geometry excluded)

MODULE III:

Arithmetic Progression, sum of the series in AP

MODULE IV:

Geometric Progression, Sum of series in GP

MODULEV:

Calculation of interests and discounts, Present value and annuities, Computing present value of money, Computing present value of annuities.

Note on course work.

This is basically a pure science subject and taught directly in classrooms. Students' participation in various fields of applicability is needed for this course. Proof of theorems and derivations are excluded, as it is beyond the scope of a B.B.A student. But applications in business are to be highlighted.

Ref.Texts:

1. Business Mathematics -S.Saha

2. Business Mathematics -D.C. Sanchet& V.K Kapoor (Sultan Chand & Sons)

3. Business Mathematics –Lloyd D Brooks, AITBS Publishers and distributers, New Delhi

BA2CMT09 STATISTICS FOR MANAGEMENT

(Use of Statistical Tables & Scientific calculators are permitted)

Complementary Course
No. of credit : 4
No. of contact hour: 4

Aim of the course

To provide a general outlook of certain statistical test which are useful to researchers in various fields.

Objective of the course

On completion of the course, a student should be able

- To have some idea about probability and probability distributions
- To develop the concept of a sampling distributions.
- To formulate hypothesis about various population parameters.
- To conduct various statistical tests.

Course Outline

MODULE I: Probability Theory

Basic concepts in probability, Addition theorem and Multiplication theorem (Two events), conditional probability, Baye's Theorem (without proof)

MODULE II: Random variables and Theoretical distributions

Random variables, Discrete and continuous random variables (Definition), Binomial, Poisson and Normal Distributions- Definition-Mean and variance (without derivation), Properties.

MODULE III: Sampling

Introduction, Methods of sampling, Statistics and Parameters. Sampling distribution, standard error, central limit theorem (statement only)

MODULEIV: Large sample tests

Introduction, procedure of testing Hypothesis, Test of significance for attributes. Test of significance for mean. (Single sample only)

MODULE V: Chi - square Test & Goodness of fit.

Introduction, Definition, chi-square test of goodness of fit (Fitting of distributions is excluded), chi-square test of independence. Uses, limitations.

Note on course work:-

On completion of this course, student should be able to apply various statistical tests in research work.

References:

1. Statistical methods: - S.P. Gupta- Sultan Chand & sons, Revised edition 1995
2. Basic Statistics:- B.L Agarwal
3. Fundamentals of mathematical Statistics: - S.P. Gupta and V.K. Kapoor, Sultan Chand & sons, Revised edition 1989

4. Statistics for Management, Sharma Ananad, *Himalaya Publishing House, Mumbai*

5. Statistics for management: - Richard Levin and David S Rubin

BA2CCT10 ENGLISH PAPER II

Common Course	
No. of credit	4
No. of contact hour:	5

THIRD SEMESTER

BA3CRT11 HUMAN RESOURCE MANAGEMENT

Core Course
No. of credit : 4
No. of contact hour: 5

MODULE- I

Definition, Nature, scope, role, objective of Personnel management, level of management, Organisation of Personnel Dept. its functions, Ergonounics, Challenger and relevance of HRM. Manpower planning.

MODULE- II

Recruitment - Sources of recruitment, Selection- Selection process, Training - Definition. Types of training Executive Development.

MODULE- III

Performance Appraisal, techniques Promotion, Career Planning.

MODULE- IV

Job analysis, Job Design, Job Evaluation Wage. Definition, Factors affecting wage policy, Wage Boards Fringe Benefits, Prerequisites, Incentives, Bonus, Profit sharing, VRS, Maintenance of service files pension.

MODULE- V

Drafting charge sheets, Model standing orders, code of conduct, Bond of service, wage & salary records, E.S.I, P.F. Gratuity, pension and bonus records.

Reference text:

SI No.	Title	Author	Publishing & Year
1	Human Resource Management	Pravin Durai	Pearson
2	Personnel management	Edwin Philipo	
3	Personnel management	Mammoria&Mammoria	*Himalaya Publishing House, Mumbai*
4	A frame work for human resource management	Gary Desseler	
5	Human resource and personnel management	K. Aswathappa	
6	Personnel HRM	Subba Rao	*Himalaya Publishing House, Mumbai*

BA3CRT12 MARKETING MANAGEMENT

Core Course
No. of credit : 4
No. of contact hour: 5

Aim of the course

The aim of this course is to provide the students with a conceptual base on marketing management and also to equip them with the necessary skills for employment in the middle level cadre.

Objective of the course

On completion of the course students should be able:

- To have an awareness on market , market segments and consumer behaviour
- To know the meaning and importance of product mix.
- To understand pricing policies and the applicability of different pricing strategies
- To know the scope of advertising and sales promotion
- To identify and develop salesmanship in them

Course Outline

MODULE I

Introduction

Meaning and definition of different marketing concepts functions of marketing - environmental factors - market segmentation - buying motive and process consumer and customer - factors affecting consumer behaviour - marketing plan

MODULE II

Marketing mix

Marketing mix: meaning - product, product mix- - product life cycle - importance of branding -packaging and labelling

MODULE III

Pricing

Pricing policies objectives factors influencing pricing decisions - different pricing strategies: skimming- penetration

Market structure channel of distribution and its importance

MODULE IV

Promotion

Advertising objectives and functions - types of advertising - personal selling and direct marketing - sales promotion

MODULE V

Marketing research definition, scope and process. Marketing risk and marketing audit

Note on course work:

Module 1 and Module 2 should definitely follow text Marketing-Planning implementation and control by Philip Kotler and Marketing Management by Ramaswami& Namakumary. Every lecture should be complemented by case studies, group discussions and seminars.

Reference Books:

Sl. No	Title	Author	Publisher
1	Marketing Management:	Philip Kotler, Jha& Koshy	Pearson Education, New Delhi
2	Marketing-Planning implementation and control	Philip Kotler	Prentice Hall
3	Marketing Management Text and Cases	SHH Kazmi	Excel Books, New Delhi
4	Marketing Management	V. S Ramaswami S. Namakumary	MacMillan Publishers, New Delhi
5	Marketing Management	Cranfield	Ane Books, New Delhi
6	Marketing Research	D. D Sharma	Sultan Chand And Sons
7	A Framework for Marketing management	Philip Kotler &Kevin Keller	Pearson, 5th edition
8	Marketing management	Biplab S Bose	Himalaya Publishing House, Mumbai

BA3CRT13 RESEARCH METHODOLOGY

Core Course
No. of credit : 4
No. of contact hour: 5

MODULE I

Research methodology- meaning. Research, meaning, objectives, significance. Research process- different steps, criteria for good research. Types of research- descriptive, analytical, applied, fundamental, quantitative, qualitative, empirical and conceptual.

MODULE II

Selection of research problem-sources-technique involved in defining a problem.

MODULE III

Research design-meaning-need, concepts-elements Sampling design-steps-criteria of selecting a sampling procedure-sampling process

MODULE IV

Types of data-primary data -meaning-advantages-disadvantages-methods of collecting primary data-sources. Secondary data- meaning, advantages-disadvantages-sources.

MODULE V

Interpretation-meaning-techniques-of interpretation. Report writing-significance- types of reports; (technical and popular) steps-layout-oral presentation.

Note on course work.

This course should not be taught in the conventional lecture method alone. Every lecture should be complemented by an appropriate activity (For example, reference, assignments, project reports etc.).

References:-
Research methodology, OR Krishnamoorthi, Himalaya publishing house, Mumbai

SI No.	Title	Author	Publishing & Year
1	Research Methodology	Ranjith Kumar	Pearson, 2nd edition
2	Research Methods for management	Dr S.Shajahan	Jaico Publishing House
3	Research Methodology. methods and techniques	C.R.Kothari	New Age International publishers
4	Research Methods	Ram Ahuja	Rawat publications
5	Research Methodology	K.R.Sharma	National Publishing House

BA3CMT14 BUSINESS LAWS

Complementary Course
No. of credit 4
No. of contact hour: 5

Aim of the course

To build a general awareness about the principles behind contract law and to introduce various type special contracts

Objective of the course

On completion of the course, student should be able

- To identify the principles behind law of contract
- To equip students to identify the validity of contracts
- To create awareness about various special contracts

MODULEI: General principles of law of contract

Law of contracts; Definition-essentials of a valid contract-kinds of contracts-Offer and accept revocation-communication-consideration. Doctrine of privity of contract-capacity to contract-con coercion-undue influence-misrepresentation-fraud-mistake-performance-discharge of contract-breac contract-remedies for breach of contract.

MODULEII: Contracts of indemnity and guarantee

Definition of indemnity–essential elements-rights of parties-definition of guarantee –essential elem rights of surety-nature of surety's liability-discharge of guarantee

MODULE III: Contract of bailment and pledge

Definition –essential elements- rights and duties of bailor and bailee-termination of bailment- finder o goods-Pledge-definition-rights and duties of pawnor and pawnee.

MODULEIV: Contract of agency

Definition- essentials-types of agency-mercantile agents-extent of agent's authority-delegation of auth personal liability of agent- liability of agent to third parties- termination of agency.

MODULE V: Contract of sale of goods

Sale of goods Act; Contract of sale and agreement to sell-conditions and warranties- transfer of propert title of goods-rights and duties of seller and buyer- rights of an unpaid seller.

References

1. Aswathappa, K., Business Laws, *Himalaya Publishing House*, *Bengaluru.*
2. Kapoor,N.D., Business Laws, *Sultan Chand publications*New Delhi.
3. Sharma,S.C., Business Law, *International Publishers,Bengaluru*
4. Tulsian, Business Law, *McGraw-Hill Education Mumbai*.

BA3PRP15 PERSONALITY DEVELOPMENT AND MANAGEMENT SKILLS (Minor Project)

Core Course
No. of credit : 4
No. of contact hour: 5

Objectives:

The students will have the opportunity to explore current management literature so as to develop an individual style and sharpen his skills in the area of leadership, communication, decision making, motivation and conflict management.

Minor Project and Presentation

Minor projects are takes that added to the knowledge of the students. Atopic shall give each student in the beginning of the semester in various areas of management. The presentation Project either comprises of either the following.

Project Presentation

OR

Case study Presentation*

Suggested Topics for Minor Projects:

1. Goals of an Organization
2. Work values
3. Character Ethics
4. Working Conditions
5. Decision Making Strategies
6. Goal Setting
7. Customer Satisfaction and
8. Any other relevant topic chooses by the student or assigned by the college.

*** Case study can be chosen by the students in this respective area of interest. Text**

Books

1. Lather, A.S. Handa, M (2009). Cases in Management. Wisdom Publications.
2. M C Garth (2009). Baric Managerial skills for All, 5th ed. Prentice Hall India.

Reference Book

1. Ellis (2009). Management Skills for New Managers.

FOURTH SEMESTER

BA4CRT16 FINANCIAL MANAGEMENT

CORE COURSE
NO. OF CREDIT : 4
NO. OF CONTACT HOUR: 5

MODULE- I

Finance Functions - Definition and scope of finance functions - Profit maximization v/s wealth maximization goal - Organisation of Finance Function.

MODULE- II

Sources of finance - short term - Bank sources - Long term - shares - debentures, preferred stock – debt

MODULE – III

Working capital management - concept - Determinants - cash management - Receivables management (Basic problems only).

Module - IV

Financing Decisions. Cost of Capital - cost of specific source of capital - Equity - preferred stock - debt - reserves - weighted average cost of capital. Capital structure - factors influencing capital structure capital optimum capital structure - Theories of capital structure – Leverage, meaning and types (Basic problems only).

MODULE V

Dividend decision - meaning and significance of dividend decision - Modigliani and Miller Approach - theory of relevance – Walter's model – Gorden's model - Corporate Dividend practice in India (Avoid problems).

Note on course work:

The course should be taught in a participate style. Lecture sessions should be supplemented by seminars and group discussions. After each module surprise tests and quizzes should be administered to ensure the participants' clarity in core concepts.

References:

1. Pandey, I. M., Financial Management, Vikas *publishing House Pvt. Ltd.New Delhi.*
2. Khan, M.Y. & Jain, P.K., Financial Management, *McGraw Hill (India) Private limited; New Delhi.*
3. OP Agarwal, Financial Management, Himalaya Publishing House, Mumbai

BA4CRT17 MANAGERIAL ECONOMICS

Core Course
No. of credit : 4
No. of contact hour: 5

MODULE -I

Introduction, Definition, Scope and uses of Managerial Economics. Role of a managerial economist. Difference between managerial economics and pure economics.

MODULE -II

Business cycles- Phases of a business cycle. Economic systems- Capitalist, Socialist, Mixed economy. Inflation: Definition, Courses of inflation, Control of inflation. Banking: Functions of Central Banks, Functions of Commercial Banks. Monetary Policy, Fiscal Policy.

MODULE - III

Demand Analysis, Meaning of demand, the law of Demand, Determinants of demand, Types of demand, Law of Diminishing Marginal Utility, Consumer Surplus. Elasticity of demand, Price elasticity of demand, Income elasticity of demand, cross elasticity of demand.

MODULE-IV

Production function, Managerial use of Production function, Law of diminishing returns, Law of returns to scale, Economies of scale, Diseconomies of scale

Isoquants, Isocost curve, Optimum combination of inputs.

Pricing, Pricing policy and Practises, Cost plus pricing, rate of return pricing, pricing of competing firms, pricing of new products, price leadership, price discrimination.

MODULE-V

Market structure, Prefect competition, Monopoly, Monopolistic competition and oligopoly

Reference texts

1. Dean, Joel Managerial economics- Prentice Hall of India
2. Varshney, R.L., & Maheshwari, K.L., Managerial Economics, Sultan Chand & Sons Private Ltd., New Delhi
3. Kasi Reddy M., & Saraswathi, S., Managerial Economics and Financial Accounting, PHI Learning, New Delhi.,
4. DM Mithani, Managerial economics, Himalaya Publishing House Mumbai.
5. Mehta, P. L., Managerial Economics, Sultan & Chand, New Delhi
6. Trivedi, M.L., Managerial Economics Theory and Applications, McGraw Hill Education Private Ltd, New Delhi.
7. Dwivedi, D. N., Managerial Economics, Vikas Publishing House Private Limited, New Delhi.
8. Gopalkrishna, Managerial Economics,Himalaya Publishing House, Mumbai
9. Craig H Petersen, W Cris Lewis &Sudhir K Jain, Managerial Economics, Pearson, 4th edition

BA4CRT18 ENTREPRENEURSHIP

Core Course
No. of credit : 4
No. of contact hour: 5

MODULE I

To make the students understand about entrepreneurs and different classifications. Entrepreneur and entrepreneurship - Definition; traits and features; classification; Entrepreneurs; Women entrepreneurs; Role of entrepreneur in Entrepreneurs in India.

MODULE- II

Create an awareness about EDP. Entrepreneurial development programme concept; Need for training; phases of EDP; curriculum & contents of Training Programme; Support systems, Target Groups; Institutions conducting EDPs in India and Kerala.

MODULE- III

General awareness about edeutification of project financing new enterprises. Promotion of a venture; opportunity Analysis Project identification and selection; External environmental analysis economic, social, technological an competitive factors; Legal requirements for establishment of a new unit; loans; Overrun finance; Bridge finance; Venture capital; Providing finance in Approaching financing institutions for loans.

MODULE- IV

To identify different Discuss opportunities in small business. Small business Enterprise - Identifying the Business opportunity in various sectors - formalities for setting up of a small business enterprise - Institutions supporting small business enterprise - EDII (Entrepreneurship Development Institute of India), 0 SLDO (Small Industries Development Organization NSIC (National small Industries Corporation Ltd. (CNSIC) NIESBUD (National Institute for Entrepreneurship and small Business Development) Sickness in small business enterprise causes and remedies.

MODULE V

To understand about a project report relating to a small business. Project formulation - Meaning of a project report significance contents formulation planning, commission's guidelines for formulating a project report - specimen of a project report, problems of entrepreneurs case studies of entrepreneurs

Reference texts:

Sl No.	**Title**	**Author**	**Publishing & Year**
1.	Entrepreneurship Development	Dorden and Natarajan	Himalaya Publishing House, Mumbai
2.	Entrepreneurship Development and Small Business Enterprises	Poornima M.Charantimath	Pearson,2nd edition

BA4CMT19 BASIC INFORMATICS FORMANAGEMENT

Complementary Course No. of credit 4 No. of contact hour: 5

AIM OF THE COURSE

To make a student competent to handle and scientifically analyse the various aspects of his business while he commence a business.

COURSE OBJECTIVE:-

- To have through knowledge in Excel.
- To get adequate knowledge in Excel to use it in their Research Work.
- To become Computer proficient.
- To get enough knowledge in Computerized Accounting.
- Should be able to scientifically analyse the financial position of a firm.

MODULE - I: EXCEL BASICS (Based on XP)

OBJECTIVES:-

- Understand the basics of Excel.
- To learn Formatting Techniques in Excel

Introduction Components of Excel Window Cell Cell Address Frame - Worksheet - Work Book Formatting Techniques (Cell, Page, Printing).

MODULE II: FORMULAS AND FUNCTIONS AND CHARTS IN EXCEL

OBJECTIVES:-

- Create Formulae
- Work with different Addressing Modes.
- Work with different Functions.

Inserting a formula Addressing Modes Relative Absolute Mixed Inter Sheet Referencing. Functions Financial Functions (NPV, PMT) Mathematical Functions (SUM, ROUND, FACTORIAL) Statistical Functions (AVERAGE, COUNT, MEDIAN, MODE, STDDEV) Logical Functions (IF, AND, FALSE, NOT, OR, TRUE).
Macros Goal Seek - Charts - Types of Charts Preparing Charts.

MODULE III: COMPUTERIZED ACCOUNTING - TALLY

OBJECTIVES:-

- Understand the features of computerized accounting
- Understand the basic and advanced features of Tally.

Introduction - Features of Computerized Accounting Advantages of Computerized Accounting Limitations of Computerized Accounting - Features of Tally Need for Tally - Technological Advantages.

MODULE IV: TALLY FUNDAMENTALS AND PROCESSING TRANSACTIONS

OBJECTIVES:-

- Identify the key components of Tally.
- Create a Company
- Define Various Fields
- Determine the Valid Inputs
- Understand F11 : Features
- Understand F12: Configure.
- Create Ledgers
- Record Transactions using Accounting Vouchers

Getting functional with Tally Tally Start-up Tally screen components Mouse / Keyboard Conventions The Tally clock Switching between Screen Areas Quitting Tally. Creation / Setting up of a Company in Tally Creation of a Company. F11: Features - F12: Configure Master Configuration Voucher Configuration.

Processing Transactions in Tally Ledgers and Groups Accounting Vouchers Contra Voucher Payment Voucher Receipt Voucher Journal Voucher Sales Invoice. Recording Transactions of Sample Data (Transactions for April Trial Balance Backup Transactions for May Transactions for June).

MODULE V: GENERATING AND PRINTING OF ACCOUNTING REPORTS

OBJECTIVES:-

- Generate Accounting Records and Statement of Accounts.
- Print Accounting Records and Statement of Accounts.

Introduction Financial Reports in Tally Balance Sheet Profit and Loss Account Account Books Group Summary Group Vouchers List of Accounts.

Note:-

- **Answers with Appropriate Screen Shots (windows) will decide higher grades.**

DISTRIBUTION OF WORKING HOURS

- **Out of 5 Hours, 3 Hours for Theory and 2 Hours for Practical.**
- **Practical hours required for Unit-I is 8 hours and for Theory 14 hours.**
- **Practical hours required for Unit-II is 16 hours and for Theory 30 hours.**
- **Theory hours required for Unit III is 5 hours.**
- **Practical hours required for Unit IV & V together is 12 hours and for Theory 3 hours.**

COURSE WORK (PRACTICALS):-

MODULE I

- Draw the Excel Screen and Identify its Components.
- Make a presentation based on the use of frame.
- Make a presentation based on Cell formatting.
- Prepare a sample SGPA Card and take a Printout.
- Make a presentation based on Page Formatting.
- Use of mail merge, preparation of a sample mail merge.

MODULE - II

- Give a problem to compare & differentiate various Addressing Modes.
- Give problems based on NPV and PMT (Financial Functions).
- Give problems based on SUM, ROUND and Factorial (Mathematical Functions).
- Give problems based on AVERAGE, COUNT, MEDIAN, MODE, STDDEV (Statistical Functions).
- Give problems based on Logical Functions. Prepare an Electricity Bill.
- Create a Macro to set all the margins of a page to 1 inch.
- Write the procedure for creating a Macro.
- Apply Goal seek to set the value of a cell by changing the value of other cells.
- Give data to prepare different charts.
- Draw and differentiate types of charts.
- Write the steps for creating a chart with appropriate screen shots.

MODULE - III

- Use OHP foils or LCD projector to take sessions.
- Make a note on computerized accounting.

MODULE IV

- Identify the screen components by drawing diagram.
- Explain the procedure of creating a company with appropriate screens.
- Create a company
- Explain the procedure for voucher entry with appropriate screen.

MODULE V

- Create Financial Reports in Tally.
- Give 5 sample Problems to prepare various Financial Reports.

REFERENCE BOOKS

Sl. NO	Title	Author	Publisher & Year
1	Learning MS-Office XP	Weixel	BPB 1st Edition
2	Office XP Simply Visual	Sybex	BPB 1st Edition
3	MS-Office XP 8 in 1	Habraken	Tech Media
4	Simply Tally 9.0	Ashok K. Nandhani	BPB 1st Edition
5	Tally 9 Training Guide	Ashok K. Nandhani	BPB 1st Edition
6	Computerized Accounting	Basheet	BPB 1st Edition

BA4CMT20 CORPORATE LAWS

Complementary Course
No. of credit 4
No. of contact hour: 5

Aim of the course

To build a general awareness about the principles behind, companies and partnerships.

Objective of the course:

On completion of the course, the student should be able

- To identify the various steps in the formation of a company
- To specify the basic principles of corporate laws
- To clarify the basic principles of partnership law
- To understand the basic features of limited liability partnership

MODULE I: Formation and incorporation of a company (The Companies Act, 2013)

Formation and incorporation of a company; characteristics and types of companies;

Promoters; corporate veil; pre-incorporation and preliminary contracts. Memorandum of association – articles of association- doctrine of ultra vires- doctrine of constructive notice- indoor management-prospectus and statement in lieu of prospectus-deemed prospectus-shelf prospectus-abridged prospectus- red- herring prospectus and information memorandum- liability for misstatement of prospectus.

MODULE II: Management of companies and Company meetings

Qualification and appointment of directors; powers, duties and liabilities of directors; kinds of company meetings; requisites of a valid meeting; Chairman- agenda-minutes-quorum; Motions and resolutions –proxy-ascertaining the sense of a meeting.

MODULEIII: Winding up of companies:

Modes of winding up; compulsory winding up- grounds and procedure; voluntary winding up-types-procedure-effects of winding up-liquidator-powers and functions-contributories; defunct companies.

MODULE IV: The Law Relating to Partnership and limited liability partnership

Nature, test and types of partnership- partnership deed- rights and liabilities of partners- relations of partners to one another and to third parties- incoming and outgoing partners- Retirement- Registration and dissolution of partnership- limited liability partnerships.

MODULEV: Pollution control Act

Definitions- Air- water and sound pollution- pollution control measures.

References

1. Shukla, M.C., & Gulshan, Principles of Company Law, *S.Chand*, *New Delhi*.

2.Venkataramana, K., Corporate Administration, *Seven Hills Books Publications.*

3. Kapoor,N.D., Company Law and Secretarial Practice, Sultan Chand,*New Delhi*.

4. Elements of corporate Law, SN Maheswari and SK Maheswari, Himalaya Publications, Mumbai.

4. Bansa,lC.L., Business and Corporate Law, *Vikas Publishers, New Delhi.*

FIFTH SEMESTER

BA5CRT21 ORGANISATIONAL BEHAVIOUR

Core Course
No. of credit : 4
No. of contact hour: 6

Course Objectives

- Understand the implications of individual and group behaviour in organisational context.
- Understand the concept of organisational behaviour, social organisation and the diverse environment alongside with the management of groups and teams
- Appreciate the culture of organisational culture

Learning Outcome

- Manage conflict amongst groups in business environment
- Comprehend and apply motivational theories in the workplace
- Identify changes within organisations and power and politics in organisations

MODULE- I:

Introduction to Organisational Behaviour- Various discipline contributing to OB- Hawthorne experiment- foundation of individual behaviour- need and importance of organisational behaviour-nature and scope- framework of organisational behaviour

MODULE- II:

Personality-types-factors affecting personality-perception-importance-factors influencing perception-learning-types of learning styles-the learning process

MODULE- III:

Motivation-theories-importance –types –values and attributes-characteristics-components-formation and measurement-group dynamics group behaviour-formation-types of groups-stages of group development-conflict management-nature of conflict-types of conflict

MODULE-IV:

Leadership-meaning-importance-leadership styles-leaders Vs. managers-power and politics-sources of power

MODULE-V:

Organisational structure and design-organisational climate- factors affecting organisational climate- organisational development-organisational culture-organisational change- current trend in OB

Core texts

SI No.	Title	Author	Publishing & Year
1	Essentials of Organisational Behaviour	Stephen P Robbins, Timothy A. Judge &SeemaSanghi	Pearson, 10th edition
2	Organizational behaviour	Bhattacharya	Oxford university Press
3	Organization behaviour	LM Prasad	Sultan Chand & Sons 2005

BA5OPT22 OPEN COURSE

Open Course No. of credit : 3 No. of contact hour: 4

BA5CRT23 ENVIRONMENT SCIENCE AND HUMAN RIGHTS

Core Course
No. of credit : 4
No. of contact hour: 5

MODULE I

Multidisciplinary nature of environmental studies

Definition, scope and importance Need for public awareness.

Natural Resources : Renewable and non-renewable resources : Natural resources and associated problems.

a) Forest resources : Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.

b) Water resources : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

c) Mineral resources : Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) Food resources : World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, Case studies.

f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification

- Role of individual in conservation of natural resources.
- Equitable use of resources for sustainable life styles.

Ecosystems

- Concept of an ecosystem
- Structure and function of an ecosystem
- Producers, consumers and decomposers
- Energy flow in the ecosystem
- Ecological succession
- Food chains, food webs and ecological pyramids.
- Introduction, types, characteristic features, structure and function of the given ecosystem:- Forest ecosystem

MODULE II

Biodiversity and its conservation

Introduction, Biogeographical classification of India ,Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. India as a mega-diversity nation, Hot-sports of biodiversity, Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India

Environmental Pollution

Definition, Causes, effects and control measures of: -

a. Air pollution
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

Solid waste Management: Causes, effects and control measures of urban and industrial wastes, Role of an individual in prevention of pollution, Pollution case studies, Disaster management: floods, earthquake, cyclone and landslides

Social Issues and the Environment- Urban problems related to energy, Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation of people: its problems and concerns, Case studies, Environmental ethics: Issues and possible solutions, Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, Case studies, Consumerism and waste products, Environment Protection Act , Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act,Issues involved in enforcement of environmental legislation

MODULE III

Introduction to Environment and Business

Introduction of ways in which business has and is responding to environmental and business issues; business and sustainable development; issues of corporate/business greening.

MODULE IV

Green entrepreneurship

What is green entrepreneurship, definition, meaning, scope, nature and characteristics. Green entrepreneurship in India. Difference between conventional and green entrepreneurship.

MODULE V

Human Rights– An Introduction to Human Rights, Meaning, concept and development, Three Generations of Human Rights (Civil and Political Rights; Economic, Social and Cultural Rights).

Human Rights and United Nations –contributions, main human rights related organs - UNESCO,UNICEF, WHO, ILO, Declarations for women and children, Universal Declaration of Human Rights.

Human Rights in India – Fundamental rights and Indian Constitution, Rights for children and women, Scheduled Castes, Scheduled Tribes, Other Backward Castes and Minorities

Environment and Human Rights - Right to Clean Environment and Public Safety: Issues of Industrial Pollution, Prevention, Rehabilitation and Safety Aspect of New Technologies such as Chemical and Nuclear Technologies, Issues of Waste Disposal, Protection of Environment

Conservation of natural resources and human rights: Reports, Case studies and policy formulation. Conservation issues of western ghats- mention Gadgil committee report, Kasthurirengan report. Over exploitation of ground water resources, marine fisheries, sand mining etc.

Internal: Field study

- Visit to a local area to document environmental grassland/ hill /mountain
- Visit a local polluted site – Urban/Rural/Industrial/Agricultural Study of common plants, insects, birds etc
- Study of simple ecosystem-pond, river, hill slopes, etc

(Field work Equal to 5 lecture hours)

REFERENCES

1. Bharucha Erach, Text Book of Environmental Studies for undergraduate Courses. University Press, IInd Edition 2013 (TB)
2. Clark.R.S., Marine Pollution, Clanderson Press Oxford (Ref)
3. Cunningham, W.P.Cooper, T.H.Gorhani, E & Hepworth, M.T.2001 Environmental Encyclopedia, Jaico Publ. House. Mumbai. 1196p .(Ref)
4. Dc A.K.Enviornmental Chemistry, Wiley Eastern Ltd.(Ref)
5. Down to Earth, Centre for Science and Environment (Ref)
6. Heywood, V.H & Watson, R.T. 1995. Global Biodiversity Assessment, Cambridge University Press 1140pb (Ref)
7. Jadhav.H & Bhosale.V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284p (Ref)
8. Mekinney, M.L & Schock.R.M. 1996 Environmental Science Systems & Solutions. Web enhanced edition 639p (Ref)
9. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co. (TB)
10. Odum.E.P 1971. Fundamentals of Ecology. W.B. Saunders Co. USA 574p (Ref)
11. Rao.M.N & Datta.A.K. 1987 Waste Water treatment Oxford & IBII Publication Co.Pvt.Ltd.345p (Ref)
12. Rajagopalan. R, Environmental Studies from crisis and cure, Oxford University Press, Published: 2016 (TB)
13. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut (Ref)
14. Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science (Ref)

15. Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Stadards, Vol I and II, Enviro Media (Ref)
16. Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (Ref)
17. Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p (Ref)
18. (M) Magazine (R) Reference (TB) Textbook

Human Rights

1. Amartya Sen, The Idea Justice, New Delhi: Penguin Books, 2009.
2. Chatrath, K. J.S., (ed.), Education for Human Rights and Democracy (Shimla: Indian Institute of Advanced Studies, 1998)
3. Law Relating to Human Rights, Asia Law House,2001.
4. Shireesh Pal Singh, Human Rights Education in 21st Century, Discovery Publishing House Pvt.Ltd, New Delhi,
5. S.K.Khanna, Children And The Human Rights, Common Wealth Publishers,1998. 2011.
6. Sudhir Kapoor, Human Rights in 21st Century,Mangal Deep Publications, Jaipur,2001.
7. United Nations Development Programme, Human Development Report 2004: Cultural Liberty in Today's Diverse World, New Delhi: Oxford University Press, 2004.

BA5CMT24 INTELLECTUAL PROPERTY RIGHTS AND INDUSTRIAL LAWS

Complementary Course
No. of credit 4
No. of contact hour: 5

Aim of the course

To build a general awareness about the principles behind, intellectual property legislations and three important industrial laws.

Objective of the course:

On completion of the course, student should be able

- **To appreciate the concepts of patent and trademark protection.**
- **To specify the various legal provisions in the Factories Act and Industrial Disputes Act. To identify the benefits offered by ESI Act.**

MODULE - I Introduction to Intellectual property Rights

Concept; patents; term and registration of patents; Rights of patent holder; infringement of patents; Trademark: Meaning; procedure for registration; infringement of registered trademark; Collective marks - certification trademarks-well known trade mark.

MODULE - II: Law relating to factories

Approval, licensing and registration of factories; provisions regarding health, safety and welfare of workers; working hours; employment of women and young persons. Annual leave with wages.

MODULE -III: Law relating to Industrial Disputes

Meaning of industry; machinery for the prevention and settlement of industrial disputes. Provisions relating to strikes, lay off, retrenchment, lock out, closure and transfer of undertakings.

MODULE - IV: Law relating to employees' state insurance

Applicability of the Act- administration of the scheme- ESI corporation-standing committee and medical benefit council- inspectors- contributions-benefits under the Act – adjudication of disputes.

MODULE -V: Consumer Protection Act

Definitions- Consumer Protection Councils- central and state consumer protection councils-objects-consumer disputes redressal agencies-composition of the District Forum- Jurisdiction of the District Forum-procedure for filing complaints- composition and jurisdiction of State Commission-composition ,jurisdiction and powers of the National Commission-procedure applicable to state and national commission-Appeal-Dismissal of frivolous or vexatious complaints-penalties.

BA5CRT25 OPERATION MANAGEMENT

Core Course
No. of credit : 2
No. of contact hour: 2

MODULE I

Production/ operation function- Production system-Objectives of production in management- the five P's of production- Types of production- production systems-Job shop- Batch continuous and cellular.

MODULE II

Production planning and control- Functions of production planning and control – characteristics- steps involved- objectives of production-objectives of production planning-Importance-prerequisites of production planning and control- production control- objective and control-objectives and advantages.

MODULEIII

Materials management- Scope and important methods of purchasing-Inventory control- objectives, functions and importance.

MODULE IV

Work improvement- and wok measurement- motion study- work place lay out- plan lay out- types of lay out- factors influencing plant lay out-fundamentals of time study.

MODULE V

Quality control – Importance and objectives.

Reference:

SI No.	Title	Author	Publishing & Year
1	Production and Operations Management	Alan Muhlemann, John Oakland et al.	Pearson, 6th edition
2	Operations Management, Theory and practice	B Mahadevan	Pearson, 2nd edition
3	Operations Management	KS Chandrasekar	*Himalaya Publishing House, Mumbai*

BA5CRT26 INDUSTRIAL RELATIONS

Core Course
No. of credit : 3
No. of contact hour: 3

Aim of the course:

To make an awareness about relations between labour and management in an industry.

Objectives of the course:

Is to enable the student

- To have a basic idea regarding industrial relations.
- To understand various prospect of workers and employers
- To understand more about the employees performance and their carrier planning.
- To know how the ....are made in industries between workers and management.
- To know how the workers are participating in daws making programmes.
- To understand various welfare facilities of education programmes provided by employers to their employees.

MODULE I: Introduction

Nature of Industrial relations- meaning and importance- Industrial labour in India,- an overview of industrial growth- Private and Public Sector Employment trends- Industrial Labour force.

MODULE II: Bargaining agents

Workers Organization: Role of Trade Union in Industries- Multiplicity of trade unions- inside and outside leadership. Employers Organization-Role of Employers Organization in maintaining industrial relations, Recognition of trade Unions.

MODULE III: Industrial Unrest

Concepts- Causes- Problems- handling techniques and procedures relating to –go- slow-work –stoppage-gherao-retrenchment-lay –off.

MODULE IV: Settlement of Industrial Disputes

State Policy- need and nature of state labour policy and intervention-ILO Statutory Measures: Holding Negotiations-bipartite-tripartite negotiations-mediation-conciliation-arbitration-adjudication.

MODULE V: Promotion of Industrial Peace

Collective bargaining-works participation in management-works education-workers welfare-Industrial truce

Reference text:

1. Industrial relations, trade unions and labour registration -**P.R.N. Sinha & InduBala Sinha & SeemaPriyadarshini Shekhar**

2. Industrial relations -C.B. Mamoria

SIXTH SEMESTER

BA6OCT27 OPTIONAL 1

Optional Course	
No. of credit	4
No. of contact hour:	5

BA6OCT28 Optional II

Optional Course	
No. of credit	4
No. of contact hour:	5

BA6CRT29 STRATEGIC MANAGEMENT

Core Course
No. of credit : 4
No. of contact hour: 5

MODULE I

Introduction to Strategic Management, Concept of Corporate Strategy, Strategic Management Process, The 7-S Framework, Corporate Policy and Planning in India.

MODULE II

Environmental Scanning, Industry Analysis, The synthesis of External Factors, External Factors Analysis Summary (EFAS), Internal Scanning, Value Chain Analysis, Synthesis of Internal Factors, Internal Factors Analysis Summary (IFAS)

MODULE III

Strategy Formulation, Strategic Factors Analysis Summary (SFAS), Business Strategy, Corporate Strategy, Functional Strategy, Strategic Choice.

MODULE IV

Strategy Implementation, Organization Structure, Corporate Culture, Diversification, Mergers and Acquisitions, Turnaround strategies, Portfolio strategy (concepts only)

MODULE V

Evaluation and control of strategies-strategic control-standard-benchmarking-cost benefit analysis-performance gap analysis-responsibility centres.
Other Strategic Issues, Small and Medium Enterprises, Non- Profit Organizations.

REFERENCES

- Robert A Pitts and David Lei, Strategic Management, 4th Edition Cengage Learning, 2006.
- Francis Chrunilam, Strategic Management, Himalaya publications, Mumbai.
- K.Govindabhat, Strategic Management, Himalaya Publications, Mumbai.

BA6CRT30 COMMUNICATION SKILLS AND PERSONALITY DEVELOPMENT

CORE COURSE
NO. OF CREDIT : 4
NO. OF CONTACT HOUR : 5

MODULE I: Speeches & Presentation

Speeches - Characteristics of a good speed, How to make speech effective

Presentation - Planning, preparation, organising, rehearing & Delivery. How to make Presentation, The various presentation tools along with guidelines of effective presentation, Boredom factors of presentation and How to overcome them, Interactive Presentation and Presentation as a part of job Interview.

MODULE II: Brief business messages

Crafting messages for electronic media, choosing media for brief messages- email, instant messaging, text messaging, blogs, and wikis. creating effective email messages, instant messages, text messages, business blogs.

MODULE III: Employment messages and Job interviews

Resume Writing skills, Guide lines for good Resume, Writing application letters and other employment messages, application follow-ups, understanding the interviewing process, common types of interviews, preparing for a job interview, stages of every interview-warm-up, question answer session and close. Follow-up after an interview.

MODULE IV: Group Discussion

GD Leadership, GD protocol, Guidelines for GD participants, debate and extempore.

MODULE V

Audio video recording and Dialogue session on current topics- economy-education system- environment-politics.

References

SI No.	Title	Author	Publishing & Year
1	Business communication essentials	Courtland Bovée And John Thill	Pearson,2015
2	Fundamentals of business communication	P D Chaturvedi, MukeshChaturvedi	Pearson, 2012
3	Basic Managerial Skills for All	McGrath E.H. S.J.	PHI; 9 edition (2011)
4	Essentials of Business Communication	Rajendra Pal , J. S. Korlahalli	Sultan Chand And Sons
5	Basic Managerial Skills for All	McGraw, S. J	8th edition, Prentice Hall of India.

BA6PRP31 Management Project

Core Course
No. of credit : 4
No. of contact hour: 5

OPEN COURSES

BA5OPT22 (A). BRAND MANAGEMENT

Open Course
No. of credit : 3
No. of contact hour: 4

Course Objectives

- To understand the concept-Brand
- To understand the process of Brand Building
- To understand the value of Brand to an organisation

Learning outcome

To develop and implement strategies for successful brand portfolio management.

MODULE I

Product- Meaning and Definition, Types of product.
Brand- Meaning and Definition, Importance of branding, process of branding, circular process, Types of Brands.

MODULE II

Brand Identity- Meaning and Definition,
Brand Name- Attributes of a brand name, Brand name protection.
Promoting your Brand-Objectives, different media.

MODULE III

Logo- Meaning and Definition.
Logo design- Do's & Dont's ingredients. Word mark, Brand mark,Trademark.
Tag line- Meaning and Definition, Functions.

MODULE IV

Brand positioning- Concept, advantages, process.
Brand Equity- Meaning& Definition, advantages, factors contributing to brand equity, measurement of brand equity.

MODULE V

Brand extension- Meaning, advantages.
Brand licensing- Meaning and benefits**.**
Co-branding-Meaning and benefits.

References:

- Brand Management-Moorthi, Vikas Publications
- Brand Management- Harsh V Verma, Excel Books
- Marketing Management- Philip Kotler, Jha& Koshy Pearson Education

BA5OPT22(B) ENTREPRENEURIAL LEADERS

Open Course
No. of credit : 3
No. of contact hour: 4

MODULE I

Muhammad Yunus

MODULE II

Steve Jobs

MODULE III

N. R. Narayana Murthy

MODULE IV

Kochouseph Chittilappilly

MODULE V

Women entrepreneur- Beena Kannan

OPTIONALS

OPTIONAL I

BA6OCT27 (a) HEALTH CARE MANAGEMENT

Optional Course No. of credit 4 No. of contact hour: 5

Aim

The aim of this subject is to create awareness among the students and equip them with the necessary skills for employment in the middle level cadre.

Objectives

- **To orient students in health care**
- **To enhance knowledge in the health care industry**
- **To familiarize the students about the various services To**
- **familiarize the students with office management**

MODULE I

Role of Hospitals in Health Care
Role of Hospitals in development of society
Types of Hospital ⁄Ownership (Private, Government), Specialization (Nursing Homes,
Diabetic clinic, General Hospital) and Service (Homeopathy, Ayurveda)

MODULE II

Management of Hospitals ⁄Importance of HRM and Staffing Financial Management ⁄ Budget Allocation

MODULE III

In patient and out patient
A study on Private and Government health care units Role of Government in health care sectors

MODULE IV

Hospital Services ⁄ Clinical Services ⁄ X-ray department, Lab Services.
Department in Hospitals ⁄Paediatric, Orthopaedic, Pathology etc.

MODULE V

Maintenance of different types of records.
New avenues of Health Care management - tourism

BA6OCT27. (b) INTRODUCTION TO RETAIL MANAGEMENT

Optional Course
No. of credit 4
No. of contact hour: 5

Objective:

The aim of the paper is to know how a logistic strategy fits into an organisation's broader decisions, understand the role of logistic providers, and realize the meaning of customer service and understand its importance to logistics management.

Module I

Logistics- Definition History and Evolution- Objectives-Elements-activities importance- The work of logistics-Logistics interface with marketing-retails logistics-Emerging concept in logistics.

Module II

Retail Management-Definition-Achievement of competitive advantage through logistics Framework-Role of Retail Management-Integrated Logistics Management- Evolution of the concept- model - process-activities (in brief)

Module III

Outsourcing logistics-reasons-Third party logistics provider-Fourth party Logistics providers -Stages-Role of logistics providers

Module IV

Logistics Strategy-Strategic role of logistics-Definition- role of logistics managers in strategic decisions-Strategy options, lean strategy, Agile Strategies &Other strategies- Designing &implementing logistical strategy

Module V

Quality customer service &integrated logistics-customer service-importance elements- the order cycle system-distribution channels -Functions performed-Types-designing.

REFERENCE BOOKS

Sl. No	Title	Author	Publisher
1	Logistics	David J Bloomberg, Stephen LeMay	Prentice Hall of India PVt Ltd.
2	Logistical Management	Donald J Bowersox& David J Closs	Tata McGraw Hill Publishing Co Ltd
3	Logistical Management	Satish C Ailawadi&Rakesh Singh	Prentice Hall of India PVt Ltd.
4	Logistics	Donald Waters	Palgrave Macmillan, New York, 2009
5	Retail Management &World Sea borne Trade	KrishnaveniMuthiah	Himalaya Publishing House, Mumbai

BA6OCT27. (c). INVESTMENT & INSURANCE MANAGEMENT

Optional Course
No. of credit 4
No. of contact hour: 5

Module I

Nature and scope of investment management – Financial and economic – Meaning of investment – Importance of investments – Factors favourable for investments – Investment media – Features of investment programme – risk – Different types of risk. Module II Financial institutions and markets in India – Development of financial securities

– Structure of financial markets – Money market – Capital market – Primary market – market securities.

Module III

Stock market in India – Regulatory frame-work – Role or functions – Procedure for trading in securities – Kinds of brokers – OTCEI-NSE.

Module IV

Alternative forms of investment – Government securities – types – Life insurance – Kinds of policies – Procedure for taking of policies – investment in units – Different schemes – Objectives of investment units – Different schemes

– Tax benefits – Provident funds – National savings schemes – Post office savings – Investment in land, gold, silver, diamonds, stamps, antiques, banks.

Module V

Insurance; Definition – Characteristics – Benefits and importance – Types of insurance. IRDA – Meaning and functions

BOOKS RECOMMENDED

1. Preethi Singh – Investment management
2. V.K.Bhalla – Investment management. S.Chand, New Delhi, 13th Edition, 2007
3. John Bowyer – Investment analysis management
4. Neelam.C.Gulati – Principles of insurance management
5. Karampal, B.S.Bodla, M.C.Garg – Insurance management, principles and practices.

BA6OCT27. (d). EVENT MANAGEMENT

Core Course
No. of credit : 4
No. of contact hour: 5

Module I

Why Event Management, Requirement of Event Manager, Analysing the events, Scope of the Event

Module II

Decision makers, Technical Staff, Developing Record-Keeping Systems, Establishing Policies &Procedures

Module III

Preparing a Planning Schedule, Organizing Tasks, Assigning Responsibility, and

Communicating. Using the Schedule Properly, The Budget, Overall Planning tips, Checklists, Expert Resources, and Computer Software Required.

Module IV

Who are the people on the Event, Locating People, Clarifying Roles, and Developing content Guidelines. Participant Tips. Reference Checks, Requirement Forms, Introduction, Fees &

Honorariums, Expense Reimbursement. Travel Arrangements, Worksheets.

Module V

Type of Events. Roles &Responsibilities of Event Management in Different Events, Scope of the Work. Approach towards Events

REFERENCE BOOKS

1. Event Management: A Blooming Industry and an Eventful Careerby DeveshKishore, Ganga Sagar Singh - Har- anand Publications Pvt.Ltd
2. Event Management by Swarup K. Goyal - Adhyayan Publisher – 2009
3. Event Management &Public, Relations by Savita Mohan - Enkay Publishing House.

OPTIONAL II

BA6OCT28. (a) ADVERTISING AND SALESMANSHIP

Optional Course	
No. of credit	4
No. of contact hour:	5

Aim

The aim of this subject is to create awareness among the students and equip them with the necessary skills for employment in the middle level cadre.

Objectives

To orient students in Marketing Management. To encourage entrepreneurial skills.
To meet the demand of the various industrial sectors.

MODULE I

Advertising – definition, objectives. Types of Advertising– Newspaper, Magazines, Journals. Outdoor Ads, Theatre Ads. Radio, TV Advertisement. Product placement

MODULE II

Ad Agencies – Its Types and functions. Ethics in Advertisement. Advertisement Budget

MODULE III

Element of Advertisement – Copy Writing. Advertisement lay out, Proof reading, Typography, Lithography. Use of Symbols, Slogans Caption Catch Phrase.

MODULE IV

Salesmanship – Importance of Salesman, Steps in selling. Direct Marketing. Different Salesman – retailer, wholesaler etc. Negotiation

MODULE V

Knowledge, Skills and Qualities required in salesmanship. Training and supervising the salesman. Motivating the salesman – perks, commission,incentives,remuneration,awards and rewards

Note on Course

Every lecture should be complemented with Case studies, Group Discussion, Seminars

REFERENCE BOOKS:

SI No.	Title	Author	Publishing & Year
1	Advertising Management	Rajeev Batra, John G Myers, David A Aaker	Pearson, 5th edition
2	Salesmanship and Advertisement	Dawar S.R	
3	Sales Promotion	Cummins. J	Kogan Page; 5 edition
4	New patterns in Sales Management	Birth and Boyd	
5	Marketing	Debbie Gilliland	

BA6OCT28 (B) SUPPLY CHAIN MANAGEMENT

Optional Course
No. of credit 4
No. of contact hour: 5

Objective

The paper aims to educate students on stages of supply chain management and new opportunities in SCM.

MODULE I

SCM, Definition, Objectives, Evolution, need, issues involved in developing SCM framework, Types. SCM activities, constituents, organisation.

MODULE II

Supply chain integration, stages, barriers to internal integration, achieving excellence in SCM, dimensions of supply chain excellence, forces influencing SCE Emotions, physical and financial supply chains, checklist for excellence.

MODULE III

Purchasing and supply management, introduction, importance, objectives, purchasing process, purchasing and other functions, purchasing and integrated logistics, interfaces, types of purchases, purchasing partnerships, material sourcing, just in time purchasing.

MODULE IV

Outsourcing in SCM, meaning, need, outsourcing risks, outsourcing process, outsourcing in SCM, new opportunities in SCM outsourcing, myths of SCM outsourcing.

MODULE V

Performance measurement in SCM, meaning, advantages of performance measures, the benefits of performance measurement, measuring SCM, supplier performance measurement, parameters choosing suppliers.

REFERENCES

Sl. No	*Title*	*Author*	*Publisher*
1	Logistics	David J Bloomberg, Stephen LeMay	Prentice Hall of India PVt Ltd.
2	Logistical Management	Donald J Bowersox& David J Closs	Tata McGraw Hill Publishing Co Ltd
3	Logistical Management	Satish C Ailawadi&Rakesh Singh	Prentice Hall of India PVt Ltd.
4	Supply Chain Management	Janat Shah	Pearson

BA6OCT28. (C) PRINCIPLES OF TOURISM MANAGEMENT

Optional Course
No. of credit 4
No. of contact hour: 5

Aim of the course

The aim of this course is to provide a fundamental knowledge on the principles of tourism management.

Objective of the course

On completion of the course, student should be able!

- To get a conceptual base on tourism
- To understand the need for developing tourism
- To identify the motivating factors of tourism
- To evolve plans for new and existing tourism destinations
- To understand the database for tourism planning.

Course Outline

Module I

Meaning of Tourism, Excursion, Leisure, Recreation, Tourist, Visitor and traveller

Types of Tourism : Domestic and international Tourism, Holidaying and sight - seeing Tourism, Business Tourism, Pilgrim Tourism, Rural Tourism, Cultural Tourism, Adventure Tourism. Farm Tourism, Dark Tourism, Eco Tourism, Responsible Tourism Modern Trends in Tourism

Tourism Industry: Meaning and features

Module II

Impact of Tourism: Economic, Psychological, political, Cultural and social significance of Tourism,

Economic significance: Foreign Exchange Benefits, Employment Generation, Tax Revenue, Multiplier effects.

Adverse Effects of Tourism

Module III

Components of Tourism: Tourist attractions Natural, cultural, Religious, Adventurous, etc.

Supplementary Attractions: Amusement parks, Film cities, fairs and festival etc.

Tourist facilities and services: Hotels, Travel Agencies, Tour Operators, Home stays, Retailers, Transportation: Airways, Roadways, Railways, and waterways.

(With examples in Indian perspective)

Module IV

Planning and Development of Tourism: Development of Tourism Potential, Scope for Development, Planning Process, Environmental Planning - Tourism and environmental Linkage, Carrying capacity and Types, Factors affecting carrying capacity.

Threats in planning: War, Natural Calamities Epidemic etc.

Module V

Measurement of Tourism: Need and General Problems of measurement, Types of tourist statistics, Methods of measurement of domestic and international tourist arrivals (in Indian perspective only)

Note on course work

Apart from the traditional lecture method, interactive sessions can be arranged with tourists, tour operators etc. Study tour may be conducted to developed and tourist destinations.

Activities

The programme envisages the following activities.

1. **Minor project (Group)** in the third semester (details given along with the syllabus) the viva-voce examination and dissertation valuation shall be done internally for 50 marks each.

2. **Management Projects individually** in the sixth semester. This is a one month implant training and project study to be conducted in the month of December. Each individual student has to undergo one month implant training plus project study in a reputed organization (with established functional departments). 30 day implant training certificate is mandatory with the project report. Project study on a selected management topics need to be conducted during this period in the contest of the organization. Project dissertation and report writing (minimum 40 pages) at the conclusion of the study. The project report should satisfy all the requisite of the research methodology theory. There will be two examinations one internal (20 marks) and another external (80 marks) based on the report.

3. Evaluation of Project , assignment, seminar, viva, internal assessment, test paper.

1. For projects

Group project for minor project . Individual project for management project.

a. Marks for external examination: 80

b. Marks for internal evaluation : 20

Components of management project evaluation (External)	Marks
Dissertation (external)	50
Viva-voce (external)	30
Total	80

Components of management project evaluation (internal)	Marks
Dissertation (internal)	10
Viva-voce (internal)	10
Total	20

Components of minor project evaluation (internal) third semester	Marks
Dissertation (internal)	80
Viva-voce (internal)	20
Total	100

4.INDUSTRIAL VISIT

The programme makes it mandatory in three semesters namely third, fourth and fifth to organise an industrial visit each. Preferably one to a manufacturing unit, another to a service sector and still another to a start-up village. Individual reports including photographs and illustration of the visit certified by the faculty in charge need to be prepared and submitted. These three reports are submitted to the external examiner for the sixth semester project viva-voce for the successful completion of the programme. The student who fail to submit satisfactory report will be consider as not completed the programme successfully.

FIRST SEMESTER

PAPER CODE	TITLE	COURSE
BA1CRT01	Principles and Methodology of Management	Core
BA1CRT02	Business Accounting	Core
BA1CMT03	Fundamentals of Business Mathematics	Complementary
BA1CMT04	Fundamentals of Business Statistics	Complementary
EN1CCT01	English Paper –I	Common

SECOND SEMESTER

PAPER CODE	TITLE	COURSE
BA2CRT06	Cost and Management Accounting	Core
BA2CRT07	Business Communication	Core
BA2CMT08	Mathematics for Management	Complementary
BA2CMT09	Statistics for Management	Complementary
EN2CMT09	English Paper –II	Common

THIRD SEMESTER

PAPER CODE	TITLE	COURSE
BA3CRT11	Human Resource Management	Core
BA3CRT12	Marketing Management	Core
BA3CRT13	Research Methodology	Core
BA3CMT14	Business Laws	Complementary
BA3PRP15	Personality Development and Management Skills (Minor Project)	Core

FOURTH SEMESTER

PAPER CODE	TITLE	COURSE
BA4CRT16	Financial Management	Core
BA4CRT17	Managerial Economics	Core
BA4CRT18	Entrepreneurship	Core

BA4CMT19	Basic informatics for Management	Complementary
BA4CMT20	Corporate Law	Complementary

FIFTH SEMESTER

PAPER CODE	**TITLE**	**COURSE**
BA5CRT21	Organisational Behaviour	Core
BA50PT22	Brand Management	OPEN
BA5CRT23	Environment Science and Human Rights	Core

BA5CMT25	Intellectual Property Rights and Industrial Laws	Complementary
BA5CRT26	Operations Management	Core
BA5CRT27	Industrial Relations	Core

SIXTH SEMESTER

PAPER CODE	TITLE	COURSE
BA6CBT29	Optional-I Investment and Insurance Management	Optional (Core)
BA6CBT32	Optional-II Advertisement and Salesmanship	Optional (Core)
BA6CRT29	Strategic Management	Core
BA6CRT30	Communication Skills and Personality development	Core
BA6PRP31	Management Project	Core

TIMETABLE OF 2019-2020

FIRST SEMESTER

WEEK	1	2	3	4	5
MONDAY	ENGLISH	MATHS	STATISTICS	PMM	BUSINESS ACCOUNTING
TUESDAY	BUSINESS ACCOUNTING	STATISTICS	MATHS	ENGLISH	BUSINESS ACCOUNTING
WEDNESDAY	MATHS	STATISTICS	ENGLISH	BUSINESS ACCOUNTING	PMM
THURSDAY	PMM	BUSINESS ACCOUNTING	STATISTICS	PMM	ENGLISH
FRIDAY	PMM	ENGLISH	BUSINESS ACCOUNTING	MATHS	PMM

THIRD SEMESTER

WEEK	1	2	3	4	5
MONDAY	HRM	BUSINESS LAW	RESEARCH METHODOLOGY	MARKETING MANGEMENT	HRM
TUESDAY	RESEARCH METHODOLOGY	MARKETING MANGEMENT	BUSINESS LAW	HRM	RESEARCH METHODOLOGY
WEDNESDAY	**BUSINESS** LAW	HRM	RESEARCH METHODOLOGY	MARKETING MANGEMENT	BUSINESS LAW
THURSDAY	MARKETING MANGEMENT	HRM	RESEARCH METHODOLOGY	BUSINESS LAW	MARKETING MANGEMENT
FRIDAY	MINOR PROJECT	MINOR PROJECT	MINOR PROJECT	MINOR PROJECT	MINOR PROJECT

FIFTH SEMESTER

WEEK	1	2	3	4	5
MONDAY	ORGANISATIONAL BEHAVIOUR	INTELLECTUAL PROPERTY RIGHTS	BRAND MANAGEMENT	ENVIRONMENTAL HUMAN RIGHTS	OPERATIONS MANAGEMENT
TUESDAY	ENVIRONMENTAL HUMAN RIGHTS	OPERATIONS MANAGEMENT	BRAND MANAGEMENT	INTELLECTUAL PROPERTY RIGHTS	ORGANISATIONAL BEHAVIOUR
WEDNESDAY	INTELLECTUAL PROPERTY RIGHTS	INDUSTRIAL RELATION	BRAND MANAGEMENT	ENVIRONMENTAL HUMAN RIGHTS	ORGANISATIONAL BEHAVIOUR
THURSDA Y	OPERATIONS MANAGEMENT	ORGANISATIONAL BEHAVIOUR	BRAND MANAGEMENT	INTELLECTUAL PROPERTY RIGHTS	ENVIRONMENTAL HUMAN RIGHTS
FRIDAY	ORGANISATIONAL BEHAVIOUR	ENVIRONMENTAL HUMAN RIGHTS	ORGANISATIONAL BEHAVIOUR	INTELLECTUAL PROPERTY RIGHTS	OPERATIONS MANAGEMENT

SECOND SEMESTER

WEEK	1	2	3	4	5
MONDAY	ENGLISH	STATISTICS	MATHS	BUSINESS COMMUNICATION	COST ACCOUNTING
TUESDAY	COST ACCOUNTING	STATISTICS	MATHS	ENGLISH	BUSINESS COMMUNICATION
WEDNESDAY	STATISTICS	COST ACCOUNTING	ENGLISH	MATHS	BUSINESS COMMUNICATION
THURSDAY	COST ACCOUNTING	BUSINESS COMMUNICATION	MATHS	COST ACCOUNTING	ENGLISH
FRIDAY	COST ACCOUNTING	ENGLISH	COST ACCOUNTING	STATISTICS	BUSINESS COMMUNICATION

FOURTH SEMESTER

WEEK	1	2	3	4	5
MONDAY	FINANCIAL MANAGEMENT	ENTREPRENEURSHIP	MANAGERIAL ECONOMICS	CORPORATE LAW	BUSINESS INFORMATICS
TUESDAY	BUSINESS INFORMATICS	CORPORATE LAW	ENTREPRENEURSHIP	FINANCIAL MANAGEMENT	MANAGERIAL ECONOMICS
WEDNESDAY	ENTREPRENEURSHIP	FINANCIAL MANAGEMENT	MANAGERIAL ECONOMICS	BUSINESS INFORMATICS	CORPORATE LAW

THURSDAY	CORPORATE LAW	ENTREPRENEURS HIP	FINANCIAL MANAGEMENT	BUSINESS INFORMATICS	MANAGERIAL ECONOMICS
FRIDAY	ENTREPRENEURSHIP	BUSINESS INFORMATICS	MANAGERIAL ECONOMICS	CORPORATE LAW	FINANCIAL MANAGEMENT

SIXTH SEMESTER

WEEK	1	2	3	4	5
MONDAY	INVESTMENT & INSURANCE MANAGEMENT	ADVERTISEMENT & SALESMANSHIP	COMMUNICATION SKILL	STRATEGIC MANAGEMENT	INVESTMENT & INSURANCE MANAGEMENT
TUESDAY	ADVERTISEMENT & SALESMANSHIP	COMMUNICATION SKILL	STRATEGIC MANAGEMENT	COMMUNICATION SKILL	INVESTMENT & INSURANCE MANAGEMENT
WEDNESDAY	STRATEGIC MANAGEMENT	COMMUNICATI ON SKILL	INVESTMENT & INSURANCE MANAGEMENT	ADVERTISEMENT & SALESMANSHIP	STRATEGIC MANAGEMENT
THURSDAY	COMMUNICATION SKILL	ADVERTISEMENT & SALESMANSHIP	ADVERTISEMENT & SALESMANSHIP	INVESTMENT & INSURANCE MANAGEMENT	STRATEGIC MANAGEMENT
FRIDAY	MAJOR PROJECT	MAJOR PROJECT	MAJOR PROJECT	MAJOR PROJECT	MAJOR PROJECT



Mahatma Gandhi University, Priyadarshini Hills

Kottayam

Bachelor's Degree Programme in Computer Applications and Science

Prepared By

Board of Studies in Computer Applications

And

Faculty of Science and Technology

May 2017

CONTENTS

	Page No
Introduction	4
Programme Objective	4
Programme structure	6
Syllabus	
BCA	24
B.Sc. Computer Science	65
B.Sc. Computer Application(Triple Main)	105
B.Sc. IT	133
Complementary / vocational courses for Model I and Model II	171

Acknowledgement

There are many profound personalities whose relentless support and guidance made this syllabus restructuring 2017 a success. I take this opportunity to express my sincere appreciation to all those who were part of this endeavor for restructuring of the syllabus and curriculum of Under Graduate Programme in Computer Applications and Science under Mahatma Gandhi University, Kottayam.

I express profound gratitude to the Honorable Vice-Chancellor, Pro-Vice chancellor, Registrar, Members of the syndicate and Academic Council for their leadership and guidance for completion of this work. I place on record my whole hearted gratitude to the members of Faculty of Science and Technology and Board of Studies (UG) in computer Applications for their untiring efforts. I also appreciate the efforts of members of University Academic section and other staff.

I am also grateful to all faculty members of various colleges who participated in the workshops organized by the University for restructuring the syllabus and curriculum. I also place on record my gratitude to all professionals, academicians and other stakeholders who gave valuable suggestions in this regard.

Dean, Faculty of Science and Technology,

Mahatma Gandhi University,

Kottayam.

1. Introduction

Mahatma Gandhi University introduced choice based credit and semester and grading system in colleges affiliated to University from the academic year 2009-2010 under direct grading system. Regulations for undergraduate programmes under choice based course-credit-semester system and grading was introduced in the university from the academic year 2013-2014 onwards under indirect grading system. The university Grants Commission, in order to facilitate student mobility across institutions within and across countries and also to enable potential employers to assess the performance of students, insisted to introduce uniform grading system in universities. The academic council of M G University resolved to introduce the UGC guidelines for choice based credit semester system from the academic year 2016-17 onwards . Meanwhile the Hon'ble Supreme Court of India has issued orders to include core courses on Environmental Studies and Human Rights in the Syllabi and curricula of all U G programmes of all Universities all over India. In continuation to this the U.G.C has issued circular regarding the implementation of the above said changes by accepting the direction of the Honorable Supreme Court as a national policy. Hence, the syndicate of M G University has decided to modify the syllabi and curricula of all UG programmes in accordance with the directions of the Honourable Supreme Court and U.G.C. Further, the syndicate has decided to implement the new regulations and syllabi with effect from the academic year 2017-18. In view of this, the Board of Studies of Computer Applications and the Faculty of Science and Technology has prepared the following syllabus for U G programmes in Computer applications and Science.

2. Scope

The revised syllabus for Computer Application and Science provides a strong foundation to pursue post graduation programme in computer science / applications. The knowledge acquired by the students may also equip them to meet the industrial need, and get placed.

3. Programme Objective

The Programme in Computer Application and Science is designed with the following specific objectives.

(a) To attract young minds to the potentially rich & employable field of computer applications.

(b) To be a foundation graduate programme which will act as a feeder course for higher studies in the area of Computer Science/Applications.

(c) To develop skills in software development so as to enable the graduates to take up self-employment in Indian & global software market.

(d) To Train & Equip the students to meet the requirement of the Industrial standards.

4. Course Design

The UG programme in Computer Applications and Science includes Common courses, Core courses, Complementary courses, Open courses, Seminar, Project and viva voce. No course shall carry more than four credits. The student shall select any one open course in semester V offered by various departments of the College.

5. Duration of Course

The pogramme shall normally extend over a period of three academic years consisting of six semesters.

Consolidated Scheme – I to VI Semesters of BCA

Sem	Title with Course Code	Course Category	Hours per week	Credit	Marks		
					Intl	Extl	Total
I	English-I	**Common**	5	4	20	80	100
	Mathematics	**Complementary**	4	4	20	80	100
	Basic Statistics	**Complementary**	4	4	20	80	100
	CA1CRT01 -Computer Fundamentals and Digital Principles	**Core**	4	4	20	80	100
	CA1CRT02-Methodology of Programming and C Language	**Core**	4	3	20	80	100
	CA1CRP01-Software Lab I (Core)	**Core**	**4**	2	20	80	100
II	English-II	**Common**	5	4	20	80	100
	Discrete Mathematics	**Complementary**	4	4	20	80	100
	CA2CRT03 -Data Base Management Systems	**Core**	4	3	20	80	100
	CA2CRT04-Computer Organization and Architecture	**Core**	4	4	20	80	100
	CA2CRT05-Object oriented programming using C++	**Core**	3	4	20	80	100
	CA2CRP02-Software Lab- II	**Core**	**5**	2	20	80	100
III	Advanced Statistical Methods	**Complementary**	4	4	20	80	100
	CA3CRT06-Computer Graphics	**Core**	4	4	20	80	100
	CA3CRT07-Microprocessor and PC Hardware	**Core**	3	4	20	80	100
	CA3CRT08-Operating Systems	**Core**	4	4	20	80	100
	CA3CRT09-Data Structure using C++	**Core**	4	3	20	80	100
	CA3CRP03-Software Lab III	**Core**	**6**	2	20	80	100
IV	Operational Research	**Complementary**	4	4	20	80	100
	CA4CRT10-Design and Analysis of Algorithms	**Core**	4	4	20	80	100
	CA4CRT11- System Analysis & Software Engineering	**Core**	4	4	20	80	100
	CA4CRT12-Linux Administration	**Core**	4	4	20	80	100
	CA4CRT13-Web Programming using PHP	**Core**	3	3	20	80	100
	CA4CRP04-Software Lab IV	**Core**	**6**	2	20	80	100

V	CA5CRT14-Computer Networks	**Core**	3	4	20	80	100
	CA5CRT15-IT and Environment	**Core**	4	4	20	80	100
	CA5CRT16-Java Programming using Linux	**Core**	3	3	20	80	100
	CA5OPT-- Open Course	**Core**	4	3	20	80	100
	CA5CRP05 -Software Lab V	**Core**	**5**	2	20	80	100
	CA5CRP06-Software Development Lab I (Mini Project in PHP)	**Core**	**6**	2	20	80	100
VI	CA6CRT17 -Cloud Computing	**Core**	4	4	20	80	100
	CA6CRT18 -Mobile Application development- Android	**Core**	4	4	20	80	100
	CA6PET-- -Elective	**Core**	4	4	20	80	100
	CA6CRP07 –Software Lab VI & Seminar	**Core**	**6**	2	100	-	100
	CA6CRP08 -Software Development Lab II (Main Project)	**Core**	**7**	3	20	80	100
	CA6VVT01-Viva Voce	**Core**		1	-	100	100

Open Course(OP): CA5OPT01 : Informatics and Cyber Ethics, CA5OPT02 : Computer Fundamentals, Internet & MS Office.

Electives (PE): CA6PET01: Data Mining, CA6PET02: Digital Image Processing, CA6PET03: Soft Computing Techniques.

Consolidated Scheme for I to VI Semesters – B.Sc. Computer Science

Sem	Course Code & Title	Course Category	Hours per Week		Credits	Marks		
			Theory	Lab		Internal	External	Total
I	English-I	Common	5		4	20	80	100
	Mathematics-I	Complementary	4		4	20	80	100
	CS1CRT01 Computer Fundamentals and Basics of PC Hardware	Complementary	4		4	20	80	100
	CS1CRT02 Methodology of Programming and C Language	Core	4		3	20	80	100
	CS1CMT01 Fundamentals of Digital Systems	Complementary	4		4	20	80	100
	CS1CRP01 Software Lab-I	Core		4	2	20	80	100
II	English-II	Common	5		4	20	80	100
	Mathematics-II	Complementary	4		4	20	80	100
	CS2CRT03 Data Communication	Complementary	4		3	20	80	100
	CS2CRT04 Computer Organization and Architecture	Core	4		4	20	80	100
	CS2CRT05 Object Oriented Programming using C++	Core	4		3	20	80	100
	CS2CCP02 Software Lab-II	Core		4	2	20	80	100
III	Probability and Statistics	Complementary	4		4	20	80	100
	CS3CRT06 Database Management Systems	Core	4		4	20	80	100
	CS3CRT07 System Analysis and Design	Core	4		4	20	80	100
	CS3CRT08 Networking Fundamentals	Complementary	4		4	20	80	100
	CS3CRT09 Data Structure using C++	Core	4		3	20	80	100
	CS3CRP03 Software Lab-III	Core		5	2	20	80	100
IV	CS4CRT10 LINUX Administration	Core	4		4	20	80	100
	CS4CRT11 Microprocessor and Assembly Language Programming	Complementary	4		4	20	80	100
	CS4CRT12 Computer Aided Optimization Techniques	Core	4		4	20	80	100
	CS4CRT13 Web Programming Techniques	Core	4		4	20	80	100

	CS4CRP04 Assembly Language Programming Lab	Complementary		5	2	20	80	100
	CS4CRP05 Software Lab IV	Core		4	2	20	80	100
V	CS5CRT14 System Software and Operating System	Core	4		4	20	80	100
	CS5CRT15 IT and Environment	Core	4		4	20	80	100
	CS5CRT16 Java Programming using Linux	Core	4		3	20	80	100
	CS5CRT17 Computer Security	Core	4		3	20	80	100
	CS5OPT Open Course	Core	4		4	20	80	100
	CS5PRP06 Software Development Lab I (Mini Project)	Core		5	2	20	80	100
VI	CS6CRT18 Computer Graphics	Core	5		4	20	80	100
	CS6CRT19 Big Data :Analytics	Core	5		4	20	80	100
	CS6PET Programme Elective	Core	5		4	20	80	100
	CS6SMP07 Seminar	Core		3	2	100	0	100
	CS6PRP08 Software Development Lab II (Main Project)	Core		7	3	20	80	100
	CS6VVP Viva Voce	Core		0	1	0	100	100
Grand Total			**113**	**37**	**120**	**780**	**2820**	**3600**

Open Course(OP): CA5OPT01 : Informatics and Cyber Ethics, CA5OPT02 : Computer Fundamentals, Internet & MS Office.

Consolidated Scheme for I to VI Semesters – B.Sc. Computer Application (Triple Main)

Sem	Course	Course Category	No. of hrs/ week		Duration of exam in hrs.	Maximum Mark			Credits
			Lect.	Lab		Intl	Extl	Tot	
I	English-I	Common	5		3	20	80	100	4
	Statistics	Core	4		3	20	80	100	3
	Mathematics	Core	4		3	20	80	100	3
	CA1CRT01-Computer Fundamentals and Digital principles	Core	4		3	20	80	100	3
	CA1CRT02-Methodology of programming and C language.	Core	4		3	20	80	100	3
	CA1CRP01 - Software Lab – I	Core		4	3	20	80	100	2
II	English	Common	5		3	20	80	100	4
	Statistics	Core	4		3	20	80	100	3
	Mathematics	Core	4		3	20	80	100	3
	CA2CRT03-Database Management System	Core	4		3	20	80	100	3
	CA2CRT04-Object Oriented Programming using C++	Core	4		3	20	80	100	3
	CA2CRP02-Software Lab II	Core		4	3	20	80	100	2
III	Statistics	Core	5		3	20	80	100	4
	Mathematics	Core	5		3	20	80	100	4
	CA3CRT05-Data Structure Using C++	Core	4		3	20	80	100	3
	CA3CRT06-Computer Network	Core	3		3	20	80	100	4
	CA3CRT07-System	Core	4		3	20	80	100	3

	Analysis and Software Engineering								
	CA3CRP03-Software lab-III	Core		4	3	20	80	100	2
IV	Statistics	Core	5		3	20	80	100	4
	Statistics	Core	5		3	20	80	100	4
	Mathematics	Core	5		3	20	80	100	4
	CA4CRT08-Linux Administration	Core	3		3	20	80	100	3
	CA4CRT09-Web Programming Using PHP	Core	3		3	20	80	100	3
	CA4CRP04- Software Lab IV	Core		4	3	20	80	100	3
V	Environmental Studies Human rights and Design of experiments	Core	5		3	20	80	100	4
	Mathematics	Core	5		3	20	80	100	4
	Mathematics	Core	5		3	20	80	100	4
	CA5CRT10-Java Programming	Core	4		3	20	80	100	4
	CA5OPT-Open Course	Core	4		3	20	80	100	4
	CA5CRP05-Software Lab V	Core		2	3	20	80	100	3
VI	Mathematics	Core	5		3	20	80	100	4
	Mathematics	Core	5		3	20	80	100	4
	CA6CRT11-Operating Systems	Core	5		3	20	80	100	4
	CA6PET-Elective	Core	5		3	20	80	100	4
	CA6CRP06-Software Development Lab (Main Project)	Core		5		20	80	100	3
	CA6VVT01 Course Viva	Core					100	100	1

Consolidated Scheme for I to VI Semesters – B.Sc. IT

Sem	Course	Course Category	No. of hrs/ week		Duration of exam in hrs.	Maximum Mark			Credits
			Lect.	Lab		Intl	Extl	Tot	
I	English-I	Common	5		3	20	80	100	4
	Mathematics	Complementary	4		3	20	80	100	4
	IT1CRT01- Computer Fundamentals and Basics of PC Hardware	Core	4		3	20	80	100	4
	IT1CRT02- Digital Electronics	Core	4		3	20	80	100	3
	IT1CRT03- Methodology of programming and C language.	Core	4		3	20	80	100	3
	IT1CRP01 - Software Lab – I	Core		4	3	20	80	100	2
II	English-II	Common	5		3	20	80	100	4
	Probability & Statistics	Complementary	4		3	20	80	100	4
	IT2CRT04- Operating Systems	Core	4		3	20	80	100	4
	IT2CRT05- Computer Organization and Architecture	Core	4		3	20	80	100	4
	IT2CRT06- Object Oriented Programming using C++	Core	4		3	20	80	100	3
	IT2CRP02- Software Lab II	Core		4	3	20	80	100	2
	IT3CRT07- Software	Core	4		3	20	80	100	4

	Engineering								
	Operation Research	Complementary	4		3	20	80	100	4
III	ITCRT08-Data Structure Using C++	Core	4		3	20	80	100	4
	IT3CRT09-Database Management Systems	Core	4		3	20	80	100	3
	IT3CRT10-Computer Graphics	Core	4		3	20	80	100	3
	CA3CRP03-Software lab-III	Core		5	3	20	80	100	2
	IT4CRT11-Design & Analysis of Algorithms	Core	4		3	20	80	100	4
	Discrete Mathematics	Complementary	4		3	20	80	100	4
IV	IT4CRT12-Linux Administration	Core	4		3	20	80	100	4
	ITCRT13-Paralle processing	Core	4		3	20	80	100	4
	IT4CRT14-Web Programming Using PHP	Core	4		3	20	80	100	3
	IT4CRP04-Software Lab IV	Core	-	5	3	20	80	100	2
	ITCR5T15-Computer Networks	Core	4		3	20	80	100	4
	IT5CRT16- Java Programming using Linux	Core	3		3	20	80	100	3
	IT5CRT17-IT and Environment		4		3	20	80	100	4

V	IT5OPT- Open Course	Core	4		3	20	80	100	4
	IT5CRP05- Software Lab V	Core		4	3	20	80	100	3
	IT5CRP06- Software Development Lab I (Mini project in PHP)	Core		6	3	20	80	100	3
VI	IT6CRT18- Mobile Application Development- Android	Core	4	4	3	20	80	100	4
	IT6CRT19- System Software	Core	4		3	20	80	100	4
	IT6PET- Elective	Core	4		3	20	80	100	4
	IT6CRP08- Software Lab VI & Seminar	Core		6					2
	IT6CRP09- Software Development Lab II	Core		7		20	80	100	3

Consolidated Scheme for I to IV Semesters – B.Sc Mathematics Vocational Model-II

Semester	Course	No. of hours per week		Durn. of Exam in hours	Maximum Mark			Credit
		Lecture	Lab.		Internal	External	Total	
I	CA1VOT01 : Computer Fundamentals	4	-	3	20	80	100	4
	CA1VOP01Software Lab –I- Introduction to WEB Technologies		4	3	20	80	100	3
II	CA2VOT02 : Object Oriented Programming with C++	4	-	3	20	80	100	4
	CA2VOP02 : Software Lab-II using C++	-	4	3	20	80	100	3
III	CA3VOT03 :Database Management Systems	6	-	3	20	80	100	4
	CA3VOP03 :Software Lab -II using SQL	-	6	3	20	80	100	3
IV	CA4VOT04:Operating System	6	-	3	20	80	100	4
	CA4VOP04 : Software Lab – IV Project	-	6	3	20	80	100	3

Consolidated Scheme for I to IV Semesters – B.Sc Physics Vocational Model-II

Semester	Title of the Course	Hours/week	Credits	Exam duration		marks	
						IA	EA
1	English I	5	4	90	3	20	80
	Second Language I	5	4	90	3	20	80
	PH1CRT01 – Methodology and Perspectives of Physics	2	2	36	3	10	60
	Complementary I – Mathematics I	5	3	90	3	20	80
	CA1VOT01 - Computer Fundamentals	2	2	36	3	20	80
	CA1VOT02 Computer Networks & Internet Technologies	2	2	36	3	10	60
	Core Practical I: PH2CRP01 Mechanics and Properties of Matter	2	-	36	-	-	-
	Vocational Practical I: CA2VOP01 Introduction to Computers & ANSI C Programming	2	-	36	-	-	-
	English II	5	4	90	3	20	80
	Second Language II	5	4	90	3	20	80

2	PH2CRT02 – Mechanics and Properties of Matter	2	2	36	3	10	60
	Complementary I – Mathematics II	5	3	90	3	20	80
	CA2VOT03 Word and Data processing Packages	2	2	36	3	20	80
	CA2VOT04 - Programming in ANSI C	2	2	36	3	10	60
	Core Practical I: PH2CRP01 Mechanics and Properties of Matter	2	2	36	3	20	40
	Vocational Practical 2: CA2 VOP01 Introduction to Computers & ANSI C Programming	2	2	36	3	20	40
	English III	5	4	90	3	20	80
	PH3CRT03 – Optics, Laser and Fiber Optics	3	3	54	3	10	60
	Complementary I – Mathematics III	5	4	90	3	20	80

3	CA3VOT05 Concepts of Object Oriented Programming	3	4	54	3	10	60
	CA3VOT06 – Operating System	3	3	54	3	10	60
	Core Practical II: PH4CRP02	2	-	36	-	-	-

	Optics and Semiconductor Physics						
	Vocational Practical II: CA4VOP02 **Data Processing Packages, Operating** **System and Visual Basic Programming**	**2**	**-**	**36**	**-**	**-**	**-**
	Vocational Practical III: CA4VOP03 **C++ Programming and Web Development**	**2**	**-**	**36**	**-**	**-**	**-**

	English IV	5	4	90	3	20	80
	PH4CRT04 - Semiconductor Physics	3	3	54	3	10	60
	Complementary I – Mathematics IV	5	4	90	3	20	80
	CA4VOT07 - Visual Basic Programming	3	4	54	3	10	60
4	CA4VOT08 Web Development and PHP Programming	3	3	54	3	10	60
	Core Practical II: PH4CRP02 Optics and Semiconductor Physics	2	2	36	3	20	40
	Vocational Practical II: CA4VOP02 Data Processing Packages, Operating System and Visual Basic Programming	2	2	36	3	20	40
	Vocational Practical III: CA4VOP03 C++ Programming and Web Development	2	2	36	3	20	40

Consolidated Scheme for III to VI Semesters – B.Com Computer Application Vocational Model-II

Semester	Course	No. of hours per week		Dum. of Exam in hours	Maximum Mark			Credit
		Lecture	Lab.		Internal	External	Total	
III	CO3OCT02- Information Technology for Business	3		3	10	60	100	3
	CO3OCP01-Information Technology for Business		2	3				1
IV	CO4OCT02 – Information Technology for Office	3	-	3	10	60	70	3
	CO4OCP02 – Information Technology for Office(P01&P02)	-	2	3				1
	Software Lab I				10+10	40	60	
V	CO5CMT04- Programming in C	3	-	3	10	60	70	3
	CO5CMP01- Programming in C	-	2	3				1
	CO5OCT02 – Computerized accounting	3		3	10	60	70	3
	CO5OCP01 – Computerized accounting		2					1
VI	CO6CMT04- Database Management System	3	-	3	10	60	70	3
	CO6CMP01- Database Management System		2	3				1
	CO6OCT02- Software for Business and Research	3		3	10	60	70	3
	CO6OCP01- Software for Business and Research		2					1

	Software Lab II				10+10	40	60	
	Software Lab III				10+10	40	60	

Consolidated scheme for I to IV Semesters-BA Economics Programme (Vocational) Model II Computer Application

Semester	Course	No. of hours per week		Durn. of Exam in hours	Maximum Mark			Credit
		Lecture	Lab.		Internal	External	Total	
I	CA1CMT01 : Computer Fundamentals	3	-	3	10	60	70	3
	Practical – I Office Automation		2					
II	CA2CMT02 : Computerized Techniques for Office	3	-	3	10	60	70	3
	Practical – II Computerized Techniques for Office	-	2					
	CA2CMP01 : Practical – I & II external				10+10	40	60	2
III	CA3CMT03 : Database Management System	2	-	3	10	60	70	3
	Practical – III DBMS and MS Access	-	2					
IV	CA4CMT04 : Visual Programming Techniques	2	-	3	10	60	70	3
	Practical – IV based on VB.NET	-						
	CA4CMP02 : Practical – III & IV external			3	10+10	40	60	2

Consolidated scheme for I to IV semesters-B.Sc Petrochemicals Complementary Papers

Semester	Course	No. of hours per week		Durn. of Exam in hours	Maximum Mark			Credit
		Lecture	Lab.		Internal	External	Total	
I	CA1CMT01 : Computer Fundamentals	3	-	3	10	60	70	2
	Practical – I Office Automation		2					
II	CA2CMT02 : Programming in C language	3	-	3	10	60	70	3
	Practical – II using C	-	2					
	CA2CMP01 : Software lab I – Lab I & Lab II			3	10+10	40	60	2
III	CA3CMT03 : Web Technology and Programming	4	-	3	10	60	70	2
	Practical – III Web Technology based	-	2					
IV	CA4CMT04 : Visual Programming Techniques	3	-	3	10	60	70	3
	Practical – IV based on VB.NET	-	2					
	CA4CMP02 : Software lab II – Lab III & Lab IV			3	10+10	40	60	2

Consolidated scheme for I to IV semesters -Model- I Complementary Paper For B.Sc. Statistics, B.Sc. Mathematics

Semester	Course	No. of hours per week		Durn. of Exam in hours	Maximum Mark			Credit
		Lecture	Lab.		Internal	External	Total	
I	CA1CMT01 : Computer Fundamentals	2	-	3	10	60	70	2
	Practical – I Office Automation		2					
II	CA2CMT02 : Programming in C Language	2	-	3	10	60	70	3
	Practical – II using C	-	2					
	CA2CMP01 : Software lab I – Lab I & Lab II			3	10+10	40	60	2
III	CA3CMT03 : Web Technology and Programming	3	-	3	10	60	70	2
	Practical – III Web Technology based	-	2					
IV	CA4CMT04 : Visual Programming Techniques	3	-	3	10	60	70	3
	Practical – IV based on VB.NET	-	2					
	CA4CMP02 : Software lab II – Lab III & Lab IV			3	10+10	40	60	2

SYLLABUS- BCA- SEMESTER I

CA1CRT01 : Computer Fundamentals and Digital Principles (Core)

Theory:4 hrs. per week

Credits:4

Unit-1: (12 hrs.)

Introduction: Functional units of a computer system, Different types of computers, Computer Software and Hardware, Types of software-System software and Application programme. Characteristic of computers. Input Devices – Keyboard, Mouse, Optical input devices, Output devices – Monitors and Printers.

Unit-2: (10 hrs.)

Introduction to Operating Systems and Networking: Definition of an Operating System - Different types of PC Operating Systems. Computer Networks- categories of networks - LAN, WAN,MAN. The Internet - Working of Internet - Major Features of Internet.

Unit 3: (12 hrs.)

Number Systems: Base or radix ,Positional number system, Popular number systems(Decimal, Binary, Octal and Hexadecimal), Conversion-From one number system to another, Concept of binary addition and subtraction, Complements in binary number systems,1^s Complement, 2^s Complement and their applications, Signed magnitude form, BCD numbers- concept and addition.

Unit 4: (20 hrs.)

Boolean Algebra and Gate Networks: Logic gates- AND, OR, NOT, NAND and NOR Truth tables and graphical representation, Basic laws of Boolean Algebra, Simplification of Expressions, De Morgans theorems, Dual expressions, Canonical expressions, Min terms and Max terms, SOP and POS expressions, Simplification of expression using K-MAP (up to 4 variables), Representation of simplified expressions using NAND/NOR Gates, Don't care conditions, XOR and its applications, parity generator and checker.

Unit5: (18 hrs.)

Sequential and Combinational Logic. Flip flops- Latch, Clocked, RS, JK, T, D and Master slave , Adders-Half adder, Full adder(need and circuit diagram), Encoders, Decodes, Multiplexers and Demultiplexers(working of each with diagram), Analog to digital and digital to analog converters (Diagram and working principle), : Concept of Registers, Shift Registers

Books of study :

1. Peter Nortons- Introduction to Computers, Sixth Edition, Published by Tata McGraw Hill

2. P K Sinha & Priti Sinha - Computer Fundamentals , Fourth Edition, BPB Publications.

3. M Morris Mano-Digital Logic and Computer design, Fourth Edition, Prentice Hall.

References Text:

1. Thomas C Bartee- Digital computer Fundamentals, Sixth Edition, TATA McGraw Hill Edition

2. Thomas L Floyd- Digital Fundamentals, Ninth edition, PEARSON Prentice Hall.

3. Malvino & Leach- Digital Principles and Applications, Sixth Edition, Tata McGraw Hill, 2006

CA1CRT02 -Methodology Of Programming And C Language (Core)

Theory:4 hrs. per week

Credits:3

UNIT 1 (12 hrs.)

Introduction to programming, Classification of computer languages, Language translators (Assembler, Compiler, Interpreter), Linker, Characteristics of a good programming language, Factors for selecting a language, Subprogram, Purpose of program planning, Algorithm, Flowchart, Pseudocode, Control structures (sequence, selection, Iteration), Testing and debugging

UNIT 2(12 hrs.)

C Character Set, Delimiters, Types of Tokens, C Keywords, Identifiers, Constants, Variables, Rules for defining variables, Data types, C data types, Declaring and initialization of variables, Type modifiers, Type conversion, Operators and Expressions- Properties of operators, Priority of operators, Comma and conditional operator, Arithmetic operators, Relational operators, Assignment operators and expressions, Logical Operators, Bitwise operators.

UNIT 3 (15 hrs.)

Input and Output in C – Formatted functions, unformatted functions, commonly used library functions, Decision Statements If, if-else, nested if-else, if-else-if ladder, break, continue, goto, switch, nested switch, switch case and nested if. Loop control- for loops, nested for loops, while loops, do while loop.

UNIT 4(15 hrs.)

Array, initialization, array terminology, characteristics of an array, one dimensional array and operations, two dimensional arrays and operations. Strings and standard functions, Pointers, Features of Pointer, Pointer and address, Pointer declaration, void wild constant pointers, Arithmetic operations with pointers, pointer and arrays, pointers and two dimensional arrays.

UNIT 5(18 hrs.)

Basics of a function, function definition, return statement, Types of functions, call by value and reference. Recursion -Types of recursion, Rules for recursive function, direct and indirect recursion, recursion vs iterations, Advantages and disadvantages of recursion. Storage class, Structure and union, Features of structures, Declaration and initialization of structures, array of structures, Pointer to structure, structure and functions, typedef , bitfields , enumerated data types, Union, Dynamic memory allocation, memory models, memory allocation functions.

Book Of Study:

1. Ashok Kamthane - Programming in C, Third Edition, Pearson Education

2. P K Sinha & Priti Sinha - Computer Fundamentals , Fourth Edition, BPB Publications.

Reference Text

1. E. Balaguruswamy -Programming in ANSI C ,Seventh Edition , McGraw Hill Education
2. Byron Gotfried - Programming with C, Second Edition, Schaums Outline series. McGraw Hill

CA1CRP01-Software Lab I (Core)

Software Lab: 4 hrs. per week

Credits:2

Syllabus

1. Programs to familiarize printf() and scanf() functions.

2. Programs Based on Decision statements , break, goto, continue, switch and Loop controls statements.

3. Programs Based on One dimensional and two dimensional arrays.

4. Programs on Strings and string handling functions.

5. Programs based on Pointers, operations on pointers, Arrays & Pointers,

6. Programs based on functions, Call by value, Call by reference, Recursion,

7. Programs based on structure and union, array of structures, Pointer to structure, structure and functions

8. Simple programs using pointers and malloc().

Scheme of Evaluation for software lab I external is as follows:

Division of Marks (Practical - 3 hours External)

First program from part 1& 2 **- 25 marks**

1.Flowchart - 5 marks

2.Logic – 10 marks

3.Successful compilation – 5 marks

4.Result – 5 marks

Second program should be based on advanced concepts ,part 3 to part 8 **- 35 marks**

1.Logic – 20 marks

2.Successful compilation – 10 marks

3. Result – 5 marks)

Viva Voce **- 10 marks**

Lab Record (minimum of 25 Programs) **- 10 marks**

Total Marks **- 80 marks**

BCA- SEMESTER II

CA2CRT03- Database Management Systems (Core)

Theory:4 hrs. per week

Credits:3

Unit 1: Introduction (12 hrs.)

Characteristics of the Database Approach – Database users :DBA , Database Designers ,End users – Advantages of using the DBMS Approach – Data models, Schemas , and Instances – Three-Schema Architecture and Data Independence.

DBMS Languages: DDL, DML – The Database System Environment: DBMS Component Modules.

Unit 2: Relational Model (16 hrs.)

Entity Relationship Modeling: Introduction –Entity Types , Entity Sets , Attributes and Keys – Relationship Types ,Relationship Sets, Roles , and Structural Constraints – Weak Entity Types – Notation for ER diagrams – Sample ER diagrams.

Relational Model concepts: Domains ,Attributes , Tuples , and Relations – Characteristics of Relations – Relational Model Constraints and Relational Database Schemas : Domain Constraints, Key Constraints , Relational Database Schemas , Entity Integrity , Referential Integrity, and Foreign Keys .

Unit 3: SQL(14 hrs.)

Data Types – Data Definition commands : CREATE , ALTER ,DROP - Adding constraints in SQL –

Basic SQL Queries : INSERT ,SELECT ,DELETE ,UPDATE - Substring comparison using LIKE operator ,BETWEEN operator – Ordering of rows – SQL set operations UNION , EXCEPT , INTERSECT – Complex Queries : Comparison involving NULL and Three-valued logic ,Nested queries , EXISTS and UNIQUE functions, Renaming of attributes and Joining of tables, Aggregate functions ,Grouping – Managing Views.

Unit 4: Normalization and Indexing Structures for Files(15 hrs.)

Normalization: Informal Design Guidelines for Relational Schemas –Functional Dependencies – Normal forms : First Normal Form , Second Normal Form , Third Normal Form – General Definitions of Second and Third Normal Forms –BCNF.

Indexing Structures for files: -Types of Single-Level Ordered Indexes: Primary Indexes, Clustering Indexes, and Secondary Indexes.

Unit 5: Transaction Processing and Database Security (15 hrs.)

Transaction Processing: Introduction to Transaction Processing - Transaction and System Concepts – Desirable properties of Transactions.

Database Security and Authorization: Types of Security – Control measures – Database Security and DBA – Access Control , User Accounts, and Database Audits –Access Control based on Granting and Revoking Privileges.

***Books of study*:**

1.Ramez Elmasri and Shamkant B.Bavathe - DATABASE SYSTEMS , Sixth Edition, Pearson Education.

***References**:*

1. C.J Date- An Introduction to Database Systems, Eighth edition, Pearson Education,2003

2. Reghu Ramakrishnan and Johannes Gehrke- Database Management Systems , Third edition, Mc Graw Hill International Edition.

3. Dipin Desai , An Introduction to Database Systems , First Edition, Galgoria Publications .

CA2CRT04 : Computer Organization and Architecture (Core)

Theory:4 hrs. per week

Credits:3

Unit 1: (12 hrs.)

Basic computer organization and design

Operational concepts, Instruction codes, Computer Registers, Computer Instructions, Memory locations and addresses, Instruction cycle, Timing and control, Bus organization.

Unit 2: (15 hrs.)

Central Processing Unit:

General Register Organization, Stack Organization, Addressing modes, Instruction Classification, Program control.

Unit 3: (16 hrs.)

Memory Organization

Memory Hierarchy, Main Memory, Organization of RAM, SRAM, DRAM, Read Only Memory-ROM-PROM,EROM,EEPROM, Auxiliary memory, Cache memory, Virtual Memory, Memory mapping Techniques.

Unit 4: (15 hrs.)

Parallel Computer Structures:

Introduction to parallel processing, Pipeline computers, Multi processing systems, Architectural classification scheme-SISD, SIMD, MISD, MIMD.

Unit 5: (14 hrs.)

Pipelining and Vector processing: Introduction to pipelining, Instruction and Arithmetic pipelines (design) Vector processing, Array Processors.

Book of study :

1. M.Morris Mano-Computer Systems Architecture, Third Edition, Pearson Education
2. Kai Hwang and F A Briggs-Computer Architecture and parallel processing, McGraw Hills,1990

Reference

1. Carl Hamacher -Computer Organization, Fifth Edition, Tata McGraw Hill.
2. John P Hayes -Computer Architecture & Organization–Mc Graw Hill
3. William Stallings-Computer Organization and Architecture , Seventh Edition, Pearson Education

CA2CRT05- Object Oriented Programming using C++ (Core)

Theory:3 hrs. per week

Credits:4

Unit 1: (10 hrs.)

Principles of Object Oriented Programming, Beginning with C++

Procedure Oriented Programming-Object Oriented Programming-Basic concepts of object-oriented programming- Benefits of OOP- Applications of OOP-A simple C++program-Structure of C++ program-C++ data types- Symbolic constants- Reference by variables-Operators in C++- Operator precedence-Control structures- Function in C++ - The main function, Function prototyping- Call by reference- Return by reference- Inline function- Default arguments- Function overloading.

Unit 2: (10 hrs.)

Classes and Objects : Specifying a class- Defining member functions- Nesting of member functions - Private member functions - Arrays within a class - Memory allocation for objects-Static data members - Static member functions -Arrays of objects - objects as function arguments -Friendly functions- Returning Objects.

Unit 3: (12 hrs.)

Constructers and Destructors, Overloading

Constructors- Default constructor-Parameterized constructor-Copy constructor- Multiple constructors-Constructors with default arguments- Dynamic constructor-Destructors- Operator overloading- Unary and Binary operator overloading- Overloading using friends- Rules for overloading- Type conversion.

Unit 4: (10 hrs.)

Inheritance: Inheritance - Defining derived classes-Visibility modes-Single, Multilevel, Multiple, Hierarchical and Hybrid inheritance- Virtual base classes- Abstract classes- Constructors in derived classes- Nesting of classes.

Unit 5: (12 hrs.)

Pointers, Virtual Functions and Polymorphism, Working with Files : Pointers- Pointers to objects-this pointer-Pointers to derived classes- Virtual functions- Pure virtual functions- File Stream classes, Opening and closing a file- File opening modes- File pointers and their manipulations- Sequential input and output operations.

Book of Study:

1. E. Balagurusamy - Object Oriented Programming with C++, Fifth edition, Tata McGraw Education Hill , 2011.

Reference*:*

1. Ashok N. Kamthane, Object oriented Programming with ANSI & Turbo C++, First Edition, Pearson India
2. Robert Lafore, Object Oriented Programming in Turbo C++, First Edition, Galgotia Publications.
3. D Ravichandran, Programming with C++, Second edition, Tata McGraw- Hill.

CA2CRP02-Software Lab II (Core)

Software Lab: 5 hrs. per week

Credits:2

I. SQL Commands (2 hrs. per week)

1. Data definition commands - CREATE, ALTER, DROP, Adding Constraints Primary key, foreign key, unique key, check, not null.
2. Basic SQL queries INSERT, SELECT, DELETE, UPDATE, Using multiple tables, ordering of rows using ORDER BY option, Set operations using UNION, EXCEPT, INTERSECT, Substring Comparison using LIKE operator, BETWEEN operator.
3. Complex Queries Nested Queries, EXISTS and UNIQUE/DISTINCT functions, NULL values, Renaming of attributes and Joining of tables, Aggregate functions and grouping.
4. Managing views, Simple stored procedures.
5. Data Control commands - Access Control and Privilege commands.

II. Object Oriented Programming using C++ (3 hrs. per week)

1. Programs based on default arguments, function overloading.
2. Programs based on array of objects, friend functions, passing objects as arguments to function.

3. Programs based on operator overloading (binary, unary) using member functions and friend functions.
4. Programs based on constructors, different types of constructors.
5. Programs based on inheritance, different types of inheritance.

Scheme of Evaluation for software lab II external is as follows:

(There will be two questions; the first from DBMS and second from C++)

Division of Marks (Practical - 3 hours External)

First program - questions from DBMS **- 25 marks**

1. Logic – 10 marks
2. Successful compilation – 8 marks
3. Result – 7 marks

Second program – questions from Object Oriented Programming using C++ **- 35 marks**

1. Logic – 20 marks
2. Successful compilation –10 marks
3. Result – 5 marks

Viva Voce **- 10 marks**

Lab Record **- 10 marks**

(DBMS -Minimum of 10 Programs

C++ -Minimum: of 15 Programs)

Total Marks **- 80 marks**

BCA- SEMESTER III

CA3CRT06 - Computer Graphics (Core)

Theory:4 hrs. per week

Credits:4

Unit 1 : (12 hrs.)

Introduction: A survey of Computer Graphics, overview of graphics systems-Video display devices- Refresh CRT, Raster-Scan and Random-Scan Displays ,Color CRT Monitors, DVST, Flat-Panel Displays , Raster Scan systems, Random scan systems, Input devices, Hard copy devices, Graphics software.

Unit 2: (14 hrs.)

Output primitives: Line drawing algorithms: DDA algorithm, Bresenham's line algorithm, Circle generating algorithm- Midpoint circle algorithm, Character generation.

Unit 3: (18 hrs.)

2D geometric Transformations: Basic transformations: Translation, Rotation, Scaling; Other transformations-Reflection and shear, Matrix representation and homogenous coordinates, Composite transformation, Interactive picture construction Techniques.

Two-dimensional viewing: viewing pipeline, window and viewport, window to viewport transformation. Clipping operations- Point clipping, Line clipping:- Cohen Sutherland line clipping, Polygon clipping:- Sutherland- Hodgeman polygon clipping, Text Clipping.

Unit 4: (14 hrs.)

Three-dimensional concepts: Three dimensional display methods, Three dimensional object representations- Polygon surfaces, Sweep representations, Constructive solid geometry methods, octrees and quadtrees.

Unit 5 (14 Hrs)

Computer Animation: Design of animation sequences, raster animations, computer animation languages, key-frame systems, morphing, motion specifications.

***Book of study* :**

1. Donald D.Hearn & M. Pauline Baker, Computer Graphics C Version, Second Edition,, PHI Pvt. Ltd.

References:

1. Newman W M & R F Sproul, Principles of Interactive Computer Graphics, Second Edition Mc-Graw Hill Publishers.
2. Plastock R & Xiang Z, Theory and problems of computer Graphics, Second Edition Schaum Series, McGraw Hill Publishers.

CA3CRT07 -Microprocessors and PC Hardware (Core)

Theory:3 hrs. per week

Credits:3

Unit1: (10 hrs.)

Introduction : Evolution of microprocessors. **Introduction to the concept of 8085 microprocessor:** Intel 8085 introduction, Architecture ,Pin diagram, Instruction cycle, Timing diagrams, Interrupts of Intel 8085.

Unit 2 : (10 hrs.)

Instruction Set of Intel 8085 : Introduction, Instruction and data format, Addressing modes, Status flags, Intel 8085 instruction set.

Unit3: (12 hrs.)

Motherboard : Components of motherboard — expansion slots, Processor socket, coprocessor, memory modules, BIOS and CMOS, chipset. Super I/O chip, ROM BIOS, System buses- Processor Buses, Memory buses, I/O Bus(ISA,PCI Local Bus, AGP, USB), Motherboard selection criteria.

Unit4: (10 hrs.)

Hard disk: Hard Disk drive, Definitions, Hard Disk operations, Disk formatting, Basic hard disk drive components, Hard disk features, Hard disk drive installation procedure, FAT Disk, VFAT, FAT 32, NTFS.

Unit5: (12 hrs.)

Types of memory: Physical Memory, Memory modules:- SIMMs, DIMMs, RIMMs, Brief study of conventional base memory, Upper memory area, High memory area, Extended memory, Expanded memory.

Book of study :

1. B Ram -Fundamentals of microprocessors and microcontrollers, Seventh revised edition, Dhanpat Rai Publications.
2. Manahar Lotia and Pradeep Nair- All about motherboard, First edition, 2005, BPB Publications..
3. Manahar Lotia and Pradeep Nair- Modern all about Hard Disk Drive , First edition, BPB publications.

References:

1. Scott Mueller - Upgrading and repairing PCs , 18th Edition, Pearson.
2. R S. Gaonkar- Micro processor Architecture, Programming and applications with 8085, Sixth Edition, PENRAM International Publishing.

CA3CRT08 - Operating Systems (Core)

Theory:4 hrs. per week

Credits:4

Unit 1: (10 hrs.)

Introduction: OS Definition, Functions, Evolution of OS,OS Structure Operating System Operations, Operating System Services, User Operating System Interface, System Calls, Types of System Calls.

Unit 2: (14 hrs.)

Process: Basic Concepts, Process Scheduling, Operations on Processes, Inter process communication, Process Scheduling - Scheduling Criteria, Scheduling Algorithms, Multiple Processor Scheduling.

Unit 3: (18 hrs.)

Process Coordination: Synchronization - The Critical Section problem, Semaphores, Classic Problems of Synchronization, Monitors. Deadlocks: System Model, Deadlock Characterization, Methods of handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

Unit 4: (16 hrs.)

Memory Management: Memory Management Strategies - Swapping, Contiguous memory allocation, Paging, Segmentation. Virtual Memory Management- Demand paging, Page Replacement.

Unit 5: (14 hrs.)

Storage Management: File System: - File Concept, Access Methods, Directory structure. Implementing File Systems:-File System Structure, Allocation Methods, Free Space Management, Disk Scheduling.

Book of study:

1. Abraham Silberschatz, Peter Galvin and Greg Gagne - Operating System Principles, Seventh Edition, John Wiley
2. William Stallings - Operating Systems, Sixth Edition, Prentice Hall of India, Pearson

Reference:

1. Milan Kovic - Operating Systems, 2ndEdition, (TMH)

CA3CRT09 - Data Structures using C++

Theory:4 hrs. per week

Credits:3

Unit 1 (12 hrs. **)**

Concept of Structured data - Data structure definition, Different types and classification of data structures, Arrays – Memory allocation and implementation of arrays in memory, array operations, Applications - sparse matrix representation and operations, polynomials representation and addition, Concept of search and sort – linear search, binary search, selection sort, insertion sort, quick sort.

Unit 2 (12 hrs.**)**

Stacks – Concepts, organization and operations on stacks using arrays (static), examples, Applications - Conversion of infix to postfix and infix to prefix, postfix evaluation, subprogram calls and execution, Multiple stacks representation.

Queues - Concepts, organization and operations on queues, examples.

Circular queue – limitations of linear queue, organization and operations on circular queue. Double ended queue, Priority queue.

Unit 3 (18 hrs.**)**

Linked list: Concept of dynamic data structures, linked list, types of linked list, linked list using pointers, insertion and deletion examples, circular linked list, doubly linked lists

Applications- linked stacks and queues, memory management basic concepts, garbage collection.

Unit 4 (15)

Trees - Concept of recursion, trees, tree terminology, binary trees, representation of binary trees, strictly binary trees, complete binary tree, extended binary trees, creation and operations on binary tree, binary search trees, Creation of binary search tree, tree traversing methods – examples, binary tree representation of expressions.

Unit 5 (15)

File - Definition, Operations on file (sequential), File organizations - sequential, Indexed sequential, random files, linked organization, inverted files, cellular partitioning, hashing – hash tables, hashing functions, collisions, collision resolving methods.

Books of study :

1. G.S Baluja - Data Structures Through C++ (A Practical Approach), Second Edition-2004, Danapat Rai & Co.
2. Ellis Horowitz and Sartaj Sahni - Fundamentals of Data Structures in C++ , Second Edition, Galgotia Publications.

References:

1. Seymour Lipschutz, Theory and Problems of Data Structures, Schaums Outline Series,2006, McGraw Hill
2. Yedidyah Langgsam, Moshe Augustein, Aaron M Tenenbaum- Data structures using C and C++ , Second Edition, Prentice Hall

CA3CRP03-Software Lab III (Core)

Software Lab: 6 hrs. per week

Credits:2

Syllabus

Module I

Array – Insertion , Deletion, Polynomial addition using arrays

Sort – Selection, Insertion, Quick

Search – Linear search, Binary search

Sparse matrix – Sparse form representation, transpose and addition using the sparse form

Module II

Stack - Implementation using arrays (linear stack), Infix to postfix conversion, Postfix evaluation

Queue – Implementation using arrays (linear queue), Implementation of circular queue

Module III

Singly linked list – Implementation using dynamic memory allocation techniques, arrange the list based on the ascending or descending order of the information field, concatenate two linked lists, interchange any two nodes in a list, Implementation of circular list, Implementation of linked stacks and queues.

Doubly linked list – Implementation of doubly linked list, Implementation of circular doubly linked list.

Module IV

Creation of binary search trees, Insertion and deletion of nodes, Tree traversals.

Scheme of Evaluation for software lab III external is as follows:

(There will be two questions)

Division of Marks (Practical - 3 hours External)

First program - questions from module 1 & II **- 25 marks**

1. Logic – 10 marks
2. Successful compilation – 8 marks
3. Result – 7 marks

Second program – questions from module III & IV **- 35 marks**

1. Logic – 20 marks
2. Successful compilation –10 marks
3. Result – 5 marks

Viva Voce **- 10 marks**

Lab Record **- 10 marks**

(Minimum of 25 Programs)

Total Marks **- 80 marks**

BCA - SEMESTER IV

CA4CRT10 - Design and Analysis of Algorithms (Core)

Theory:4 hrs. per week

Credits:4

Unit 1: (12 hrs.)

Introduction, Definition of Algorithm, Algorithm design techniques, Algorithm Analysis, performance analysis - space complexity, time complexity, Best, Worst, And average case complexity.

Unit 2 (14 hrs.)

Divide and Conquer General method, Binary search, finding the maximum and minimum, merge sort, quick sort, performance measurement of quick sort, Selection, Strassen's matrix multiplication.

Unit 3 (18 hrs.)

Greedy Algorithm General Characteristics of greedy algorithms, Problem solving using Greedy Algorithm - Knapsack problem, Minimum Spanning trees (Kruskal's algorithm, Prim's algorithm).

Unit 4: (16 hrs.)

Dynamic programming The general method, multistage graphs, all-pairs shortest path, Single source shortest path, 0/1 Knapsack problem, Traveling Sales person problem.

Unit 5: (12 hrs)

Basic traversal and search techniques - BFS and traversal, DFS and traversal, Bi-connected components and DFS, Backtracking General method, 8-queens problem, Sum of subsets problem, Graph coloring, Hamiltonian cycles.

Book of study:

1. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekharan, Computer algorithms/C++,Second Edition, Universities Press.

References:

1. Anany Levitin- Introduction to design and analysis of algorithms, Third Edition, Addison Wesley Low price edition.
2. Richard Neapolitan & Kumarss Naimipour, Foundation of Algorithms using C++ Pseudocode, Third edition, Jones And Bartlett Publishers.

CA4CRT11 - System Analysis & Software Engineering (Core)

Theory:4 hrs. per week

Credits:4

Unit 1: (12 hrs.)

Information systems concepts, Business information systems; Describing the business organization – organization chart , organization function list ; information system levels - operational, lower, middle, top management; SDLC Life cycle activities- life cycle flow chart, task, management review, baseline specifications, role of system analyst.

Unit 2: (14 hrs.)

Introduction to Software Engineering - Definition, Program Vs Software, and Software process, Software Characteristics, Brief introduction about product and process, Software process and product matrices. Software life cycle models , Definition, Waterfall model, Increment process models- Iterative , RAD , Evolutionary process models-Prototyping ,Spiral. Selection of a life cycle model.

Unit 3: (18 hrs.)

Software Requirement Analysis and Specification Requirements Engineering type of requirements, Feasibility Studies, Requirement Elicitation – Use Case, DFD, Data Dictionaries , Various steps for requirement analysis, Requirement documentation, Requirement validation, an example to illustrate the various stages in Requirement analysis. Project planning-Size estimation, cost estimation, the constructive cost model (COCOMO).

Unit 4: (14 hrs.)

Software Design - Definition, Various types, Objectives and importance of Design phase, Modularity, Strategy of design, Function oriented design, IEEE recommended practice for software design descriptions. Steps to Analyze and Design Objected Oriented System. Software Reliability Definition, McCall software quality model, Capability Maturity Model.

Unit 5: (14 hrs.)

Software Testing : What is testing?, Test, Test case and Test Suit, Verification and Validation, Alpha, beta and acceptance testing, functional testing, techniques to design test cases, boundary value analysis, Equivalence class testing, decision table based testing, cause effect graphing technique, Structural testing path testing, Graph matrices, Data flow testing; Levels of testing Unit testing, integration testing, system testing, validation testing,

Book of Study:

1. Marvin Gore & John Stubbe -Elements Of System Analysis, Fourth Edition, Galgotia Book Source.
2. K K Aggarwal, Yogesh Singh - Software Engineering,Third Edition, New Age International Publications.

References :

1. Roger S Pressman - Software Engineering: A Practitioner's Approach, Sixth Edition, McGraw-Hill Higher Education.
2. Ian Sommerville - Software Engineering , Seventh Edition, Pearson Education.
3. Pankaj Jalote - An Integrated approach to Software Engineering, Second Edition, Narosa Publishing Company.

CA4CRT12 - Linux Administration (Core)

Theory:4 hrs. per week

Credits:4

Unit-1 (12 hrs.)

Overview of Linux : What is Linux, Linux's root in Unix, Common Linux Features, advantage of Linux, Overview of Unix and Linux architectures, Linux files system, hardware requirements for Linux, Linux standard directories. Commands for files and directories cd, ls, cp, rm, mkdir, rmdir, pwd, file, more, less, Creating and viewing files using cat, file comparisons.

Unit 2 (15 hrs.)

Essential Linux commands: Processes in Linux, process fundamentals, connecting processes with pipes, redirecting input/output, Background processing, managing multiple processes, process scheduling – (at, batch), nohup command, kill, ps, who, find, sort, touch, file, file processing commands - wc, cut, paste etc Mathematical commands - expr, factor etc. Creating and editing files with vi editor.

Unit 3 (15 hrs.)

Shell programming - Basics of shell programming, various types of shell available in Linux, comparisons between various shells, shell programming in bash.Conditional and looping statements, case

statement, parameter passing and arguments, Shell variables, system shell variables, shell keywords, Creating Shell programs for automating system tasks

Unit-4 (18 hrs.)

System administration - Common administrative tasks, identifying administrative files configuration and log files, Role of system administrator, Managing user accounts-adding & deleting users, changing permissions and ownerships, Creating and managing groups, modifying group attributes, Temporary disabling of users accounts, creating and mounting file system, checking and monitoring system performance - file security & Permissions, becoming super user using su. Getting system information with uname, host name, disk partitions & sizes, users, kernel, installing and removing packages with rpm command.

Unit-5: (12 hrs.)

Simple filter commands: pr, head, tail, cut, sort, uniq, tr - Filter using regular expression grep, egrep, sed **Understanding various Servers :**DHCP, DNS, Squid, Apache, Telnet, FTP,Samba.

Book of study :

1. Cristopher Negus - Red Hat Linux Bible, Wiley Dreamtech India 2005 edition.
2. Yeswant Kanethkar - UNIX Shell Programming, First edition, BPB.

References :

1. Official Red Hat Linux Users guide by Redhat, Wiley Dreamtech India
2. Graham Glass & King Ables - UNIX for programmers and users, Third Edition, Pearson Education.
3. Neil Mathew & Richard Stones - Beginning Linux Programming, Fourth edition, Wiley Dreamtech India.

CA4CRT13 -Web Programming Using PHP

Theory:3 hrs. per week

Credits:3

Unit 1 (8 hrs.)

Introduction to web, WWW architecture, Fundamentals of HTML, text formatting tags, marquee, inserting images, links, lists, creating tables, frames, working with form elements.

Unit 2 (10 hrs.)

CSS introduction, <link> and <style> elements, CSS properties, Controlling Fonts, Text formatting, Text- pseudo classes, Selectors, Links, Backgrounds, lists

Introduction to Java Script, Java Script variables, operators, decision control statements, looping, functions, arrays, events, popup boxes-alert, prompt, conform box, built-in objects, writing JavaScript, form validation

Unit 3 (10 hrs.)

Introduction to PHP, server side scripting, role of web server software, php comments, variables, echo and print, PHP operators, data types, branching statements, loops, arrays

Unit 4 (12 hrs.)

PHP functions, PHP form, Passing information between pages, $_GET, $_POST, $_REQUEST. String functions, include and require, session and cookie management, error handling in PHP, Object Oriented Programming using PHP

Unit 5 (14 hrs.)

Introduction to MySQL, datatypes, SQL commands-CREATE, UPDATE, INSERT, DELETE, SELECT, PHP functions for MySQL connectivity and operation- mysql_connect, mysql_select_db, mysql_query, mysql_fetch_row, mysql_fetch_array, mysql_result, mysql_list_fields, mysql_num_fields, insertion, updation and deletion of data using PHP, displaying data from MySQL in webpage.

Book of Study:

1. Dave W Mercer, Allan Kent, Steven D Nowicki, David Mercer, Dan Squier, Wankyu Choi - "Beginning PHP", Wiley Publishing, Inc
2. Ivan Bayross - "HTML, DHTML, JavaScript, Pearl & CGI ", Fourth Revised Edition, BPB Publication.
3. "Programming PHP",Rasmus Lerdorf and Kevin Tatore, Shroff Publishers & Distributors Pvt. Ltd
4. "Beginning PHP", Dave W Mercer, Allan Kent, Steven D Nowicki, David Mercer, Dan Squier, Wankyu Choi, Wiley Publishing, Inc

CA4CRP04 - Software Lab IV (Core)

Software Lab: 6 hrs. per week

Credits:2

I. **Linux** (2 hrs. per week)

Sl.No	Topic and Details
1	Getting started –Commands
2	The Linux Architecture and command usage – Commands, General-purpose utilities
3	The File system –Commands
4	Process related commands
5	Handling ordinary files, Basic file attributes
6	The vi editor
7	Simple Filters, Filters using regular expressions-use of grep command
8	Introduction to shell concept and writing shell script
9	Introduction to shell concept and writing shell script, Essential Shell Programming
10	User management, monitoring system performance, disk usage etc.

II. **Web Programming using PHP** (4 hrs. per week)

1. Creating programs based on HTML

2.Creating Java script based programs

3.Creating simple programs based on PHP

4.Programs using PHP functions

5.Programs based on MY SQL

Scheme of Evaluation for software lab IV external is as follows:

(There will be two questions; the first from LINUX and second from PHP)

Division of Marks (Practical - 3 hours External)

First program - questions from LINUX **- 25 marks**

1. Logic – 10 marks
2. Successful compilation – 8 marks
3. Result – 7 marks

Second program – questions from PHP **- 35 marks**

1. Logic – 15 marks
2. Successful compilation –15 marks
3. Result – 5 marks

Viva Voce **- 10 marks**

Lab Record **- 10 marks**

(LINUX -Minimum of 10 Programs

PHP -Minimum of 15 Programs)

Total Marks **- 80 marks**

BCA - SEMESTER V

CA5CRT14 : Computer Networks (Core)

Theory:3 hrs. per week

Credits:4

Unit 1: (10 hrs.)

Introduction to Networks, Data and signals-analog and digital, periodic analog signals, digital signals, bit rate, baud rate, bandwidth. Transmission impairments- attenuation, distortion and noise.

Data communication protocols and standards, Network models - OSI model-layers and their functions. TCP/IP protocol suite.

Unit 2: (10 hrs.)

Bandwidth utilization Multiplexing: FDM, TDM, spread spectrum.

Transmission Media- guided media and unguided media.

Switching: message, Circuit and packet switched networks, datagram networks, virtual- circuit networks.

Unit 3: (12 hrs.)

Data link layer: Error Detection and Correction, Framing, flow and error control, Protocols - Noiseless channels (Simplest, Stop and Wait) and Noisy channels (Stop and Wait and Piggy Backing).

Multiple Access Protocols. Random Access-ALOHA, CSMA. Wired LANs-IEEE standards, wireless LANs-Bluetooth, Cellular Telephony

Unit 4: (12 hrs.)

Network layer and Transport layer: Repeaters, Bridges, Gateways and routers. Logical addressing – IPV4 and IPV6 addressing, Internet protocol - IPV4 and IPV6. Connectionless and Connection Oriented Services: UDP and TCP. Congestion Control, Quality of Service.

Unit 5: (10 hrs.)

Application layer: HTTP, FTP, SMTP, DNS. Network security: Common Threats- Firewalls (advantages and disadvantages), Cryptography.

Book of study:

1. B. A. Forouzan - Data communication and Networking, Fourth edition-,TMH
2. Andrew S Tanenbaum - Computer Networks ,Fourth Edition, Prentice Hall of India.

CA5CRT15 - IT & Environment (Core)

Theory:4 hrs. per week

Credits:4

Unit 1 : (18 hrs.)

Multidisciplinary nature of environmental studies : Definition, scope and importance, Need for public awareness. (**2 hrs**)

Natural Resources: Renewable and non-renewable resources: Natural resources and associated problems. a) **Forest resources**: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. b) **Water resources**: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. c) **Mineral resources**: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. d) **Food resources**: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. e) **Energy resources**: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources, Case studies. f) **Land resources**: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of individual in conservation of natural resources. Equitable use of resources for sustainable life styles. (**10hrs**)

Ecosystems : Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids., Introduction, types, characteristic features, structure and function of the given ecosystem:- Forest ecosystem

(**6 hrs**)

Unit 2: (26 hrs)

Biodiversity and its conservation: Introduction, Biogeograhical classification of India, Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values., India as a mega-diversity nation, Hot-sports of biodiversity, Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India

(**8 hrs**)

Environmental Pollution : Definition, Causes, effects and control measures of: - Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards, Solid waste Management: Causes, effects and control measures of urban and industrial wastes., Role of an individual in prevention of pollution, Pollution case studies, Disaster management: floods, earthquake, cyclone and landslides. (**8 hrs**)

Social Issues and the Environment : Urban problems related to energy, Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation of people: its problems and concerns,

Case studies, Environmental ethics: Issues and possible solutions, Climate change, global warming, acid rain, ozone layer depletion , nuclear accidents and holocaust, Case studies, Consumerism and waste products, Environment Protection Act , Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation, Public awareness. (**10hrs**)

Unit 3: (10 hrs.)

Internet as a knowledge repository, academic search techniques, creating cyber presence. Academic websites, open access initiatives, opens access publishing models, Introduction to use of IT in teaching and learning -Educational software, Academic services–INFLIBNET, NPTEL, NICNET, BRNET . (**10hrs**)

Unit 4: (10 hrs.)

IT & Society- issues and concerns- digital divide, IT & development, the free software movement , IT industry: new opportunities and new threats, software piracy, cyber ethics, cyber crime, cyber threats, cyber security, privacy issues, cyber laws, cyber addictions, information overload, health issues- guide lines for proper usage of computers, internet and mobile phones. e-wastes and green computing, impact of IT on language & culture-localization issues- Unicode- IT and regional languages, Green Computing Concept. (**10hrs**)

Unit 5: (8 hrs.)

Human Rights– An Introduction to Human Rights, Meaning, concept and development, Three Generations of Human Rights (Civil and Political Rights; Economic, Social and Cultural Rights).

Human Rights and United Nations – contributions, main human rights related organs - UNESCO,UNICEF, WHO, ILO, Declarations for women and children, Universal Declaration of Human Rights. **Human Rights in India** – Fundamental rights and Indian Constitution, Rights for children and women, Scheduled Castes, Scheduled Tribes, Other Backward Castes and Minorities

Environment and Human Rights - Right to Clean Environment and Public Safety: Issues of Industrial Pollution, Prevention, Rehabilitation and Safety Aspect of New Technologies such as Chemical and Nuclear Technologies, Issues of Waste Disposal, Protection of Environment **Conservation of natural resources and human rights**: Reports, Case studies and policy formulation. Conservation issues of western ghats- mention Gadgil committee report, Kasthurirengan report. Over exploitation of ground water resources, marine fisheries, sand mining etc. **(8 Hrs)**

Internal: Field study

- Visit to a local area to document environmental grassland/ hill /mountain
- Visit a local polluted site – Urban/Rural/Industrial/Agricultural Study of common plants, insects, birds etc

- Study of simple ecosystem-pond, river, hill slopes, etc

(Field work Equal to 5 lecture hours)

References:

1. "Technology in Action" Alan Evans, Kendall Martin, Mary Anne Poatsy, Pearson
2. Bharucha Erach, Text Book of Environmental Studies for undergraduate Courses. University Press, IInd Edition 2013 (TB)
3. Clark.R.S., Marine Pollution, Clanderson Press Oxford (Ref)
4. Cunningham, W.P.Cooper, T.H.Gorhani, E & Hepworth, M.T.2001 Environmental Encyclopedia, Jaico Publ. House. Mumbai. 1196p .(Ref)
5. Dc A.K.Enviornmental Chemistry, Wiley Eastern Ltd.(Ref)
6. Down to Earth, Centre for Science and Environment (Ref)
7. Heywood, V.H & Watson, R.T. 1995. Global Biodiversity Assessment, Cambridge University Press 1140pb (Ref)
8. Jadhav.H & Bhosale.V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284p (Ref)
9. Mekinney, M.L & Schock.R.M. 1996 Environmental Science Systems & Solutions. Web enhanced edition 639p (Ref)
10. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co. (TB)
11. Odum.E.P 1971. Fundamentals of Ecology. W.B. Saunders Co. USA 574p (Ref)
12. Rao.M.N & Datta.A.K. 1987 Waste Water treatment Oxford & IBII Publication Co.Pvt.Ltd.345p (Ref)
13. Rajagopalan. R, Environmental Studies from crisis and cure, Oxford University Press, Published: 2016 (TB)
14. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut (Ref)
15. Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science (Ref)
16. Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Stadards, Vol I and II, Enviro Media (Ref)
17. Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (Ref)

18. Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p (Ref)

19. M-Magazine, R-Reference TB- Text Book

CA5CRT16 – Java Programming using Linux (Core)

Theory:3 hrs. per week

Credits:3

UNIT 1 (10 hrs.)

Concepts of Object oriented programming, Benefits of OOP, Features of java. Java environment, java tokens, Constant, variables, data types, operators, Control Statements-branching statements, looping statements, jump statements, labeled loops.

UNIT 2 (10 hrs.)

Defining a Class, Fields declaration, Method declaration, Creating object, Accessing class members, method overloading, Constructors, constructor overloading, super keyword, static Members, Inheritance, overriding methods, dynamic method dispatch, final(variables, methods and classes), abstract methods and classes, interfaces, visibility control.

UNIT 3 (12 hrs.)

Arrays- One dimensional arrays, declaration, creation, initialization of arrays, two dimensional arrays, String class. Packages: - java API packages overview (lang, util, io, awt, swing, applet), user defined packages-creating packages, using packages

Exception Handling Techniques-try-catch-throw-throws-finally -Multithreading- creation of multithreaded program-Thread class-Runnable interface, Thread life cycle.

UNIT 4 (10 hrs.)

Event Handling-Delegation Event Model-Event Classes-Sources of Events-Event Listeners- Event classes- Swing- architecture, components of swing- JLabel, JButton, JCheckBox, JRadioButton, JList, JComboBox, JTextField, JText Area, JPanel, JFrame, Layout Managers(Flow Layout, Grid Layout, Card Layout, Border Layout, Box Layout, Null Layout).

UNIT 5 (10 hrs.)

Applet Fundamentals -applet tag, applet life cycle, passing parameters to applets. Working with graphics -Line, Rectangle, Oval, Arc, color setting. JDBC architecture- JDBC connection, JDBC statement object, JDBC drivers.

Book of study :

1. E. Balagurusamy- Programming with Java , Third Edition, McGraw Hill Companies.

2. K. Somasundaram - PROGRAMMING IN JAVA2, First Edition, Jaico Publishing House.

Reference*:*

1. Patrick Naughton - Java2 The Complete Reference, Seventh Edition:
2. Cay S Horstmann & Gary Cornell - Core Java Volume 1- Fundamentals, Eighth edition.
3. Java 6 Programming Black Book 2007 Edition, Dreamtech press.

CA5CRP05 : Software Lab V (core)

Software Lab**: 5** hrs. per week

Credits: 2

Syllabus

Part I. Applet, JDBC connection and swing based Programs

Part II (using class and read inputs from keyboard)

Java Programs: Method Overloading- Method Overriding-inheritance-abstract class, interfaces- packages- Exception Handling-Multithreading

Scheme of Evaluation for software lab V external is as follows:

(There will be two questions; the first from Part I and second from Part II)

Division of Marks (Practical - 3 hours External)

First program - questions from Part I **- 25 marks**

1. Logic – 10 marks
2. Successful compilation – 8 marks
3. Result – 7 marks

Second program – questions from Part II **- 35 marks**

1. Logic – 20 marks

2.Successful compilation –10 marks

3. Result – 5 marks

Viva Voce	**- 10 marks**
Lab Record	**- 10 marks**
(Minimum of 25 Programs)	
Total Marks	**- 80 marks**

CA5CRP06 : Software Development Lab I (core)

Software Development Lab: 6 hrs. per week

Credits: 2

Mini project can be a small complete application project, to make the student confident in designing a system based on Software engineering course. The internal and external evaluation is to be done with the project demonstration and presentation, viva and modification. It must be done in the college lab under the guidance of a faculty.

Scheme of Evaluation for Software Development Lab I external is as follows:

Division of Marks (Software Development Lab I)

Project demonstration and Presentation	**- 25 marks**
Modification	**- 15 marks**
Viva Voce	**- 15 marks**
Project report with proper content and binding	**- 25 marks**
Total Marks	**- 80 marks**

OPEN COURSES

CA5OPT01 -Informatics and Cyber Ethics

Theory:4 hrs. per week, Credits:4

Unit I (12 hrs.)

The Internet, TCP/IP, IP Addressing, Client Server Communication, Intranet, WWW, Web Browser and Web Server, Hyperlinks, URLs, Electronic mail.

Unit II (16 hrs.)

Internet as a knowledge repository, academic search techniques, creating cyber presence. Academic websites, open access initiatives, opens access publishing models, Introduction to use of IT in teaching and learning -Educational software, Academic services–INFLIBNET, NPTEL, NICNET, BRNET.

Unit III (16 hrs.)

Introduction to purchase of technology, License, Guarantee, Warranty, Basic concepts of IPR, copyrights and patents, plagiarism. IT & development, the free software movement

Unit IV (14 hrs.)

Cyber space, information overload, cyber ethics, cyber addictions, cybercrimes– categories –person, property, Government–types-stalking, harassment, threats, security & privacy issues.

Unit V(14 hrs.)

Cyber Addiction, Information Overload, Health Issues, e-Waste and Green computing impact of IT on language & culture-localization issues- Unicode- IT and regional languages e-Governance in India, IT for National Integration, Role of IT.

Book of Study:

1. Alan Evans, Kendall Martin, Mary Anne Poatsy - "Technology in Action", Pearson

References:

1. Dinesh Maidasani "Learning Computer Fundamentals, MS Office and Internet & Web Technology",

Firewall Media, Lakshmi Publications.

2. V Rajaraman - "Introduction to Information Technology", Prentice- Hall of India.

3. Barkhs and U. Rama Mohan - HTML Black Book 3. "Cyber Law Crimes", Asia Law House,

New Edition

4. Peter Nortons- Introduction to Computers, Sixth Edition, Published by Tata McGraw Hill

CA5OPT02 - Computer Fundamentals, Internet & MS Office

Theory:4 hrs. per week

Credits:4

Unit I (12 hrs.)

Computer Fundamentals: History, Generations, Classifications, Operating Systems, Types of Networks

Unit II (12 hrs.)

The Internet, TCP/IP, IP Addressing, Client Server Communication, Intranet, WWW, Web Browser and Web Server, Hyperlinks, URLs, Electronic Email

Unit III (14 hrs.)

Word processing: Introduction, Microsoft Word, Basic Menus, Formatting the text & paragraph, Working with Index

Unit IV (18 hrs.)

Spread Sheet: Introduction, Microsoft Excel, Basic Menus, Formulas, Basic functions, Charts and Graphs.

Unit V (16 hrs.)

Microsoft PowerPoint: Introduction, Basic Menus, Template, Slide Basics, Charts, Adding Multimedia & Animation.

Book of Study:

1. Dinesh Maidasani, Firewall Media - "Learning Computer Fundamentals, MS Office and Internet & WebTechnology", , Lakshmi Publications.

References:

1. Harley Hahn - "Internet Complete Reference", , Second Edition, Tata McGraw Hill Education

2. Gary B. Shelly, Misty E. Vermaat - "Microsoft Office 2010: Advanced" , CENGAGE Learning 2010

BCA - SEMESTER VI

CA6CRT17 - CLOUD COMPUTING (Core)

Theory:4 hrs. per week

Credits:4

Unit 1: (14 hrs.)

Introduction: Cloud Computing at a Glance, Historical Developments, Building Cloud Computing Environments, Computing Platforms and Technologies, Principles of Parallel and Distributed Computing: Eras of Computing, Parallel vs. Distributed Computing, Elements of Parallel Computing, Elements of Distributed Computing.

Unit 2: (14 hrs.)

Virtualization: Introduction, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Technology Examples.

Unit 3: (14 hrs.)

Cloud Computing Architecture :Introduction, Cloud Reference Model, Types of Clouds, Economics of the Cloud, Open Challenges.

Unit 4: (16 hrs.)

Aneka: Cloud Application Platform: Framework Overview, Anatomy of the Aneka Container, Building Aneka Clouds, Cloud Programming and Management, Data Intensive Computing: Map-Reduce Programming - What is Data-Intensive Computing?, Technologies for Data-Intensive Computing, Aneka MapReduce Programming.

Unit 5: (16 hrs.)

Cloud Platforms in Industry: Amazon Web Services, Google AppEngine, Microsoft Azure, Cloud Applications: Scientific Applications, Business and Consumer Applications.

Book of Study:

1. Rajkumar Buyya, Christian Vecchiola, S ThamaraiSelvi- Mastering Cloud Computing, Tata McGraw Hill Publications.

References:

1. Kumar Saurabha, “Cloud Computing “ Wiley Publication Krutz ,Vines “Cloud Security”. Wiley Publication.
2. A Srinivasan & J. Suresh “ Cloud Computing : A Practical Approach for learning and Implementation “ , First edition ,Pearson

CA6CRT18 -**Mobile Application Development – Android** (Core)

Theory:4 hrs. per week

Credits:4

Unit 1 (10 hrs.)

Introduction to Android, Android Versions, Android Activity, Android Features and Architecture, Java JDK, Android SDK, Android Development Tools, Android Virtual Devices,

Emulators, Dalvik Virtual Machine, Layouts – Linear, Absolute, Frame, Relative and Table.

Unit 2 (16 hrs.)

Android User Interface- Fundamental UI design , User interface with View- Text View, Buttons, Image Button, Edit Text, Check Box, Toggle Button, Radio Button and Radio Group, Progress Bar, Autocomplete Text View, Spinner, List View, Grid View, Image View, Scroll View, Custom Toast Alert and Time and Date Picker.

Unit 3 (14 hrs.)

Activity - Introduction, Intent, Intent_filter, Activity Life Cycle, Broadcast Life Cycle, Services, multimedia-Android System Architecture, Play Audio and Video, Text to Speech.

Unit 4 (16 hrs.)

SQLite Database in Android- Introduction to SQLite Database, Creation and Connection of the

Database, Extracting values from Cursors, Transactions, Telephoning and Messaging-SMS Telephony, Sending SMS, Receiving SMS, Wi-Fi Activity.

Unit 5 (16 hrs.)

Introduction to JSON and XML, Use of JSON, Syntax and Rule of JSON, JSON Name, JSON Values, JSON Objects, JSON Arrays, Parsing JSON and XML.

Google Play services, Location services, Maps

Book of Study:

1. Prasanna Kumar Dixit - ANDROID, Vikas Publishing House.
2. Anubhav Pradhan, Anil Deshpande, Composing Mobile Apps using Android, Wiley India Pvt.Ltd,2014

References:

1. Kevin Grant and Chris Haseman, Beginning Android Programming – Develop and Design, Pearson.

Software Lab Work (**Four** hours per week)

Module II

Installation and configuration of Eclipse and Development Tools

Module III

Creating simple apps using Interface Tools

Module IV

Creating Andoid Apps using SQLite

Module V

Familiarizing with JSON and XML, Creation and distribution of Android Apps.

Elective papers (core)

CA6ELT01- DATA MINING (Core)

Theory:4 hrs. per week

Credits:4

Unit 1: (12 hrs.)

Introduction Data Mining, Data Ware House, Transactional Databases, Data Mining Functionalities Characterization and Discrimination, Mining frequent patterns, Association and correlation, Classification and Prediction, Cluster Analysis, Classification of Data Mining Systems, Data Mining Task Primitive, Integration of Data Mining systems, Major issues in Data Mining, Data integration and transformation, Data reduction, Data discretization.

Unit 2: (12 hrs.)

Data Warehouse and OLAP technology Data Warehouse, Multidimensional data Model, Data warehouse architecture, Data Warehouse implementation, OLAP, Data Warehouse and data mining.

Unit 3: (18 hrs.)

Association Rules and Classification Concepts Efficient and Scalable Frequent item set Mining methods, Mining various kind of association rules, from association mining to Co-relation analysis, Classification and prediction, Issues, Classification by Decision tree induction, Bayesian Classification, Rule-based classification, Support Vector Machines, Learning from your neighbors, Prediction.

Unit 4: (18 hrs.)

Cluster Analysis Definition, Types of data in cluster analysis, A categorization major Clustering methods- Partitioning methods, K-means and k-medoids, from k-medoids to CLARANS, Hierarchical methods, Density based methods.

Unit 5: (12 hrs.)

Mining Complex Data Spatial Data Mining, Multimedia Data Mining, Text Mining and Mining WWW.

Book of study:

1. Jiawei Han and Micheline Kamber - Data Mining - Concepts and Techniques,Second Edition, Elsevier, 2006

Reference:

1. Witten and Frank - Data Mining Practical Machine Learning Tools and Techniques, Second Edition, Elsevier, 2005

2. Soman, Divakar and Ajay, Data Mining Theory and Practice, PHI, 2006

3. Margaret H Dunham- Data Mining –Introductory and Advanced Topics, Fourth Edition, Person 2006

CA6ELT02 -Digital Image Processing

Theory:4 hrs. per week

Credits:4

Unit 1: (10 hrs.)

Digital Image Fundamentals

Image, Digital Image, Digital image processing-definitions, Examples of fields that use Digital Image Processing, Fundamental steps in Digital Image Processing, Components of Image processing system.

Unit 2 : (14 hrs.)

Elements of visual perception

Elements of visual perception- Image Formation, Brightness adaptation and Discrimination, Image sampling and quantization- basic concepts, spatial and Intensity resolution, Basic relationship among Pixels.

Unit 3: (16 hrs.)

Image Enhancement in Spatial and Frequency Domain

Intensity Transformation and spatial Filtering Basics, Intensity transformation functions- Image Negatives, Log Transformations, Power Law Transformations, Histogram Processing, Spatial filtering-correlation and convolution; Fourier transform and frequency domain.

Unit 4: (15 hrs.)

Morphological Image Processing

Introduction, basis of set theory, Dilation, Erosion, Structuring elements, Opening and

Closing, Hit or miss transformation.

Unit 5: (17 hrs.)

Image Segmentation

Point, Line, Edge detection-detection of isolated points, Basic edge detection- Gradient operators; Pixel based approach-Basics of intensity thresholding, Basic global thresholding; Region based segmentation-region growing, region splitting and merging.

Book of Study:

1. Rafael C. Gonzalez, Richard E. Words- Digital Image Processing, Third Edition, Pearson.

References:

1. Anil K Jain- Fundamentals of Digital Image Processing , Pearson Education.
2. Er. Rishabh Anand, Digital Image Processing, MEDTEC Publications.

CA6ELT03- Soft Computing Techniques

Theory:4 hrs. per week

Credits:4

Unit 1 (14 hrs.)

Soft Computing, Difference between soft computing and hard computing. **Neural Networks:** Basic concepts of Neural Networks, Human Brain, Artificial Neuron model, Activation functions,Neural network architecture,Single layer and multilayer feedforward networks, Recurrent networks, Neural network characteristics, Learning methods, Rosenblatt's perceptron,Perceptron and linearly separable tasks, XOR problem, Neural network applications.

Unit 2 : (14 hrs.)

Back Propagation Networks: Architecture- perceptron model, solution, single layer artificial neural network, multilayer perception model, back propagation learning- input layer computation, hidden layer computation, output layer computation, calculation of error, Training of neural network, effect of learning rate coefficient, Back propagation algorithm.

Unit 3: (15 hrs.)

Fuzzy Set Theory: Fuzzy versus crisp, Crisp sets, Operations on crisp sets, Properties of crisp sets, Partition and covering, Fuzzy sets, Membership functions, Basic fuzzy set operations, Properties of fuzzy sets, Crisp relations, Operations on crisp relations, Fuzzy relations, Fuzzy cartesian product, Operations on fuzzy relations.

Unit 4 : (15 hrs.)

Fuzzy Systems: Crisp logic, Laws of propositional logic, Inference in propositional logic, Predicate logic, Interpretations of predicate logic formula, Inference in predicate logic, Fuzzy logic, Fuzzy propositions, Fuzzy connectives, Fuzzy quantifiers, Fuzzy inference, Fuzzy rule based system, Defuzzification methods, Applications.

Unit 5: (14 hrs.)

Genetic Algorithm: History, Basic concepts, Biological background, Creation of offsprings, Encoding, Fitness function, Reproduction, **Genetic Modeling**:Crossover, Inversion and deletion,Mutation,Bit-wise operators used in geneticalgorithm, Generational cycle, Convergence of a genetic algorithm, Issues and benefits of GA, Application domains.

Book of study:

1. S. Rajasekaran and G.A VijayalakshmiPai- Neural Networks, Fuzzy Logic, and Genetic AlgorithmsSynthesis and Applications, Prentice-Hall of India Pvt.Ltd ,2004.

References:

1. S. N. Sivanandan and S. N. Deepa, Principles of Soft Computing, Wiley India 2nd Ed, 2011.
2. B K Tripathy, J. Anuradha, Soft computing Advances and Applications, Cengage Learning.
3. B Yegnanarayana, Prentice, Artificial Neural Network, Hall of India Pvt.Ltd ,2012.

CA6CRP07 : Seminar (core)

Seminar Presentation: 2 hrs. per week

Credits: 2

Each student can choose a latest topic of current day interest in the areas of Computer Science / Information Technology and present a seminar presentation using appropriate presentation media. A seminar presentation report in bound form in the pattern of a complete technical report (with contents page, well structured presentation, references etc.) should be submitted. There will not be any external evaluation for Seminar Presentation.

Scheme of Evaluation of Seminar Presentation (core) for INTERNAL is as follows:

Division of Marks

Seminar Presentation Internal (100 marks)

Presentation	**- 40 marks**
Discussion(Questions and Answers)	**- 30 marks**
Documentation	**10 marks**
Seminar report with proper Content	
and Binding	**- 20 marks**
Total Marks	**-100 marks**

CA6CRP08 : Software Development Lab II (Main Project) (Core)

Software development lab: 7 hrs. per week

Credits: 3

Individual project.

The project topic shall be chosen from areas of current day interest using latest packages / languages running on appropriate platforms (Except the tools used in software development-I), so that the student can be trained to meet the requirements of the Industry. A project report should be submitted in hard bound complete in all aspects. For internal evaluation, the progress of the student shall be systematically assessed through various stages of evaluation at periodic intervals.

Scheme of Evaluation for Software Development Lab II external is as follows:

Division of Marks (Software Development Lab II)

Project demonstration and Presentation	**- 40 marks**
Viva related to project	**- 20 marks**
Project report with proper content and binding	**-20 marks**
Total Marks	**- 80marks**

CA6VVT01 –VIVA VOCE (Core)

Credit :1

Scheme of Evaluation of Viva voce (core) for External is as follows:

Each student should attend a course viva voce based on syllabus from semester I to semester IV.

Total Marks – 100 marks

SYLLABUS- B.Sc. Computer Science

SEMESTER I

CS1CRT01 : Computer Fundamentals and Basics of PC Hardware (Complementary)

Theory: 4 hrs. per week

Credits : 4

Unit I:

Introduction to Computers: Generations of Computer (I-V), Classification of Computers: Analog, Digital and Hybrid Computers, Micro, Mini, Mainframe, Super Computers, Servers, Laptop and Block Diagram of a Computer, Functions of the Different Units: Input unit, Output unit, Memory unit, CPU (ALU+CU). Booting Process- POST, BIOS, clock speed, memory speed, memory capacity.

Unit II:

Introduction to Computer Hardware, DC regulated power supply- Block Diagram, Concepts of Switch Mode Power supply, Inverters, UPS and their applications. Basic Components of CPU, Mother Board.

Unit III:

Expansion Slots- ISA, EISA, MCA, VESA, PCI local bus, Processor, Connectors, CMOS memory, SMPS, Serial and Parallel Ports, USB, BIOS chip, Steps for assembling a PC.

Unit IV:

Input Devices: Keyboard, Point and draw devices: mouse, joystick, track ball, light pen, Data Scanning devices: image scanner, OCR, OMR, MICR, Bar code reader, Voice Recognition Device: Microphone, Output Devices: Monitor- CRT displays, Non-CRT displays, TFT: LED, LCD, Plasma. Printer, Impact and non-impact, Character, line and Page Printers.

Unit V:

Memory: Primary Memory, RAM- SRAM, DRAM, ROM, PROM, EPROM, EEPROM, flash memory, Secondary memory: Hard Disk: Structure of a hard disk, how data is stored in a hard disk, concept of tracks, sectors, clusters, cylinders, CD-R, RW, DVD-RW, Blue-ray disk, HVD, PC memory Units: SIMM, DIMM, RIMM.

Book of study:

1. Pradeep Sinha and Priti Sinha - Computer Fundamentals, Fourth Edition- 2007, BPB Publications
2. B. RAM, "Computer Fundamentals: Architecture and Organization", New age international (P) Limited.

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Reference:

1. Balagurusamy - Fundamentals of Computer, First Edition- 2009, McGraw-Hill
2. Anita Goel - Computer Fundamentals, First Edition-2010, Pearson.
3. Peter Norton, "Introduction to Computers", McGraw Hill

CS1CRT02 : Methodology Of Programming And C Language (Core)

Theory: 4 hrs. per week

Credits: 3

UNIT 1

Introduction to programming, Classification of computer languages, Language translators (Assembler, Compiler, Interpreter), Linker, Characteristics of a good programming language, Factors for selecting a language, Subprogram, Purpose of program planning, Algorithm, Flowchart, Pseudocode, Control structures (sequence, selection, Iteration), Testing and debugging

UNIT 2

C Character Set, Delimiters, Types of Tokens, C Keywords, Identifiers, Constants, Variables, Rules for defining variables, Data types, C data types, Declaring and initialization of variables, Type modifiers, Type conversion, Operators and Expressions- Properties of operators, Priority of operators, Comma and conditional operator, Arithmetic operators, Relational operators, Assignment operators and expressions, Logical Operators, Bitwise operators

UNIT 3

Input and Output in C – Formatted functions, unformatted functions, commonly used library functions, Decision Statements If, if-else, nested if-else, if-else-if ladder, break, continue, goto, switch, nested switch, switch case and nested if. Loop control- for loops, nested for loops, while loops, do while loop.

UNIT 4

Array, initialization, array terminology, characteristics of an array, one dimensional array and operations, two dimensional arrays and operations. Strings and standard functions, Pointers, Features of Pointer, Pointer and address, Pointer declaration, void wild constant pointers, Arithmetic operations with pointers, pointer and arrays, pointers and two dimensional arrays.

UNIT 5

Basics of a function, function definition, return statement, Types of functions, call by value and reference. Recursion -Types of recursion, Rules for recursive function, direct and indirect recursion, recursion vs iterations, Advantages and disadvantages of recursion. Storage class, Structure and union, Features of structures, Declaration and initialization of structures, array of structures, Pointer to structure, structure and functions, typedef, bitfields , enumerated data types, Union, Dynamic memory allocation, memory models, memory allocation functions.

Book Of Study:

1. Ashok Kamthane - Programming in C, Third Edition, Pearson Education
2. P K Sinha & Priti Sinha - Computer Fundamentals , Fourth Edition, BPB Publications.

Reference :

1. E. Balaguruswamy -Programming in ANSI C ,Seventh Edition , McGraw Hill Education
2. Byron Gotfried - Programming with C, Second Edition, Schaums Outline series. McGraw Hill

CS1CMT01 : Fundamentals of Digital Systems (Complementary)

Theory: 4 hrs. per week

Credits: 4

Unit I: Number Systems, Operations and Codes

Decimal Numbers, Binary Numbers, Decimal to Binary Conversion, Binary Arithmetic,

1's and 2's complement of binary numbers, Signed numbers, Arithmetic operations with signed numbers, Hexadecimal numbers, Binary to hexadecimal conversion, Hexadecimal to binary conversion, Hexadecimal to decimal conversion, Decimal to Hexadecimal conversion, Hexadecimal addition and subtraction, Octal numbers, Octal to decimal conversion, Decimal to Octal conversion, Octal to binary conversion, Binary to Octal conversion, Binary coded decimal, 8421 BCD code, BCD addition, Digital codes- gray code, binary to gray code conversion, Alphanumeric codes, parity codes.

Unit II: Logic Gates, Logic Levels and Waveforms

Logic Levels and Digital waveforms, Logic Gates: AND, OR, NOT, XOR, XNOR, NAND (Definition, Symbols, Truth Tables and Operation). Universal Property of NAND and NOR gates. Logic gate operations with pulse waveforms.

Unit III: Boolean Algebra and Logic Simplifications. Boolean operations and expressions, Laws and rules of Boolean algebra, De-morgans theorems, Boolean analysis of logic circuits, simplification using Boolean algebra, standard forms of Boolean expression, Boolean expressions and truth tables. The Karnaugh Map, Karnaugh SOP minimization, Karnaugh POS minimization, Five variable Karnaugh maps.

Unit IV: Combinational Logic and its functions.

Basic combinational Logic circuits, Implementing combinational logic, combinational logic using NAND and NOR gates, Basic overview of logic functions, Basic adders, parallel binary adders, comparators, decoders, encoders, code converters, multiplexers, demultiplexers, parity generators/ checkers.

Unit V: Sequential Circuits.

Latches, RS flip flop using NAND/ NOR gates, Clocked RS, D, JK and T flip flops, Edge triggered flip flops, Master slave flip flops, Asynchronous counter operation, Synchronous counter operations, Up/ Down Synchronous counter, Design of synchronous counters. Basic shift register functions. Serial in-Parallel out shift registers, Parallel in -Serial out shift registers, Serial in- Serial out shift registers, Parallel in Parallel out shift registers.

Book of Study:

1. Floyd and Jain- Digital Fundamentals, Eighth Edition, Pearson Education

Reference:

1.A P Malvino and D P Leach - Digital Principles and Applications, Fourth edition, Tata McGraw Hill Publishers, co Ltd.

CS1CRP01 : Software Lab - I

Software Lab: 4 hrs. per week

Credits:2

Syllabus

1. Programs to familiarize printf() and scanf() functions.

2. Programs Based on Decision statements , break, goto, continue, switch and Loop controls statements.

3. Programs Based on One dimensional and two dimensional arrays.

4. Programs on Strings and string handling functions.

5. Programs based on Pointers, operations on pointers, Arrays & Pointers,

6. Programs based on functions, Call by value, Call by reference, Recursion,

7. Programs based on structure and union, array of structures, Pointer to structure, structure and functions

8. Simple programs using pointers and malloc().

Scheme of Evaluation for software lab I external is as follows:

Division of Marks (Practical - 3 hours External)

First program from part 1& 2 **- 25 marks**

1.Flowchart - 5 marks

2.Logic – 10 marks

3.Successful compilation – 5 marks

4.Result – 5 marks

Second program should be based on advanced concepts ,part 3 to part 8 **- 35 marks**

1.Logic – 20 marks

2.Successful compilation – 10 marks

3. Result – 5 marks)

Viva Voce **- 10 marks**

Lab Record (minimum of 25 Programs) **- 10 marks**

Total Marks **- 80 marks**

B.Sc. Computer Science - SEMESTER II

CS2CRT03 : Data Communication(Complementary)

Theory: 4 hrs. per week

Credits: 3

Unit I: Data and Signals

Analog and Digital Data, Analog and Digital Siginals, Periodic and Nonperiodic, Periodic Analog signals, Time and Frequency Domains, Composite Signals, Bandwidth, Digital Signals, Bit Rate, Digital Signal as a Composite Analog Signal, Transmission of Digital and Analog Signals, Transmission Impairment, Attenuation, Distortion, Noise, Data rate limits, Noiseless channel: Nyquist bit rate, Noisy Channel: Shannon Capacity, Simplified Communication & Data Communication models. Data Flow-Simplex, Half Duplex, Full Duplex.

Unit II : Transmission Media

Guided media, Twisted-pair cable – UTP, STP, Connectors Coaxial Cable, Connectors Fiber-Optic Cable Propagation Modes, Unguided Media - Wireless Transmission - Terrestrial

Microwave, Satellite Microwave, Radio Waves. Infrared.

Unit III: Digital Transmission

Analog to Digital Conversion : Block Diagram of Digital Communication System. Parallel and serial ports Pulse Code Modulation(PCM), Sampling, Sampling Rate, Quantization, Delta modulation, Adaptive Delta Modulation, Transmission modes, Parallel Transmission, Serial Transmission, Asynchronous Transmission, Synchronous Transmission.

Unit IV: Analog Transmission

Digital to Analog Conversation, Modulation of Digital Data, Bit Rate, Baud Rate, Carrier signal, ASK, FSK, PSK, QAM. Analog to Analog modulation, Amplitude Modulation, Frequency Modulation, and Phase Modulation. Bandwidth Utilization : Multiplexing and Spectrum Spreading : Multiplexing, FDM, WDM, TDM, Synchronous TDM, Digital Siginal Services, Statistical TDM, Spread Spectrum, FHSS, DSSS.

Unit V: Switching

Circuit-Switched Networks, Three Phases, Packet Switching, Datagram Networks, Virtual-Circuit networks, Three Phases, Connection Oriented and Connectionless Services.

Telephone Network :Major Components, Local Loops, Trunks, Switching Offices, Dial-Up service, Digital Subscriber Line, Cable Networks, Traditional Cable Networks, HFC Network, Cable TV for data transfer.

Book of Study:

1. Behrouz A.Forouzan - Data Communications and Networking, Fifth Edition, TATA McGraw Hill Education.

References:

1. William Stallings- Data and Computer communications,Eighth Edition, Pearson.
2. Willaim L.Sechwebar- Data Communications, First Edition, Tata McGraw Hill Publishing Co Ltd .

CS2CRT04: Computer Organization and Architecture (Core)

Theory: 4 hrs. per week

Credits: 4

Unit 1:Basic computer organization and design:

Operational concepts, Instruction codes, Computer Registers, Computer Instructions, Memory locations and addresses, Instruction cycle, Timing and control, Bus organization.

Unit 2: Central Processing Unit:

General Register Organization, Stack Organization, Addressing modes, Instruction Classification, Program control.

Unit 3: Memory Organization:

Memory Hierarchy, Main Memory, Organization of RAM, SRAM, DRAM, Read Only Memory-ROM-PROM,EROM,EEPROM, Auxiliary memory, Cache memory, Virtual Memory, Memory mapping Techniques.

Unit 4: **Parallel Computer Structures**:

Introduction to parallel processing, Pipeline computers, Multi processing systems, Architectural classification scheme-SISD, SIMD, MISD, MIMD.

Unit 5: **Pipelining and Vector processing**: Introduction to pipelining, Instruction and Arithmetic pipelines (design) Vector processing, Array Processors.

Book of study :

1.M.Morris Mano-Computer Systems Architecture, Third Edition, Pearson Education
2.Kai Hwang and F A Briggs-Computer Architecture and parallel processing, McGraw Hills,1990

Reference

1.Carl Hamacher -Computer Organization, Fifth Edition, Tata McGraw Hill.
2. John P Hayes -Computer Architecture & Organization–Mc Graw Hill
3. William Stallings-Computer Organization and Architecture , Seventh Edition, Pearson

Education

CS2CRT05 : Object Oriented Programming using C++

Theory: 4 hrs. per week

Credits: 3

Unit I:Principles of Object Oriented Programming, Beginning with C++

Procedure Oriented Programming-Object Oriented Programming-Basic concepts of object-oriented programming- Benefits of OOP- Applications of OOP-A simple C++program-Structure of C++ program-C++ data types- Symbolic constants- Reference by variables-Operators in C++- Operator precedence-Control structures- Function in C++ - The main function, Function prototyping- Call by reference- Return by reference- Inline function- Default arguments- Function overloading.

Unit II: Classes and Objects

Specifying a class- Defining member functions- Nesting of member functions -Private member functions - Arrays within a class - Memory allocation for objects-Static data members -Static member functions - Arrays of objects - objects as function arguments -Friendly functions- Returning Objects.

Unit III: **Constructers and Destructors, Overloading**

Constructors- Default constructor-Parameterized constructor-Copy constructor- Multiple constructors-Constructors with default arguments- Dynamic constructor-Destructors- Operator overloading- Unary and Binary operator overloading- Overloading using friends- Rules for overloading- Type conversion.

Unit IV:Inheritance

Inheritance- Defining derived classes-Visibility modes-Single, Multilevel, Multiple, Hierarchical and Hybrid inheritance- Virtual base classes- Abstract classes- Constructors in derived classes- Nesting of classes.

UnitV: Pointers, Virtual Functions and Polymorphism, Working with Files

Pointers- Pointers to objects- this pointer-Pointers to derivedclasses- Virtual functions- Pure virtual functions- File Stream classes, Opening and closing a file- File opening modes- File pointers and their manipulations- Sequential input and output operations.

Book of Study:

1.E. Balagurusamy - Object Oriented Programming with C++, Fifth edition, Tata McGraw Education Hill , 2011.

Reference*:*

1.Ashok N. Kamthane, Object oriented Programming with ANSI & Turbo C++, First Edition, Pearson India
2.Robert Lafore, Object Oriented Programming in Turbo C++, First Edition, Galgotia Publications.
3.D Ravichandran, Programming with C++, Second edition, Tata McGraw- Hill.

CS2CRP02 : Software Lab - II

1. Programs based on default arguments, function overloading.
2. Programs based on array of objects, friend functions, passing objects as arguments to function.
3. Programs based on operator overloading (binary, unary) using member functions and friend functions.
4. Programs based on constructors, different types of constructors.
5. Programs based on inheritance, different types of inheritance.

B.Sc.Computer Science- SEMESTER III

CS3CRT06 : Database Management Systems (Core)

Unit I: Introduction

Characteristics of the Database Approach – Database users :DBA , Database Designers ,End users – Advantages of using the DBMS Approach – Data models, Schemas , and Instances – Three-Schema Architecture and Data Independence.

DBMS Languages: DDL, DML – The Database System Environment: DBMS Component Modules.

Unit II: Relational Model

Entity Relationship Modeling: Introduction –Entity Types , Entity Sets , Attributes and Keys – Relationship Types ,Relationship Sets, Roles , and Structural Constraints – Weak Entity Types – Notation for ER diagrams – Sample ER diagrams.

Relational Model concepts: Domains ,Attributes , Tuples , and Relations – Characteristics of Relations – Relational Model Constraints and Relational Database Schemas : Domain Constraints, Key Constraints , Relational Database Schemas , Entity Integrity , Referential Integrity, and Foreign Keys .

Unit III: SQL

Data Types – Data Definition commands : CREATE , ALTER ,DROP - Adding constraints in SQL – Basic SQL Queries : INSERT ,SELECT ,DELETE ,UPDATE - Substring comparison using LIKE operator ,BETWEEN operator – Ordering of rows – SQL set operations :UNION , EXCEPT , INTERSECT – Complex Queries : Comparison involving NULL and Three-valued logic ,Nested queries , EXISTS and UNIQUE functions, Renaming of attributes and Joining of tables, Aggregate functions ,Grouping – Managing Views.

Unit: Normalization and Indexing Structures for Files

Normalization: Informal Design Guidelines for Relational Schemas –Functional Dependencies – Normal forms : First Normal Form , Second Normal Form , Third Normal Form – General Definitions of Second and Third Normal Forms –Boyce-Codd Normal Form.

Indexing Structures for files: -Types of Single-Level Ordered Indexes: Primary Indexes, Clustering Indexes, and Secondary Indexes.

Unit V: Transaction Processing and Database Security

Transaction Processing: Introduction to Transaction Processing - Transaction and System Concepts – Desirable properties of Transactions.

Database Security and Authorization: Types of Security – Control measures – Database Security and DBA – Access Control , User Accounts, and Database Audits –Access Control based on Granting and Revoking Privileges.

***Books of study*:**

1.Ramez Elmasri and Shamkant B.Bavathe - DATABASE SYSTEMS , Sixth Edition, Pearson Education.

***References**:*

1. C.J Date- An Introduction to Database Systems, Eighth edition, Pearson Education,2003

2. Reghu Ramakrishnan and Johannes Gehrke- Database Management Systems , Third edition, Mc Graw Hill International Edition.

3. Dipin Desai , An Introduction to Database Systems , First Edition, Galgoria Publications .

CS3CRT07 : System Analysis And Design

Unit1

Information systems concepts, Business information systems; Describing the business organization – organization chart , organization function list ; information system levels - operational, lower, middle, top management; the system development life cycle concepts;hardware and software end products. Life cycle activities- life cycle flow chart, task,

management review, baseline specifications, role of system analyst.

Unit II

Basic tool of system analysis: identification codes – definition, need for codes, code plan, code dictionary, common type of codes, forms design – basic parts of form, style and types of form, principles of form design .Tools for structure analysis and design: Types of basic charts, decision tables, decision trees,

structured English, data flow diagram, data dictionary, system flow charts, flow charting symbols, information oriented flow charts, process oriented flow charts, HIPO charts.

Unit III

Study phase: Study phase activities, information service request, initial investigation, fact finding techniques, fact analysis techniques, steps in feasibility analysis, study phase report.

Unit IV

Design phase: Design phase activities, structure design, input design- input data, input media and devices, output design, design phase report.

Unit V

Development phase: Development phase activities, bottom up and top down computer program development, training- programmer, operator, user trainings ; convertion; change over plan; steps in computer program development; structured programming; development phase report.

Unit VI

Operation phase: Operation phase activities; change over crisis; change over activities; routine operations; security; performance evaluation.

Book of study :

1.Marvin Gore & John Stubbe- Elements Of System Analysis, Galgotia Book Source.

References:

1. Elias M Awad - System Analysis And Design , Second Edition, Galgotia Publications.

2. Richard Fairley - Software Engineering Concepts , Tata McGraw Publication,2001.

CS3CRT08 : Networking Fundamentals (Complementary)

Unit I

Network: Definition-Models-LAN, WAN, MAN, Network Criteria, Type of connections-point-to-point, multipoint. Topology-Categories-Mesh, Star, Bus, Ring. Internet-History, service providers. Protocol and standards

Connecting Devices: Hubs, Repeaters, Bridges, Switches, Gateways. Connecting remote LANS

Unit II

Reference Models : OSI Reference model, TCP/IP Reference model, Addressing. Data Link Layer: Error Detection and Correction, Block Coding-Linear Block Codes, Cyclic Codes, Cyclic Redundancy Check-Advantages, Checksum-One's Complement

Unit III

Framing- Flow Control, Error Control, Noisy and Noiseless Channels. Network Layer: Logical Addressing, IPV4 Address-Address Space Notation, Network Address Translation.IPV6 address-structure, address space, advantages, tunnelling, Address mapping.

Unit IV

Routing and Forwarding: Forwarding techniques, Routing table, Distance vector routing, multicast routing, and routing protocols. User Datagram Protocol-ports, user datagram, uses, TCP-features, segment, connection.

Unit V

Congestion Control- Open loop and Closed loop, Quality of Service. Application Layer -Domain Name Space, Distribution, TELNET, FTP, SMTP, URL, Cookies, HTTP-Definition, Proxy Sever

Book of study:

1. Behrouz A Forouzan - Data communication and Networking , Fourth Edition, McGraw Hill

References:

1. Andrew S Tanenbaum - Computer Networks, Fourth Edition, Prentice Hall.

2. .William Stallings- Data and Computer Communications , Eighth Edition, Prentice Hall

3. Fred Halsall, Lingana Gauda Kulkarni - Computer Networking & Internet, Fifth Edition, Addison-Wesley .

CS3CRT09 Data Structures using C++ (Core)

Unit I

Concept of Structured data - Data structure definition, Different types and classification of data structures, Arrays – Memory allocation and implementation of arrays in memory, array operations, Applications - sparse matrix representation and operations, polynomials representation and addition, Concept of search and sort – linear search, binary search, selection sort, insertion sort, quick sort.

Unit II

Stacks – Concepts, organization and operations on stacks using arrays (static), examples, Applications - Conversion of infix to postfix and infix to prefix, postfix evaluation, subprogram calls and execution, Multiple stacks representation.

Queues - Concepts, organization and operations on queues, examples.

Circular queue – limitations of linear queue, organization and operations on circular queue. Double ended queue, Priority queue.

Unit III

Linked list: Concept of dynamic data structures, linked list, types of linked list, linked list using pointers, insertion and deletion examples, circular linked list, doubly linked lists

Applications- linked stacks and queues, memory management basic concepts, garbage collection.

Unit IV

Trees - Concept of recursion, trees, tree terminology, binary trees, representation of binary trees, strictly binary trees, complete binary tree, extended binary trees, creation and operations on binary tree, binary search trees, Creation of binary search tree, tree traversing methods – examples, binary tree representation of expressions.

Unit V

File - Definition, Operations on file (sequential), File organizations - sequential, Indexed sequential, random files, linked organization, inverted files, cellular partitioning, hashing – hash tables, hashing functions, collisions, collision resolving methods.

Books of study :

1.G.S Baluja - Data Structures Through C++ (A Practical Approach), Second Edition-2004, Danapat Rai & Co.

2. Ellis Horowitz and Sartaj Sahni - Fundamentals of Data Structures in C++ , Second Edition, Galgotia Publications.

References:

1.Seymour Lipschutz, Theory and Problems of Data Structures, Schaums Outline Series,2006, McGraw Hill

2.Yedidyah Langgsam, Moshe Augustein, Aaron M Tenenbaum- Data structures using C and C++ , Second Edition, Prentice Hall

CS3CRP03 : Software Lab – III

(There will be two questions; the first from DBMS and second from Data structures.)

I. SQL Commands (2 hrs. per week)

1. Data definition commands - CREATE, ALTER, DROP, Adding Constraints Primary key, foreign key, unique key, check, not null.
2. Basic SQL queries INSERT, SELECT, DELETE, UPDATE, Using multiple tables, ordering of rows using ORDER BY option, Set operations using UNION, EXCEPT, INTERSECT, Substring Comparison using LIKE operator, BETWEEN operator.
3. Complex Queries Nested Queries, EXISTS and UNIQUE/DISTINCT functions, NULL values, Renaming of attributes and Joining of tables, Aggregate functions and grouping.
4. Managing views, Simple stored procedures.
5. Data Control commands - Access Control and Privilege commands

II. Data Structures using C++. (3 hours per week)

Section I

Array – Insertion , Deletion, Polynomial addition using arrays

Sort – Selection, Insertion, Quick

Search – Linear search, Binary search

Sparse matrix – Sparse form representation, transpose and addition using the sparse form

Section II

Stack - Implementation using arrays (linear stack)

Queue – Implementation using arrays (linear queue)

Section III

Singly linked list – Implementation using dynamic memory allocation techniques, arrange the list based on the ascending or descending order of the information field, concatenate two linked lists, interchange any two nodes in a list.

Section IV

Creation of binary search trees, Insertion and deletion of nodes.

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B.Sc.Computer Science- SEMESTER IV

CS4CRT10: Linux Administration (Core)

Unit-I

Overview of Linux : What is Linux, Linux's root in Unix, Common Linux Features, advantage of Linux, Overview of Unix and Linux architectures, Linux files system, hardware requirements for Linux, Linux standard directories. Commands for files and directories cd, ls, cp, rm, mkdir, rmdir, pwd, file, more, less, Creating and viewing files using cat, file comparisons.

Unit II

Essential Linux commands: Processes in Linux, process fundamentals, connecting processes with pipes, redirecting input/output, Background processing, managing multiple processes, process scheduling – (at, batch), nohup command, kill, ps, who, find, sort, touch, file, file processing commands - wc, cut, paste etc Mathematical commands - expr, factor etc. Creating and editing files with vi editor.

Unit III

Shell programming - Basics of shell programming, various types of shell available in Linux, comparisons between various shells, shell programming in bash. Conditional and looping statements, case statement, parameter passing and arguments, Shell variables, system shell variables, shell keywords, Creating Shell programs for automating system tasks

Unit-IV

System administration- Common administrative tasks, identifying administrative files configuration and log files, Role of system administrator, Managing user accounts-adding & deleting users, changing permissions and ownerships, Creating and managing groups, modifying group attributes, Temporary disabling of users accounts, creating and mounting file system, checking and monitoring system performance - file security & Permissions, becoming super user using su. Getting system information with uname, host name, disk partitions & sizes, users, kernel, installing and removing packages with rpm command.

Unit-V:

Simple filter commands: pr, head, tail, cut, sort, uniq, tr - Filter using regular expression grep, egrep, sed **Understanding various Servers :**DHCP, DNS, Squid, Apache, Telnet, FTP,Samba.

Book of study :

1. Cristopher Negus - Red Hat Linux Bible, Wiley Dreamtech India 2005 edition.
2. Yeswant Kanethkar - UNIX Shell Programming, First edition, BPB.

References :

1. Official Red Hat Linux Users guide by Redhat, Wiley Dreamtech India
2. Graham Glass & King Ables - UNIX for programmers and users, Third Edition, Pearson Education.
4. Neil Mathew & Richard Stones - Beginning Linux Programming, Fourth edition, Wiley Dreamtech India.

CS4CRT11: Microprocessors and Assembly Language Programming (Complementary)

Unit I

Microprocessor architecture and its operations – microprocessor initiated operations and 8085 bus organization, internal data operations, 8085 registers, externally initiated operations. Memory – memory map, memory and instructions, peripheral mapped I/O.8085 Microprocessor and its architecture.

Unit II

8086 Internal architecture. Basic 8086 microcomputer system – system overview, 8086 bus, Read machine cycle,Write machine cycle. Assembly language programming – program development steps, 8086 instructions – data transfer instructions, arithmetic instructions, bit manipulation instructions, string instructions, program execution, Constructing the machine codes for 8086 instructions. Implementing standard program in 8086 - unconditional jump instructions, condition flags, conditional jump instructions, If-then, If-then else, and multiple if-then-else, while-do , repeat-until , loop instructions, instruction timing and delay loops.

Unit III

Strings, Procedures and Macros – 8086 string instructions, writing and using procedures,CALL and RET instructions, stack, using PUSH and POP to save register contents, passing parameters, reentrant and recursive procedures, writing and using macros.

Unit IV

8086 interrupts – program examples, interrupt Types, 8254 software – programmable TIMER/ COUNTER – basic 8253 and 8254 operations, 8255A, 8259A Priority interrupt controller. Direct Memory Access data transfer – circuit connections and operations of the Intel 8257 DMA controller, DMA transfer timing diagram.

Unit V

Intel 80286 microprocessor – architecture, signals and system connections, Real address mode operation, protected mode operation. Intel 80386 32-bit microprocessor – architecture, pins and signals. Introduction to 80486 microprocessor. Introduction to RISC machines.

Book of study:

1. A.Nagoor Kani - Microprocessor 8086 programming & interfacing,Second edition, Tata McGraw Hill Education.
2. Microprocessors and Interfacing , Programming and Hardware, Douglas V- Hall. Tata McGraw-Hill,1990.

References:

1. Barry B.Brey - Architecture, Programming and Interfacing ,Eighth Edition, Prentice – Hall India.
2. The Intel Microprocessors 8086 / 8088 , 80186 / 80188 , 80286 , 80386 , 80486 , Pentium, and Pentium Pro processor

CS4CRT12 : Computer Aided Optimization Techniques (core)

Unit I

OR: Introduction, origin and development, nature and features, scientific methods, modelling, advantages and limitations of models, solution methods for models, methodology, OR and decision making, applications, opportunities and shortcomings.

Linear Programming Problem: Introduction, Mathematical formulation of LPP, Graphical solution method and exceptional cases, General LPP, Canonical and Standard forms of LPP.

Unit II

Linear Programming Problem: Simplex method - Introduction, Properties, Computational Procedure of simplex method, Artificial variables, Two-Phase method, Big-M method.

Duality in Linear Programming: Introduction, General Primal-Dual pair, Formulating Dual problem, Dual Simplex Method.

Unit III

Transportation Problem: Introduction, LP formulation, Existence of solution, Transportation Table, Loops, Solution – Initial Basic Feasible Solution (North West Corner method, Least Cost method and VAM) and Optimal Solution (MODI method and Stepping Stone method), Tran-shipment problems.

Assignment Problems: Introduction, Mathematical formulation, Solution – using Hungarian method, Special cases, Traveling Salesman problem.

Unit IV

Sequencing Problem: Introduction, Problem of Sequencing, Basic Terms, Processing n jobs through 2 machines, Processing n jobs through k machines, Processing 2 jobs through k machines and Maintenance Crew Scheduling.

Unit V

Network Routing Problems: Introduction, Network Flow Problems, Minimal Spanning Tree problem, Shortest Route problem, Maximal Flow problems – Augmenting path and Maxflow-Mincut methods.

Network Scheduling: Introduction, Basic Components, Logical Sequencing, Rules, Concurrent Activities, Critical Path Analysis – CPM, Probability Considerations and PERT method, Distinction between PERT and CPM, Applications, Advantages and Limitations.

Book of study:

1. Kanti Swarup, P.K. Gupta, Man Mohan, Operations Research, 16th edition , Sultan Chand & Sons.

References:

1. Hamdy A. Taha, Operations Research: An Introduction, 9th edition, Pearson
2. Prem Kumar Gupta and D.S. Hira, Problems in Operations Research, Sultan Chand & Sons.
3. K. V Mital and C. Mohan, Optimization Methods in Operations Research and System Analysis, Third edition, New Age International.

CS4CRT13 : Web Programming Using PHP(Core)

Unit I

Introduction to web, WWW architecture, Fundamentals of HTML, text formatting tags, marquee, inserting images, links, lists, creating tables, frames, working with form elements.

Unit II

CSS introduction, <link> and <style> elements, CSS properties, Controlling Fonts, Text formatting, Text- pseudo classes, Selectors, Links, Backgrounds, lists

Introduction to Java Script, Java Script variables, operators, decision control statements, looping, functions, arrays, events, popup boxes-alert, prompt, conform box, built-in objects, writing JavaScript, form validation

Unit III

Introduction to PHP, server side scripting, role of web server software, php comments, variables, echo and print, PHP operators, data types, branching statements, loops, arrays

Unit IV

PHP functions, PHP form, Passing information between pages, $_GET, $_POST, $_REQUEST. String functions, include and require, session and cookie management, error handling in PHP, Object Oriented Programming using PHP

Unit V

Introduction to MySQL, data types, SQL commands-CREATE, UPDATE, INSERT, DELETE, SELECT, PHP functions for MySQL connectivity and operation- mysql_connect, mysql_select_db, mysql_query, mysql_fetch_row, mysql_fetch_array, mysql_result, mysql_list_fields, mysql_num_fields, insertion, updation and deletion of data using PHP, displaying data from MySQL in webpage.

Book of Study:

1. Dave W Mercer, Allan Kent, Steven D Nowicki, David Mercer, Dan Squier, Wankyu Choi- "Beginning PHP5", Wiley Publishing, Inc

2. Ivan Bayross -"HTML, DHTML, JavaScript, Pearl & CGI ", , BPB Publication

Reference Books:

1. Rasmus Lerdorf and Kevin Tatore, "Programming PHP", Shroff Publishers & Distributors Pvt. Ltd

2. Dave W Mercer, Allan Kent, Steven D Nowicki, David Mercer, Dan Squier, Wankyu Choi, "Beginning PHP" Wiley Publishing, Inc

CS4CRP04 : Assembly Language Programming Lab (Complementary)

(Five programs from each section and 12 hrs per section.)

1. Simple Arithmetic Calculations

2. Conditional Statements

3. Control Statements

4. Loop and Arrays

5. Character Strings

6. Subroutines and Stack Operations

Scheme of Evaluation for lab external is as follows:

Division of Marks (Practical - 3 hours External)

First program - questions from 1 to 3 - 25 marks

(Logic – 12 marks, Successful compilation – 8 marks, Result – 5 marks)

Second program should be based on advanced concepts – questions from 4 to 6 - 35 marks

(Logic – 20 marks, Successful compilation – 10 marks, Result – 5 marks)

Viva Voce - 10 marks

Lab Record (minimum of 20 Programs) - 10 marks

Total 80 marks

CS4CRP05 : Software Lab - IV

Section 1 : Module I,II,III

- Creating simple webpages using HTML tags and CSS.
- Simple validation programs using Java Script.
- PHP including Loops, decision statements and arrays

Section 2 : Module IV,V

- PHP programs using session.
- PHP programs using Data base connectivity

Division of Marks (Practical - 3 hours External)

First program - questions from Modules 1 to 3 - 25 marks

Second program should be based on advanced concepts – questions from modules 4 to 6 - 35 marks

Viva Voce - 10 marks

Lab Record (minimum of 20 Programs) - 10 marks

Total 80marks

B.Sc. Computer Science - SEMESTER V

CS5CRT14 : System Software and Operating Systems (Core)

Unit I

System software- General concepts,Language processing concepts, Fundamentals of Language processing, Fundamentals of language specification - Programming Language Grammar, Classification of grammar. Assemblers: Elements of assembly language programming – assembly language statements, Design specification of an assembler. Macros: Definition- Call- Expansion.

Unit II

Scanning & Parsing : Finite State Automata. Parsing - Parse trees ,topdown parsing,bottom up parsing. Compilers - Phases of compiler- Aspects of compilations- code optimization. Linkers and Loaders - Relocation and linking concepts- Design of linker-Type of loaders.

Unit III

Operating System: OS Definition, Functions, OS as a resource manager, types of OS Evolution of OS, Operating System Services. Process:Basic Concepts, Process Scheduling, Operations on Processes, Inter process communication, CPU Scheduling - Scheduling Criteria, Scheduling Algorithms.

Unit IV

Process Synchronization -The Critical Section problem,Semaphores. Dead Locks : System Model, Dead Lock Characterization, Methods of Handling Dead Locks, Dead Lock Prevention, Dead Lock Avoidance, Dead Lock Detection, Recovery from Dead Lock.

Unit V

Memory Management:Memory Management Strategies -Swapping, Contiguous memory allocation, Paging, Segmentation, Page Replacement.File System :- File Concept, Access Methods, Allocation Methods.

Book of study:

1. D M Dhamdhere - System programming and operating Systems , Tata McGraw Hill
2. Abraham Silberschatz, Peter Galvin and Greg Gagne - Operating System Principles, Seventh Edition, John Wiley

Reference :

1. John J Donovan - System Programming, First edition, Tata McGraw Hill 2009.
2. William Stallings - Operating Systems, Sixth edition, Prentice Hall of India 2010.

CS5CRT15 : IT & Environment (Core)

Unit 1 : (18 hrs.)

Multidisciplinary nature of environmental studies : Definition, scope and importance, Need for public awareness. (**2 hrs**)

Natural Resources: Renewable and non-renewable resources: Natural resources and associated problems. a) **Forest resources**: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. b) **Water resources**: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. c) **Mineral resources**: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. d) **Food resources**: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. e) **Energy resources**: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources, Case studies. f) **Land resources**: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of individual in conservation of natural resources. Equitable use of resources for sustainable life styles. (**10hrs**)

Ecosystems : Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids., Introduction, types, characteristic features, structure and function of the given ecosystem:- Forest ecosystem

(**6 hrs**)

Unit 2: (26 hrs)

Biodiversity and its conservation: Introduction, Biogeograhical classification of India, Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values., India as a mega-diversity nation, Hot-sports of biodiversity, Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India

(**8 hrs**)

Environmental Pollution : Definition, Causes, effects and control measures of: - Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards, Solid waste Management: Causes, effects and control measures of urban and industrial wastes., Role of an individual in prevention of pollution, Pollution case studies, Disaster management: floods, earthquake, cyclone and landslides. (**8 hrs**)

Social Issues and the Environment : Urban problems related to energy, Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation of people: its problems and concerns, Case studies, Environmental ethics: Issues and possible solutions, Climate change, global warming, acid rain, ozone layer depletion , nuclear accidents and holocaust, Case studies, Consumerism and waste products, Environment Protection Act , Air (Prevention and Control of Pollution) Act, Water

(Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation, Public awareness. (**10hrs**)

Unit 3: (10 hrs.)

Internet as a knowledge repository, academic search techniques, creating cyber presence. Academic websites, open access initiatives, opens access publishing models, Introduction to use of IT in teaching and learning -Educational software, Academic services–INFLIBNET, NPTEL, NICNET, BRNET . (**10hrs**)

Unit 4: (10 hrs.)

IT & Society- issues and concerns- digital divide, IT & development, the free software movement , IT industry: new opportunities and new threats, software piracy, cyber ethics, cyber crime, cyber threats, cyber security, privacy issues, cyber laws, cyber addictions, information overload, health issues- guide lines for proper usage of computers, internet and mobile phones. e-wastes and green computing, impact of IT on language & culture-localization issues- Unicode- IT and regional languages, Green Computing Concept. (**10hrs**)

Unit 5: (8 hrs.)

Human Rights– An Introduction to Human Rights, Meaning, concept and development, Three Generations of Human Rights (Civil and Political Rights; Economic, Social and Cultural Rights).

Human Rights and United Nations – contributions, main human rights related organs - UNESCO,UNICEF, WHO, ILO, Declarations for women and children, Universal Declaration of Human Rights. **Human Rights in India** – Fundamental rights and Indian Constitution, Rights for children and women, Scheduled Castes, Scheduled Tribes, Other Backward Castes and Minorities

Environment and Human Rights - Right to Clean Environment and Public Safety: Issues of Industrial Pollution, Prevention, Rehabilitation and Safety Aspect of New Technologies such as Chemical and Nuclear Technologies, Issues of Waste Disposal, Protection of Environment **Conservation of natural resources and human rights**: Reports, Case studies and policy formulation. Conservation issues of western ghats- mention Gadgil committee report, Kasthurirengan report. Over exploitation of ground water resources, marine fisheries, sand mining etc. **(8 Hrs)**

Internal: Field study

- Visit to a local area to document environmental grassland/ hill /mountain
- Visit a local polluted site – Urban/Rural/Industrial/Agricultural Study of common plants, insects, birds etc
- Study of simple ecosystem-pond, river, hill slopes, etc

References:

1 ."Technology in Action" Alan Evans, Kendall Martin, Mary Anne Poatsy, Pearson

2. Bharucha Erach, Text Book of Environmental Studies for undergraduate Courses. University Press, IInd Edition 2013 (TB)

3 .Clark.R.S., Marine Pollution, Clanderson Press Oxford (Ref)

4. Cunningham, W.P.Cooper, T.H.Gorhani, E & Hepworth, M.T.2001 Environmental Encyclopedia, Jaico Publ. House. Mumbai. 1196p .(Ref)

5. Dc A.K.Enviornmental Chemistry, Wiley Eastern Ltd.(Ref)

6 .Down to Earth, Centre for Science and Environment (Ref)

7. Heywood, V.H & Watson, R.T. 1995. Global Biodiversity Assessment, Cambridge University Press 1140pb (Ref)

8. Jadhav.H & Bhosale.V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284p (Ref)

9. Mekinney, M.L & Schock.R.M. 1996 Environmental Science Systems & Solutions. Web enhanced edition 639p (Ref)

10 .Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co. (TB)

11 .Odum.E.P 1971. Fundamentals of Ecology. W.B. Saunders Co. USA 574p (Ref)

12. Rao.M.N & Datta.A.K. 1987 Waste Water treatment Oxford & IBII Publication Co.Pvt.Ltd.345p (Ref)

13. Rajagopalan. R, Environmental Studies from crisis and cure, Oxford University Press, Published: 2016 (TB)

14. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut (Ref)

15. Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science (Ref)

16. Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Stadards, Vol I and II, Enviro Media (Ref)

17. Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (Ref)

18. Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p (Ref)

19.M-Magazine, R-Reference TB- Text Book

CS5CRT16 : Java Programming using Linux (Core)

Unit I

Concepts of Object oriented programming, Benefits of OOP, Features of Java. Java environment, Java tokens, Constant, variables, data types, operators, Control Statements-branching statements, looping statements, jump statements, labeled loops.

Unit II

Defining a Class, Fields declaration, Method declaration, Creating object, Accessing class members, method overloading, Constructors, constructor overloading, super keyword, static Members, Inheritance, overriding methods, dynamic method dispatch, final(variables, methods and classes), abstract methods and classes, interfaces, visibility control.

UNIT III

Arrays- One dimensional arrays, declaration, creation, initialization of arrays, two dimensional arrays, String class. Packages: - Java API packages overview (lang, util, io, awt, swing, applet), user defined packages-creating packages, using packages

Exception Handling Techniques-try-catch-throw-throws-finally -Multi-threading- creation of multi-threaded program-Thread class-Runnable interface, Thread life cycle.

UNIT IV

Event Handling-Delegation Event Model-Event Classes-Sources of Events-Event Listeners- Event classes- Swing- architecture, components of swing- JLabel, JButton, JCheckBox, JRadioButton, JList, JComboBox, JTextField, JText Area, JPanel, JFrame, Layout Managers(Flow Layout, Grid Layout, Card Layout, Border Layout, Box Layout, Null Layout).

UNIT V

Applet Fundamentals -applet tag, applet life cycle, passing parameters to applets. Working with graphics - Line, Rectangle, Oval, Arc, color setting. JDBC architecture- JDBC connection, JDBC statement object, JDBC drivers.

Book of study :

1. E. Balagurusamy- Programming with Java , Third Edition, McGraw Hill Companies.

2. K. Somasundaram - PROGRAMMING IN JAVA2, First Edition, Jaico Publishing House.

***Reference**:*

1. Patrick Naughton - Java2 The Complete Reference, Seventh Edition:
2. Cay S Horstmann & Gary Cornell - Core Java Volume 1- Fundamentals, Eighth edition.
3. Java 6 Programming Black Book 2007 Edition, Dreamtech press.

CS5CRT17 : Computer Security (Core)

Unit I

Introduction-Principles of Security- Need for Security- Threats- Attacks

Unit II

Cryptography :Cipher Methods: Caesar cipher -One time pad – Mono alphabetic Cipher -Play fair cipher- Poly alphabetic cipher -Vigenère – Cipher, Transposition ciphers – Cryptographic Algorithms: Symmetric & Asymmetric- Cryptographic tools: PKI- Digital Signatures-Stenography

Unit III

System Security :

Intrusion Detection and Prevention Systems, Why IDPS? Types of IDPS,Password Management, Countermeasures

Unit IV

Network Security:Electronic Mail Security, Pretty Good Privacy, S/MIME, IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload.

Unit V

Web Security: Web Security considerations- Secure Socket Layer -Transport layer Security-Secure electronic transaction. Firewalls-Packet filters- Application Level Gateway-Circuit Level Gateway.

Book of Study:

1.Michael E. Whitman, Herbert J. Mattord, “Principles of Information Security” Fourth Edition

2.William Stallings, “Cryptography and Network Security – Principles and Practices”,Fourth Edition,2006,Pearson Education.

Reference :

1.Behrouz A. Forouzan, Dedeep Mukhopadhyay “Cryptography & Network Security”, Second Edition,Tata McGraw Hill, New Delhi, 2010.

2. Atul Kahate, “Cryptography and Network Security”, Second Edition, Tata McGraw Hill

OPEN COURSE

CS5OPT01 Informatics and Cyber Ethics

Unit I

The Internet, TCP/IP, IP Addressing, Client Server Communication, Intra-net, WWW, Web Browser and Web Server, Hyper links, URLs, Electronic mail.

Unit II

Internet as a knowledge repository, academic search techniques, creating cyber presence. Academic websites, open access initiatives, opens access publishing models, Introduction to use of IT in teaching and learning -Educational software, Academic services–INFLIBNET, NPTEL, NICNET, BRNET.

Unit III

Introduction to purchase of technology, License, Guarantee, Warranty, Basic concepts of IPR, copyrights and patents, plagiarism. IT & development, the free software movement

Unit IV

Cyber space, information overload, cyber ethics, cyber addictions, cybercrimes– categories

–person, property, Government–types-stalking, harassment, threats, security & privacy issues.

Unit V

Cyber Addiction, Information Overload, Health Issues, e-Waste and Green computing impact of IT on language & culture-localization issues- Unicode- IT and regional languages e-Governance in India, IT for National Integration, Role of IT.

Book of Study:

1. Alan Evans, Kendall Martin, Mary Anne Poatsy -"Technology in Action", Pearson

References:

1. Dinesh Maidasani "Learning Computer Fundamentals, MS Office and Internet & Web Technology", Firewall Media, Lakshmi Publications.
2. V Rajaraman - "Introduction to Information Technology", Prentice- Hall of India.
3. Barkhs and U. Rama Mohan - HTML Black Book 3. "Cyber Law Crimes", Asia Law House, New Edition
4. Peter Nortons- Introduction to Computers, Sixth Edition, Published by Tata McGraw Hill

CS5OPT02 – Computer Fundamentals, Internet & MS Office

Unit I

Computer Fundamentals: History, Generations, Classifications, Operating Systems, Types of Networks

Unit II

The Internet, TCP/IP, IP Addressing, Client Server Communication, Intra-net, WWW, Web Browser and Web Server, Hyper-links, URLs, Electronic Email

Unit III

Word processing: Introduction, Microsoft Word, Basic Menus, Formatting the text & paragraph, Working with Index

Unit IV

Spread Sheet: Introduction, Microsoft Excel, Basic Menus, Formulas, Basic functions, Charts and Graphs.

Unit V

MicrosoftPower Point: Introduction, Basic Menus, Template, Slide Basics, Charts, Adding Multimedia & Animation.

Book of Study:

1. "Learning Computer Fundamentals, MS Office and Internet & Web Technology", Dinesh Maidasani, Firewall Media, Lakshmi Publications.

References:

1. Harley Hahn - "Internet Complete Reference", , Second Edition, Tata McGraw Hill Education
2. Gary B. Shelly, Misty E. Vermaat - "Microsoft Office 2010: Advanced" , CENGAGE Learning 2010

CS5CRP06 : Software Development Lab - I

Part I. Java Programs: using class and read inputs from keyboard , Method Overloading- Method Overriding- inheritance- JDBC connection -Exception Handling

Part II Mini Project using Java

Scheme of Evaluation for software Development lab I external is as follows:

Division of Marks (Practical - 3 hours External)

First program - part I **- 20 marks**

(Logic – 10 marks, Successful compilation – 6 marks, Result – 4 marks)

Lab Record (minimum of 10 Programs) **- 5 marks**

Project demonstration and Presentation **- 30 marks**

Viva Voce **- 15 marks**

Project Report **- 10 marks**

B.Sc.Computer Science - SEMESTER VI

CS6CRT18 : Computer Graphics (Core)

Unit 1 : (12 hrs.)

Introduction: A survey of Computer Graphics, overview of graphics systems-Video display devices- Refresh CRT, Raster-Scan and Random-Scan Displays ,Color CRT Monitors, DVST, Flat-Panel Displays , Raster Scan systems, Random scan systems, Input devices, Hard copy devices, Graphics software.

Unit 2: (14 hrs.)

Output primitives: Line drawing algorithms: DDA algorithm, Bresenham's line algorithm, Circle generating algorithm- Midpoint circle algorithm, Character generation.

Unit 3: (18 hrs.)

2D geometric Transformations: Basic transformations: Translation, Rotation, Scaling; Other transformations-Reflection and shear, Matrix representation and homogenous coordinates, Composite transformation, Interactive picture construction Techniques.

Two-dimensional viewing: viewing pipeline, window and viewport, window to viewport transformation. Clipping operations- Point clipping, Line clipping:- Cohen Sutherland line clipping, Polygon clipping:- Sutherland- Hodgeman polygon clipping, Text Clipping.

Unit 4: (14 hrs.)

Three-dimensional concepts: Three dimensional display methods, Three dimensional object representations- Polygon surfaces, Sweep representations, Constructive solid geometry methods, octrees and quadtrees.

Unit 5 (14 Hrs)

Computer Animation: Design of animation sequences, raster animations, computer animation languages, key-frame systems, morphing, motion specifications.

***Book of study* :**

1.Donald D.Hearn & M. Pauline Baker, Computer Graphics C Version, Second Edition,, PHI Pvt. Ltd.

References:

1.Newman W M & R F Sproul, Principles of Interactive Computer Graphics, Second Edition Mc-Graw Hill Publishers.
2.Plastock R & Xiang Z, Theory and problems of computer Graphics, Second Edition Schaum Series, McGraw Hill Publishers.

CS6CRT19 : Big Data Analytics

Unit I: Introduction to Big Data

Introduction to BigData Platform – Challenges of Conventional Systems - Intelligent data analysis – Nature of Data - Analytic Processes and Tools - Analysis vs Reporting - Modern Data Analytic Tools - Statistical Concepts: Sampling Distributions - Re-Sampling - Statistical Inference - Prediction Error.

Unit II: Mining Data Streams

Introduction To Streams Concepts – Stream Data Model and Architecture - Stream Computing - Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window – Decaying Window - Real time Analytics Platform(RTAP) Applications - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions.

Unit III : Hadoop

History of Hadoop- The Hadoop Distributed File System – Components of Hadoop-Analyzing the Data with Hadoop- Scaling Out- Hadoop Streaming- Design of HDFS-Java interfaces to HDFS- Basics-Developing a Map Reduce Application-How Map Reduce Works-Anatomy of a Map Reduce Job run-Failures-Job Scheduling-Shuffle and Sort – Task execution - Map Reduce Types and Formats- Map Reduce Features.

Unit IV : Hadoop Environment

Setting up a Hadoop Cluster - Cluster specification - Cluster Setup and Installation - Hadoop Configuration-Security in Hadoop - Administering Hadoop – HDFS - Monitoring-Maintenance-Hadoop benchmarks- Hadoop in the cloud

Unit V : Frameworks

Applications on Big Data Using Pig and Hive – Data processing operators in Pig – Hive services – HiveQL – Querying Data in Hive - fundamentals of HBase and ZooKeeper - IBM InfoSphere BigInsights and Streams. Visualizations - Visual data analysis techniques, interaction techniques; Systems and applications

Book of Study:

1. Michael Berthold, David J. Hand, “Intelligent Data Analysis”, Springer, 2007.
2. Tom White “ Hadoop: The Definitive Guide” Third Edition, O’reilly Media, 2012.
3. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, “Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data”, McGrawHill Publishing, 2012

References:

1. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.
2. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & sons, 2012.
3. Glenn J. Myatt, "Making Sense of Data", John Wiley & Sons, 2007
4. Pete Warden, "Big Data Glossary", O'Reilly, 2011.

Elective Papers

CS6PET01: Python and LateX

Module I - Introduction to Python

The Python Pogramming Language , Variables , Basic expressions and statements , Arithmetic Operators , Data types - Type conversion , Numbers, Floats , String operations

Module II - Control Flow and Data Structures

Logical operators , if , If-Else , While loop , For loop , List value, lenght, operation and deletion , Dictionary operation & methods , Tuples

Module III – Functions

Basic inbuild functions , User defined functions , Function Calls , Parametrized function calls , Function returns , Recursive functions , Scope concepts - local, global

Module IV - Files and user I/O

User input , Reading files , Writing to files , Directories , Interactive programming , Pickling , Exceptions

Module V - Basic LaTeX

What is LaTeX , Structure -Layout - Margin, Header/Footer , Sectioning , Bullets and Numbering , Images

Book of Study:

1. Downey, A. et al., "How to think like a Computer Scientist: Learning with Python", John Wiley, 2015

2. Stefan Kottwitz “LaTeX: Beginner's Guide”Packt Publishing, 2011

References:

1.Swaroop C H, "Byte of Python", CreateSpace Independent Publishing Platform, 2015

2. Zed Shaw, "Learn Python the Hard Way",Addison-Wesley, 2014

3.WikiBooks - https://en.wikibooks.org/wiki/LaTeX/

4. F. Mittelbach and M Goossens with Braams, Carlisle, and Rowley, “The LaTeX Companion”, Addison-Wesley Second edition

CS6PET02: Digital Image Processing

Module I: Digital Image Fundamentals

Definition of an image, different types of images, digital image processing-definition, advantages, applications. Basic steps in DIP, elements of visual perception, pixel relationship.

Module II: Image Enhancement In Spatial Domain

Basics, histogram manipulation. Spatial filtering: smoothing linear filters, order- statistics filter- median filter and mean filter; sharpening filters-the Laplacian.

Module III: Image Enhancement In Frequency Domain

Fourier transform and frequency domain, basis of filtering in frequency domain. Smoothing filters-Ideal, Butterworth, Gaussian low pass filter; Sharpening filters- Ideal, Butterworth, Gaussian high pass filters.

Module IV: Morphological Image Processing

Introduction, basis of set theory, Dilation, Erosion, Structuring elements, Opening and Closing, Top hat and bottom hat transformation.

Module V: Image Segmentation Point, line, edge detection-detection of isolated points, basic edge detection; Pixel based approach-Basics of intensity thresholding, Basic global thresholding; region based segmentation-region growing, region splitting and merging.

Book of Study :

1. Rafael C. Gonzalez, Richard E. Words, Digital Image Processing, Third Edition

2. S. Jayaraman, S. Esakkirajan, T. Veerakumar , Digital Image Processing

References :

1.Anil K Jain, Fundamentals of Digital Image Processing , Pearson Education 2003

CS6PET03 : Cloud Computing

Unit 1: (14 hrs.)

Introduction: Cloud Computing at a Glance, Historical Developments, Building Cloud Computing Environments, Computing Platforms and Technologies, Principles of Parallel and Distributed Computing: Eras of Computing, Parallel vs. Distributed Computing, Elements of Parallel Computing, Elements of Distributed Computing.

Unit 2: (14 hrs.)

Virtualization: Introduction, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Technology Examples.

Unit 3: (14 hrs.)

Cloud Computing Architecture :Introduction, Cloud Reference Model, Types of Clouds, Economics of the Cloud, Open Challenges.

Unit 4: (16 hrs.)

Aneka: Cloud Application Platform: Framework Overview, Anatomy of the Aneka Container, Building Aneka Clouds, Cloud Programming and Management, Data Intensive Computing: Map-Reduce Programming - What is Data-Intensive Computing?, Technologies for Data-Intensive Computing, Aneka MapReduce Programming.

Unit 5: (16 hrs.)

Cloud Platforms in Industry: Amazon Web Services, Google AppEngine, Microsoft Azure, Cloud Applications: Scientific Applications, Business and Consumer Applications.

Book of Study:

1. Rajkumar Buyya, Christian Vecchiola, S ThamaraiSelvi- Mastering Cloud Computing, Tata McGraw Hill Publications.

References:

1. Kumar Saurabha, "Cloud Computing " Wiley Publication Krutz ,Vines "Cloud Security". Wiley Publication.
2. A Srinivasan & J. Suresh " Cloud Computing : A Practical Approach for learning and Implementation " , First edition ,Pearson

CS6SMP07 : Seminar

Each student can choose a latest topic of current day interest in the areas of Computer Science / Information Technology and present a seminar presentation using appropriate presentation media. A seminar presentation report in bound form in the pattern of a complete technical report (with contents page, well structured presentation, references etc.) should be submitted. There will not be any external evaluation for the Software lab VI and Seminar Presentation

Scheme of Evaluation of Seminar Presentation (core) (INTERNAL) is as follows:

Division of Marks

Seminar Presentation Internal (100 marks)

Presentation	**- 40 marks**
Questions and Answers	**- 30 marks**
Documentation	**10 marks**
Seminar report with proper Content and Binding	**- 20 marks**
Total Marks	**-100 marks**

CA6CRP08 : Software Development Lab II (Main Project) (Core)

Software development lab: 7 hrs. per week

Individual project.

The project topic shall be chosen from areas of current day interest using latest packages / languages running on appropriate platforms (Except the tools used in software development-I), so that the student can be trained to meet the requirements of the Industry. A project report should be submitted in hard bound complete in all aspects. For internal evaluation, the progress of the student shall be systematically assessed through various stages of evaluation at periodic intervals.

Scheme of Evaluation for Software Development Lab II external is as follows:

Division of Marks (Software Development Lab II)

Project demonstration and Presentation	**- 40 marks**
Viva related to project	**- 20 marks**
Project report with proper content and binding	**-20 marks**
Total Marks	**- 80marks**

CS6VVT01 –VIVA VOCE (Core)

Credit :1

Scheme of Evaluation of Viva voce (core) for External is as follows:

Each student should attend a course viva voce based on syllabus from semester I to semester IV.

Total Marks – 100 marks

SYLLABUS- B.Sc. Computer Application(Triple Main)

SEMESTER I

CA1CRT01 : Computer fundamentals and digital principles (Core)

Unit-1:

Introduction: Functional units of a computer system, Different types of computers, Computer Software and Hardware, Types of software-System software and Application programme. Characteristic of computers. Input Devices – Keyboard, Mouse, Optical input devices, Output devices – Monitors and Printers.

Unit-2:

Introduction to Operating Systems and Networking: Definition of an Operating System - Different types of PC Operating Systems. Computer Networks- categories of networks - LAN, WAN,MAN. The Internet - Working of Internet - Major Features of Internet.

Unit 3:

Number Systems: Base or radix ,Positional number system, Popular number systems(Decimal, Binary, Octal and Hexadecimal), Conversion-From one number system to another, Concept of binary addition and subtraction, Complements in binary number systems, 1^s Complement, 2^s Complement and their applications, Signed magnitude form, BCD numbers- concept and addition.

Unit 4:

Boolean Algebra and Gate Networks: Logic gates- AND, OR, NOT, NAND and NOR Truth tables and graphical representation, Basic laws of Boolean Algebra, Simplification of Expressions, De Morgans theorems, Dual expressions, Canonical expressions, Min terms and Max terms, SOP and POS expressions, Simplification of expression using K-MAP (up to 4 variables), Representation of simplified expressions using NAND/NOR Gates, Dont care conditions, XOR and its applications, parity generator and checker.

Unit 5:-

Sequential and Combinational Logic. Flip flops- Latch, Clocked, RS, JK, T, D and Master slave , Adders-Half adder, Full adder(need and circuit diagram), Encoders, Decodes, Multiplexers and Demultiplexers(working of each with diagram), Analog to digital and digital to analog converters (Diagram and working principle), : Concept of Registers, Shift Registers

Books of study :

1. Peter Nortons- Introduction to Computers, Sixth Edition, Published by Tata McGraw Hill

2. P K Sinha & Priti Sinha - Computer Fundamentals , Fourth Edition, BPB Publications.

3. M Morris Mano-Digital Logic and Computer design, Fourth Edition, Prentice Hall.

References :

1. Thomas C Bartee- Digital computer Fundamentals, Sixth Edition, TATA McGraw Hill Edition

2. Thomas L Floyd- Digital Fundamentals, Ninth edition, PEARSON Prentice Hall.

3. Malvino & Leach- Digital Principles and Applications, Sixth Edition, Tata McGraw Hill, 2006

CA1CRT02-Methodology Of Programming And C Language (Core)

UNIT 1

Introduction to programming, Classification of computer languages, Language translators (Assembler, Compiler, Interpreter), Linker, Characteristics of a good programming language, Factors for selecting a language, Subprogram, Purpose of program planning, Algorithm, Flowchart, Pseudocode, Control structures (sequence, selection, Iteration), Testing and debugging.

UNIT 2

C Character Set, Delimiters, Types of Tokens, C Keywords, Identifiers, Constants, Variables, Rules for defining variables, Data types, C data types, Declaring and initialization of variables, Type modifiers, Type conversion, Operators and Expressions- Properties of operators, Priority of operators, Comma and conditional operator, Arithmetic operators, Relational operators, Assignment operators and expressions, Logical Operators, Bitwise operators

UNIT 3

Input and Output in C – Formatted functions, unformatted functions, commonly used library functions, Decision Statements If, if-else, nested if-else, if-else-if ladder, break, continue, goto, switch, nested switch, switch case and nested if. Loop control- for loops, nested for loops, while loops, do while loop.

UNIT 4

Array, initialization, array terminology, characteristics of an array, one dimensional array and operations, two dimensional arrays and operations. Strings and standard functions, Pointers, Features of Pointer,

Pointer and address, Pointer declaration, void wild constant pointers, Arithmetic operations with pointers, pointer and arrays, pointers and two dimensional arrays.

UNIT 5

Basics of a function, function definition, return statement, Types of functions, call by value and reference. Recursion -Types of recursion, Rules for recursive function, direct and indirect recursion, recursion vs iterations, Advantages and disadvantages of recursion. Storage class, Structure and union, Features of structures, Declaration and initialization of structures, array of structures, Pointer to structure, structure and functions, typedef, bitfields , enumerated data types, Union, Dynamic memory allocation, memory models, memory allocation functions.

Book Of Study:

1. Ashok Kamthane - Programming in C, Third Edition, Pearson Education
2. P K Sinha & Priti Sinha - Computer Fundamentals , Fourth Edition, BPB Publications.

Reference Text

1. E. Balaguruswamy -Programming in ANSI C ,Seventh Edition , McGraw Hill Education
2. Byron Gotfried - Programming with C, Second Edition, Schaums Outline series. McGraw Hill

CA1CRP01-Software Lab I (Core)

Software Lab: 4 hrs. per week

Credits:2

Syllabus

1. Programs to familiarize printf() and scanf() functions.

2. Programs Based on Decision statements , break, goto, continue, switch and Loop controls statements.

3. Programs Based on One dimensional and two dimensional arrays.

4. Programs on Strings and string handling functions.

5. Programs based on Pointers, operations on pointers, Arrays & Pointers,

6. Programs based on functions, Call by value, Call by reference, Recursion,

7. Programs based on structure and union, array of structures, Pointer to structure, structure and functions

8. Simple programs using pointers and malloc().

Scheme of Evaluation for software lab I external is as follows:

Division of Marks (Practical - 3 hours External)

First program from part 1& 2 **- 25 marks**

1.Flowchart - 5 marks

2.Logic – 10 marks

3.Successful compilation – 5 marks

4.Result – 5 marks

Second program should be based on advanced concepts ,part 3 to part 5 **- 35 marks**

1.Logic – 20 marks

2.Successful compilation – 10 marks

3. Result – 5 marks)

Viva Voce **- 10 marks**

Lab Record (minimum of 25 Programs) **- 10 marks**

Total Marks **- 80 marks**

B.Sc.Computer Application- SEMESTER II

CA2CRT03-Database Management Systems (Core)

Theory:4 Hours per week
Credit:3

Unit 1: Introduction (12 hrs.)

Characteristics of the Database Approach – Database users :DBA , Database Designers ,End users – Advantages of using the DBMS Approach – Data models, Schemas , and Instances – Three-Schema Architecture and Data Independence.

DBMS Languages: DDL, DML – The Database System Environment: DBMS Component Modules.

Unit 2: Relational Model (16 hrs.)

Entity Relationship Modeling: Introduction –Entity Types , Entity Sets , Attributes and Keys – Relationship Types ,Relationship Sets, Roles , and Structural Constraints – Weak Entity Types – Notation for ER diagrams – Sample ER diagrams.

Relational Model concepts: Domains ,Attributes , Tuples , and Relations – Characteristics of Relations – Relational Model Constraints and Relational Database Schemas : Domain Constraints, Key Constraints , Relational Database Schemas , Entity Integrity , Referential Integrity, and Foreign Keys .

Unit 3: SQL(14 hrs.)

Data Types – Data Definition commands : CREATE , ALTER ,DROP - Adding constraints in SQL –

Basic SQL Queries : INSERT ,SELECT ,DELETE ,UPDATE - Substring comparison using LIKE operator ,BETWEEN operator – Ordering of rows – SQL set operations UNION , EXCEPT , INTERSECT – Complex Queries : Comparison involving NULL and Three-valued logic ,Nested queries , EXISTS and UNIQUE functions, Renaming of attributes and Joining of tables, Aggregate functions ,Grouping – Managing Views.

Unit 4: Normalization and Indexing Structures for Files(15 hrs.)

Normalization: Informal Design Guidelines for Relational Schemas –Functional Dependencies – Normal forms : First Normal Form , Second Normal Form , Third Normal Form – General Definitions of Second and Third Normal Forms –BCNF.

Indexing Structures for files: -Types of Single-Level Ordered Indexes: Primary Indexes, Clustering Indexes, and Secondary Indexes.

Unit 5: Transaction Processing and Database Security (15 hrs.)

Transaction Processing: Introduction to Transaction Processing - Transaction and System Concepts – Desirable properties of Transactions.

Database Security and Authorization: Types of Security – Control measures – Database Security and DBA – Access Control , User Accounts, and Database Audits –Access Control based on Granting and Revoking Privileges.

***Books of study*:**

1.Ramez Elmasri and Shamkant B.Bavathe - DATABASE SYSTEMS , Sixth Edition, Pearson Education.

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References*:*

1. C.J Date- An Introduction to Database Systems, Eighth edition, Pearson Education,2003
2. Reghu Ramakrishnan and Johannes Gehrke- Database Management Systems , Third edition, Mc Graw Hill International Edition.
3. Dipin Desai , An Introduction to Database Systems , First Edition, Galgoria Publications

CA2CRT04-Object Oriented Programming using C++

Unit I:Principles of Object Oriented Programming, Beginning with C++

Procedure Oriented Programming-Object Oriented Programming-Basic concepts of object-oriented programming- Benefits of OOP- Applications of OOP-A simple C++program-Structure of C++ program-C++ data types- Symbolic constants- Reference by variables-Operatorsin C++- Operator precedence-Control structures- Function in C++ - The main function, Function prototyping- Call byreference- Return by reference- Inline function- Default arguments- Functionoverloading.

Unit II:Classes and Objects

Specifying a class- Defining member functions- Nesting of member functions -Private member functions - Arrays within a class - Memory allocation for objects-Staticdata members -Static member functions - Arrays of objects - objects asfunction arguments -Friendly functions- Returning Objects.

Unit III: **Constructers and Destructors, Overloading**

Constructors- Default constructor-Parameterized constructor-Copy constructor- Multiple constructors-Constructors withdefault arguments- Dynamic constructor-Destructors- Operator overloading- Unary andBinary operator overloading- Overloading using friends- Rules for overloading- Type conversion.

Unit IV:Inheritance

Inheritance- Defining derived classes-Visibility modes-Single,Multilevel,Multiple, Hierarchical andHybrid inheritance- Virtual base classes- Abstractclasses- Constructors in derived classes- Nesting of classes.

UnitV:Pointers, Virtual Functions and Polymorphism, Working with Files

Pointers- Pointers to objects- this pointer-Pointers to derivedclasses- Virtual functions- Pure virtual functions- File Stream classes, Opening and closing a file- File opening modes- File pointers and their manipulations- Sequential input and output operations.

Book of Study:

1. E. Balagurusamy - Object Oriented Programming with C++, Fifth edition, Tata McGraw Education Hill , 2011.

Reference:

1. Ashok N. Kamthane, Object oriented Programming with ANSI & Turbo C++, First Edition, Pearson India
2. Robert Lafore, Object Oriented Programming in Turbo C++, First Edition, Galgotia Publications.
3. D Ravichandran, Programming with C++, Second edition, Tata McGraw- Hill

CA2CRP02-Software Lab II

I. SQL Commands (2 hrs. per week)

1. Data definition commands - CREATE, ALTER, DROP, Adding Constraints Primary key, foreign key, unique key, check, not null.
2. Basic SQL queries INSERT, SELECT, DELETE, UPDATE, Using multiple tables, ordering of rows using ORDER BY option, Set operations using UNION, EXCEPT, INTERSECT, Substring Comparison using LIKE operator, BETWEEN operator.
3. Complex Queries Nested Queries, EXISTS and UNIQUE/DISTINCT functions, NULL values, Renaming of attributes and Joining of tables, Aggregate functions and grouping.
4. Managing views, Simple stored procedures.

5. Data Control commands - Access Control and Privilege commands.

II. Object Oriented Programming using C++ (3 hrs. per week)

1. Programs based on default arguments, function overloading.
2. Programs based on array of objects, friend functions, passing objects as arguments to function.
3. Programs based on operator overloading (binary, unary) using member functions and friend functions.
4. Programs based on constructors, different types of constructors.
5. Programs based on inheritance, different types of inheritance.

Scheme of Evaluation for software lab II external is as follows:

(There will be two questions; the first from DBMS and second from C++)

Division of Marks (Practical - 3 hours External)

First program - questions from DBMS **- 25 marks**

1. Logic – 10 marks
2. Successful compilation – 8 marks
3. Result – 7 marks

Second program – questions from Object Oriented Programming using C++ **- 35 marks**

1. Logic – 20 marks
2. Successful compilation –10 marks
3. Result – 5 marks

Viva Voce **- 10 marks**

Lab Record **- 10 marks**

(DBMS -Minimum of 10 Programs

C++ -Minimum: of 15 Programs)

Total Marks **- 80 marks**

B.Sc. Computer Application - SEMESTER III

CA3CRT05-Data Structures using C++ (Core)

Module I

Concept of Structured data - Data structure definition, Different types and classification of data structures, Arrays – Memory allocation and implementation of arrays in memory, array operations, Applications - sparse matrix representation and operations, polynomials representation and addition, Concept of search and sort – linear search, binary search, selection sort, insertion sort, quick sort.

Module II

Stacks – Concepts, organization and operations on stacks using arrays (static), examples, Applications - Conversion of infix to postfix and infix to prefix, postfix evaluation, subprogram calls and execution, Multiple stacks representation. Queues - Concepts, organization and operations on queues, examples. Circular queue – limitations of linear queue, organization and operations on circular queue. Double ended queue, Priority queue.

Module III

Linked list: Concept of dynamic data structures, linked list, types of linked list, linked list using pointers, insertion and deletion examples, circular linked list, doubly linked lists, Applications- linked stacks and queues, memory management basic concepts, garbage collection.

Module IV

Trees - Concept of recursion, trees, tree terminology, binary trees, representation of binary trees, strictly binary trees, complete binary tree, extended binary trees, creation and operations on binary tree, binary search trees, Creation of binary search tree, tree traversing methods – examples, binary tree representation of expressions.

Module V

File - Definition, Operations on file (sequential), File organizations - sequential, Indexed sequential, random files, linked organization, inverted files, cellular partitioning, hashing – hash tables, hashing functions, collisions, collision resolving methods.

Books of study :

1. G.S Baluja - Data Structures Through C++ (A Practical Approach), Second Edition-2004, Danapat Rai & Co.

2. Ellis Horowitz and Sartaj Sahni - Fundamentals of Data Structures in C++ , Second Edition, Galgotia Publications.

References:

1. Seymour Lipschutz, Theory and Problems of Data Structures, Schaums Outline Series,2006, McGraw Hill

2. Yedidyah Langgsam, Moshe Augustein, Aaron M Tenenbaum- Data structures using C and C++ , Second Edition, Prentice Hall

CA3CRT06- Computer Networks

Unit 1:

Introduction to Networks, Data and signals-analog and digital, periodic analog signals, digital signals, bit rate, baud rate, bandwidth. Transmission impairments- attenuation, distortion and noise.

Data communication protocols and standards, Network models - OSI model-layers and their functions. TCP/IP protocol suite.

Unit 2:

Bandwidth utilization Multiplexing: FDM, TDM, spread spectrum. Transmission Media- guided media and unguided media. Switching: message, Circuit and packet switched networks, datagram networks, virtual- circuit networks.

Unit 3:

Data link layer: Error Detection and Correction, Framing, flow and error control, Protocols - Noiseless channels (Simplest, Stop and Wait) and Noisy channels (Stop and Wait and Piggy Backing).

Multiple Access Protocols. Random Access-ALOHA, CSMA. Wired LANs-IEEE standards, wireless LANs-Bluetooth, Cellular Telephony

Unit 4:

Network layer and Transport layer: Repeaters, Bridges, Gateways and routers. Logical addressing – IPV4 and IPV6 addressing, Internet protocol - IPV4 and IPV6. Connectionless and Connection Oriented Services: UDP and TCP. Congestion Control, Quality of Service.

Unit 5:

Application layer: HTTP, FTP, SMTP, DNS. Network security: Common Threats- Firewalls (advantages and disadvantages), Cryptography.

Book of study:

1. B. A. Forouzan - Data communication and Networking, Fourth edition-,TMH
2. Andrew S Tanenbaum - Computer Networks ,Fourth Edition, Prentice Hall of India.

CA3CRT07-SYSTEM ANALYSIS AND SOFTWARE ENGINEERING

Module 1:

Information systems concepts, Business information systems; Describing the business organization – organization chart , organization function list ; information system levels - operational, lower, middle, top management; the system development life cycle concepts; hardware and software end products. Life cycle activities- life cycle flow chart, task, management review, baseline specifications, role of system analyst.

Module 2:

Introduction to Software Engineering - Definition, Program Vs Software, and Software process, Software Characteristics, Brief introduction about product and process, Software process and product matrices. Software life cycle models - Definition, Waterfall model, Increment process models, Evolutionary process models, Selection of a life cycle model.

Module 3:

Software Requirement Analysis and Specification Requirements Engineering type of requirements, Feasibility Studies, Requirement Elicitation, Various steps for requirement analysis, Requirement documentation, Requirement validation, an example to illustrate the various stages in Requirement analysis. Project planning-Size estimation, cost estimation, the constructive cost model (COCOMO).

Module 4:

Software Design - Definition, Various types, Objectives and importance of Design phase, Modularity, Strategy of design, Function oriented design, IEEE recommended practice for software design descriptions. Steps to Analyze and Design Objected Oriented System. Software Reliability Definition, McCall software quality model, Capability Maturity Model.

Module 5:

Software Testing What is testing?, Test, Test case and Test Suit, Verification and Validation, Alpha, beta and acceptance testing, functional testing, techniques to design test cases, boundary value analysis, Equivalence class testing, decision table based testing, cause effect graphing technique, Structural testing path testing, Graph matrices, Data flow testing; Levels of testing Unit testing, integration testing, system testing, validation testing, a brief introduction about debugging and various testing tools.

Book of Study:

1. Marvin Gore & John Stubbe -Elements Of System Analysis, Fourth Edition, Galgotia Book Source.
2. K K Aggarwal, Yogesh Singh - Software Engineering,Third Edition, New Age International Publications.

References :

1. Roger S Pressman - Software Engineering: A Practitioner's Approach, Sixth Edition, McGraw-Hill Higher Education.
2. Ian Sommerville - Software Engineering , Seventh Edition, Pearson Education.
3. Pankaj Jalote - An Integrated approach to Software Engineering, Second Edition, Narosa Publishing Company.

CA3CRP03-Software Lab III (Core)

Software Lab: 6 hrs. per week

Credits:2

Syllabus

Module I

Array – Insertion , Deletion, Polynomial addition using arrays

Sort – Selection, Insertion, Quick

Search – Linear search, Binary search

Sparse matrix – Sparse form representation, transpose and addition using the sparse form

Module II

Stack - Implementation using arrays (linear stack), Infix to postfix conversion, Postfix evaluation

Queue – Implementation using arrays (linear queue), Implementation of circular queue

Module III

Singly linked list – Implementation using dynamic memory allocation techniques, arrange the list based on the ascending or descending order of the information field, concatenate two linked lists, interchange any two nodes in a list, Implementation of circular list, Implementation of linked stacks and queues.

Doubly linked list – Implementation of doubly linked list, Implementation of circular doubly linked list.

Module IV

Creation of binary search trees, Insertion and deletion of nodes, Tree traversals.

Scheme of Evaluation for software lab III external is as follows:

(There will be two questions)

Division of Marks (Practical - 3 hours External)

First program - questions from module 1 & II **- 25 marks**

1. Logic – 10 marks
2. Successful compilation – 8 marks
3. Result – 7 marks

Second program – questions from module III & IV **- 35 marks**

1. Logic – 20 marks
2. Successful compilation –10 marks
3. Result – 5 marks

Viva Voce **- 10 marks**

Lab Record **- 10 marks**

(Minimum of 25 Programs)

Total Marks **- 80 marks**

B.Sc. Compuer Application - SEMESTER IV

CA4CRT08-Linux Administration (Core)

Unit-I

Overview of Linux : What is Linux, Linux's root in Unix, Common Linux Features, advantage of Linux, Overview of Unix and Linux architectures, Linux files system, hardware requirements for Linux, Linux standard directories. Commands for files and directories cd, ls, cp, rm, mkdir, rmdir, pwd, file, more, less, Creating and viewing files using cat, file comparisons.

Unit II

Essential Linux commands: Processes in Linux, process fundamentals, connecting processes with pipes, redirecting input/output, Background processing, managing multiple processes, process scheduling – (at, batch), nohup command, kill, ps, who, find, sort, touch, file, file processing commands - wc, cut, paste etc Mathematical commands - expr, factor etc. Creating and editing files with vi editor.

Unit III

Shell programming - Basics of shell programming, various types of shell available in Linux,comparisons between various shells, shell programming in bash. Conditional and looping statements, case statement, parameter passing and arguments, Shell variables, system shell variables, shell keywords, Creating Shell programs for automating system tasks

Unit-IV

System administration - Common administrative tasks, identifying administrative files configuration and log files, Role of system administrator, Managing user accounts-adding & deleting users, changing permissions and ownerships, Creating and managing groups, modifying group attributes, Temporary disabling of users accounts, creating and mounting file system, checking and monitoring system performance - file security & Permissions, becoming super user using su. Getting system information with uname, host name, disk partitions & sizes, users, kernel, installing and removing packages with rpm command.

Unit-V:

Simple filter commands: pr, head, tail, cut, sort, uniq, tr - Filter using regular expression grep, egrep, sed Understanding various Servers **:**DHCP, DNS, Squid, Apache, Telnet, FTP,Samba.

Book of study :

1. Cristopher Negus - Red Hat Linux Bible, Wiley Dreamtech India 2005 edition.
2. Yeswant Kanethkar - UNIX Shell Programming, First edition, BPB.

References :

1. Official Red Hat Linux Users guide by Redhat, Wiley Dreamtech India
2. Graham Glass & King Ables - UNIX for programmers and users, Third Edition, Pearson Education.
5. Neil Mathew & Richard Stones - Beginning Linux Programming, Fourth edition, Wiley Dreamtech India.

CA4CRT09- Web Programming Using PHP

MODULE I

Introduction to web, WWW architecture, Fundamentals of HTML, text formatting tags, marquee, inserting images, links, lists, creating tables, frames, working with form elements.

MODULE II

CSS introduction, <link> and <style> elements, CSS properties, Controlling Fonts, Text formatting, Text- pseudo classes, Selectors, Links, Backgrounds, lists

Introduction to Java Script, Java Script variables, operators, decision control statements, looping, functions, arrays, events, popup boxes-alert, prompt, conform box, built-in objects, writing JavaScript, form validation

MODULE III

Introduction to PHP, server side scripting, role of web server software, php comments, variables, echo and print, PHP operators, datatypes, branching statements, loops, arrays

MODULE IV

PHP functions, PHP form, Passing information between pages, $_GET, $_POST, $_REQUEST. String functions, include and require, session and cookie management, error handling in PHP, Object Oriented Programming using PHP

MODULE V

Introduction to MySQL, datatypes, SQL commands-CREATE, UPDATE, INSERT, DELETE, SELECT, PHP functions for MySQL connectivity and operation- mysql_connect, mysql_select_db, mysql_query,

mysql_fetch_row, mysql_fetch_array, mysql_result, mysql_list_fields, mysql_num_fields, insertion, updation and deletion of data using PHP, displaying data from MySQL in webpage.

Book of Study:

1. Dave W Mercer, Allan Kent, Steven D Nowicki, David Mercer, Dan Squier, Wankyu Choi - "Beginning PHP", Wiley Publishing, Inc
2. Ivan Bayross - "HTML, DHTML, JavaScript, Pearl & CGI ", Fourth Revised Edition, BPB Publication.
3. "Programming PHP",Rasmus Lerdorf and Kevin Tatore, Shroff Publishers & Distributors Pvt. Ltd
4. "Beginning PHP", Dave W Mercer, Allan Kent, Steven D Nowicki, David Mercer, Dan Squier, Wankyu Choi, Wiley Publishing, Inc

CA4CRP04 - Software Lab IV (Core)

Software Lab: 6 hrs. per week

Credits:2

I. Linux (2 hrs. per week)

Sl.No	**Topic and Details**
1	Getting started –Commands
2	The Linux Architecture and command usage – Commands, General-purpose utilities
3	The File system –Commands
4	Process related commands
5	Handling ordinary files, Basic file attributes
6	The vi editor
7	Simple Filters, Filters using regular expressions-use of grep command
8	Introduction to shell concept and writing shell script
9	Introduction to shell concept and writing shell script, Essential Shell Programming
10	User management, monitoring system performance, disk usage etc.

II. Web Programming using PHP (4 hrs. per week)

1. Creating programs based on HTML

2.Creating Java script based programs

3.Creating simple programs based on PHP

4.Programs using PHP functions

5.Programs based on MY SQL

Scheme of Evaluation for software lab IV external is as follows:

(There will be two questions; the first from LINUX and second from PHP)

Division of Marks (Practical - 3 hours External)

First program - questions from LINUX **- 25 marks**

1. Logic – 10 marks
2. Successful compilation – 8 marks
3. Result – 7 marks

Second program – questions from PHP **- 35 marks**

1. Logic – 15 marks
2. Successful compilation –15 marks
3. Result – 5 marks

Viva Voce **- 10 marks**

Lab Record **- 10 marks**

(LINUX -Minimum of 10 Programs

PHP -Minimum of 15 Programs)

Total Marks **- 80 marks**

B.Sc. Computer Application - SEMESTER V

CA5CRT10 – Java Programming using Linux (Core)

Theory:3 hrs. per week

Credits:3

UNIT 1 (10 hrs.)

Concepts of Object oriented programming, Benefits of OOP, Features of java. Java environment, java tokens, Constant, variables, data types, operators, Control Statements-branching statements, looping statements, jump statements, labeled loops.

UNIT 2 (10 hrs.)

Defining a Class, Fields declaration, Method declaration, Creating object, Accessing class members, method overloading, Constructors, constructor overloading, super keyword, static Members, Inheritance, overriding methods, dynamic method dispatch, final(variables, methods and classes), abstract methods and classes, interfaces, visibility control.

UNIT 3 (12 hrs.)

Arrays- One dimensional arrays, declaration, creation, initialization of arrays, two dimensional arrays, String class. Packages: - java API packages overview (lang, util, io, awt, swing, applet), user defined packages-creating packages, using packages

Exception Handling Techniques-try-catch-throw-throws-finally -Multithreading- creation of multithreaded program-Thread class-Runnable interface, Thread life cycle.

UNIT 4 (10 hrs.)

Event Handling-Delegation Event Model-Event Classes-Sources of Events-Event Listeners- Event classes- Swing- architecture, components of swing- JLabel, JButton, JCheckBox, JRadioButton, JList, JComboBox, JTextField, JText Area, JPanel, JFrame, Layout Managers(Flow Layout, Grid Layout, Card Layout, Border Layout, Box Layout, Null Layout).

UNIT 5 (10 hrs.)

Applet Fundamentals -applet tag, applet life cycle, passing parameters to applets. Working with graphics -Line, Rectangle, Oval, Arc, color setting. JDBC architecture- JDBC connection, JDBC statement object, JDBC drivers.

Book of study :

1. E. Balagurusamy- Programming with Java , Third Edition, McGraw Hill Companies.

2. K. Somasundaram - PROGRAMMING IN JAVA2, First Edition, Jaico Publishing House.

Reference:

1. Patrick Naughton - Java2 The Complete Reference, Seventh Edition:
2. Cay S Horstmann & Gary Cornell - Core Java Volume 1- Fundamentals, Eighth edition.
3. Java 6 Programming Black Book 2007 Edition, Dreamtech press.

CA5CRP05 : Software Lab V (core)

Software Lab**: 5** hrs. per week

Credits: 2

Syllabus

Part I. Applet, JDBC connection and swing based Programs

Part II (using class and read inputs from keyboard)

Java Programs: Method Overloading- Method Overriding-inheritance-abstract class

interfaces- packages-Exception Handling-Multithreading

Scheme of Evaluation for software lab V external is as follows:

(There will be two questions; the first from Part I and second from Part II)

Division of Marks (Practical - 3 hours External)

First program - questions from Part I **- 25 marks**

1. Logic – 10 marks
2. Successful compilation – 8 marks
3. Result – 7 marks

Second program – questions from Part II **- 35 marks**

1. Logic – 20 marks
2. Successful compilation –10 marks
3. Result – 5 marks

Viva Voce **- 10 marks**

Lab Record **- 10 marks**

(Minimum of 25 Programs)

Total Marks **- 80 marks**

OPEN COURSES

CA5OPT01 -Informatics and Cyber Ethics

Theory:4 hrs. per week

Credits:4

Unit I (12 hrs.)

The Internet, TCP/IP, IP Addressing, Client Server Communication, Intranet, WWW, Web Browser and Web Server, Hyperlinks, URLs, Electronic mail.

Unit II (16 hrs.)

Internet as a knowledge repository, academic search techniques, creating cyber presence. Academic websites, open access initiatives, opens access publishing models, Introduction to use of IT in teaching and learning -Educational software, Academic services–INFLIBNET, NPTEL, NICNET, BRNET.

Unit III (16 hrs.)

Introduction to purchase of technology, License, Guarantee, Warranty, Basic concepts of IPR, copyrights and patents, plagiarism. IT & development, the free software movement

Unit IV (14 hrs.)

Cyber space, information overload, cyber ethics, cyber addictions, cybercrimes– categories –person, property, Government–types-stalking, harassment, threats, security & privacy issues.

Unit V(14 hrs.)

Cyber Addiction, Information Overload, Health Issues, e-Waste and Green computing impact of IT on language & culture-localization issues- Unicode- IT and regional languages e-Governance in India, IT for National Integration, Role of IT.

Book of Study:

1. Alan Evans, Kendall Martin, Mary Anne Poatsy - "Technology in Action", Pearson

References:

1. Dinesh Maidasani "Learning Computer Fundamentals, MS Office and Internet & Web Technology", Firewall Media, Lakshmi Publications.

2. V Rajaraman - "Introduction to Information Technology", Prentice- Hall of India.

3. Barkhs and U. Rama Mohan - HTML Black Book 3. "Cyber Law Crimes", Asia Law House, New Edition

4. Peter Nortons- Introduction to Computers, Sixth Edition, Published by Tata McGraw Hill

CA5OPT02 - Computer Fundamentals, Internet & MS Office (Open Course)

Theory:4 hrs. per week

Credits:4

Unit I (12 hrs.)

Computer Fundamentals: History, Generations, Classifications, Operating Systems, Types of Networks

Unit II (12 hrs.)

The Internet, TCP/IP, IP Addressing, Client Server Communication, Intranet, WWW, Web Browser and Web Server, Hyperlinks, URLs, Electronic Email

Unit III (14 hrs.)

Word processing: Introduction, Microsoft Word, Basic Menus, Formatting the text & paragraph, Working with Index

Unit IV (18 hrs.)

Spread Sheet: Introduction, Microsoft Excel, Basic Menus, Formulas, Basic functions, Charts and Graphs.

Unit V (16 hrs.)

Microsoft PowerPoint: Introduction, Basic Menus, Template, Slide Basics, Charts, Adding Multimedia & Animation.

Book of Study:

1. Dinesh Maidasani, Firewall Media - "Learning Computer Fundamentals, MS Office and Internet & WebTechnology", , Lakshmi Publications.

References:

1. Harley Hahn - "Internet Complete Reference", , Second Edition, Tata McGraw Hill Education

2. Gary B. Shelly, Misty E. Vermaat - "Microsoft Office 2010: Advanced" , CENGAGE Learning 2010

B.Sc. Computer Application - SEMESTER VI

CA6CRT11- Operating Systems

Unit 1:
Introduction: OS Definition, Functions, Evolution of OS,OS Structure Operating System Operations, Operating System Services, User Operating System Interface, System Calls, Types of System Calls.

Unit 2:
Process: Basic Concepts, Process Scheduling, Operations on Processes, Inter process communication, Process Scheduling - Scheduling Criteria, Scheduling Algorithms, Multiple Processor Scheduling.

Unit 3:
Process Coordination: Synchronization - The Critical Section problem, Semaphores, Classic Problems of Synchronization, Monitors. Deadlocks: System Model, Deadlock Characterization, Methods of handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

Unit 4:
Memory Management: Memory Management Strategies - Swapping, Contiguous memory allocation, Paging, Segmentation. Virtual Memory Management- Demand paging, Page Replacement.

Unit 5:
Storage Management: File System: - File Concept, Access Methods, Directory structure. Implementing File Systems:-File System Structure, Allocation Methods, Free Space Management, Disk Scheduling.

Book of study:

1. Abraham Silberschatz, Peter Galvin and Greg Gagne - Operating System Principles, Seventh Edition, John Wiley
2. William Stallings - Operating Systems, Sixth Edition, Prentice Hall of India, Pearson

Reference:

1. Milan Kovic - Operating Systems, 2ndEdition, (TMH)

PROGRAMME ELECTIVES

CA6PET01- DATA MINING (Core)

Theory:4 hrs. per week

Credits:4

Unit 1: (12 hrs.)

Introduction Data Mining, Data Ware House, Transactional Databases, Data Mining Functionalities Characterization and Discrimination, Mining frequent patterns, Association and correlation, Classification and Prediction, Cluster Analysis, Classification of Data Mining Systems, Data Mining Task Primitive, Integration of Data Mining systems, Major issues in Data Mining, Data integration and transformation, Data reduction, Data discretization.

Unit 2: (12 hrs.)

Data Warehouse and OLAP technology Data Warehouse, Multidimensional data Model, Data warehouse architecture, Data Warehouse implementation, OLAP, Data Warehouse and data mining

Unit 3: (18 hrs.)

Association Rules and Classification Concepts Efficient and Scalable Frequent item set Mining methods, Mining various kind of association rules, from association mining to Co-relation analysis, Classification and prediction, Issues, Classification by Decision tree induction, Bayesian Classification, Rule-based classification, Support Vector Machines, Learning from your neighbors, Prediction

Unit 4: (18 hrs.)

Cluster Analysis Definition, Types of data in cluster analysis, A categorization major Clustering methods- Partitioning methods, K-means and k-medoids, from k-medoids to CLARANS, Hierarchical methods, Density based methods

Unit 5: (12 hrs.)

Mining Complex Data Spatial Data Mining, Multimedia Data Mining, Text Mining and Mining WWW.

Book of study:

1. Jiawei Han and Micheline Kamber - Data Mining - Concepts and Techniques,Second Edition, Elsevier, 2006

Reference:

1. Witten and Frank - Data Mining Practical Machine Learning Tools and Techniques, Second Edition, Elsevier, 2005

2. Soman, Divakar and Ajay, Data Mining Theory and Practice, PHI, 2006

3. Margaret H Dunham- Data Mining –Introductory and Advanced Topics, Fourth Edition, Person 2006

CA6PET02 -Digital Image Processing

Theory:4 hrs. per week

Credits:4

Unit 1: (10 hrs.)

Digital Image Fundamentals

Image, Digital Image, Digital image processing-definitions, Examples of fields that use Digital Image Processing, Fundamental steps in Digital Image Processing, Components of Image processing system.

Unit 2 : (14 hrs.)

Elements of visual perception

Elements of visual perception- Image Formation, Brightness adaptation and Discrimination, Image sampling and quantization- basic concepts, spatial and Intensity resolution, Basic relationship among Pixels.

Unit 3: (16 hrs.)

Image Enhancement in Spatial and Frequency Domain

Intensity Transformation and spatial Filtering Basics, Intensity transformation functions- Image Negatives, Log Transformations, Power Law Transformations, Histogram Processing, Spatial filtering-correlation and convolution; Fourier transform and frequency domain.

Unit 4: (15 hrs.)

Morphological Image Processing

Introduction, basis of set theory, Dilation, Erosion, Structuring elements, Opening and Closing, Hit or miss transformation.

Unit 5: (17 hrs.)

Image Segmentation

Point, Line, Edge detection-detection of isolated points, Basic edge detection- Gradient operators; Pixel based approach-Basics of intensity thresholding, Basic global thresholding; Region based segmentation-region growing, region splitting and merging.

Book of Study:

1. Rafael C. Gonzalez, Richard E. Words- Digital Image Processing, Third Edition, Pearson.

References:

1.Anil K Jain- Fundamentals of Digital Image Processing , Pearson Education.
2.Er. Rishabh Anand, Digital Image Processing, MEDTEC Publications.

CA6PET03- Soft Computing Techniques

Theory:4 hrs. per week

Credits:4

Unit 1 (14 hrs.)

Soft Computing, Difference between soft computing and hard computing. **Neural Networks:** Basic concepts of Neural Networks, Human Brain, Artificial Neuron model, Activation functions,Neural network architecture,Single layer and multilayer feedforward networks, Recurrent networks, Neural network characteristics, Learning methods, Rosenblatt's perceptron,Perceptron and linearly separable tasks, XOR problem, Neural network applications.

Unit 2 : (14 hrs.)

Back Propagation Networks: Architecture- perceptron model, solution, single layer artificial neural network, multilayer perception model, back propagation learning- input layer computation, hidden layer computation, output layer computation, calculation of error, Training of neural network, effect of learning rate coefficient, Back propagation algorithm.

Unit 3: (15 hrs.)

Fuzzy Set Theory: Fuzzy versus crisp, Crisp sets, Operations on crisp sets, Properties of crisp sets, Partition and covering, Fuzzy sets, Membership functions, Basic fuzzy set operations, Properties of fuzzy sets, Crisp relations, Operations on crisp relations, Fuzzy relations, Fuzzy cartesian product, Operations on fuzzy relations.

Unit 4 : (15 hrs.)

Fuzzy Systems: Crisp logic, Laws of propositional logic, Inference in propositional logic, Predicate logic, Interpretations of predicate logic formula, Inference in predicate logic, Fuzzy logic, Fuzzy propositions, Fuzzy connectives, Fuzzy quantifiers, Fuzzy inference, Fuzzy rule based system, Defuzzification methods, Applications.

Unit 5: (14 hrs.)

Genetic Algorithm: History, Basic concepts, Biological background, Creation of offsprings, Encoding, Fitness function, Reproduction, **Genetic Modeling**:Crossover, Inversion and deletion,Mutation,Bit-wise operators used in geneticalgorithm, Generational cycle, Convergence of a genetic algorithm, Issues and benefits of GA, Application domains.

Book of study:

1. S. Rajasekaran and G.A VijayalakshmiPai- Neural Networks, Fuzzy Logic, and Genetic AlgorithmsSynthesis and Applications, Prentice-Hall of India Pvt.Ltd ,2004.

References:

1. S. N. Sivanandan and S. N. Deepa, Principles of Soft Computing, Wiley India 2nd Ed, 2011.
2. B K Tripathy, J. Anuradha, Soft computing Advances and Applications, Cengage Learning.
3. B Yegnanarayana, Prentice, Artificial Neural Network, Hall of India Pvt.Ltd ,2012.

CA6CRP08 : Software Development Lab (Main Project) (Core)

Software development lab: 7 hrs. per week

Credits: 3

Individual project.

The project topic shall be chosen from areas of current day interest using latest packages / languages running on appropriate platforms (Except the tools used in software development-I), so that the student can be trained to meet the requirements of the Industry. A project report should be submitted in hard bound complete in all aspects. For internal evaluation, the progress of the student shall be systematically assessed through various stages of evaluation at periodic intervals.

Scheme of Evaluation for Software Development Lab II external is as follows:

Division of Marks (Software Development Lab II)

Project demonstration and Presentation	**- 40 marks**
Viva related to project	**- 20 marks**
Project report with proper content and binding	**-20 marks**
Total Marks	**- 80marks**

CA6VVT01 –VIVA VOCE (Core)

Credit :1

Scheme of Evaluation of Viva voce (core) for External is as follows:

Each student should attend a course viva voce based on syllabus from semester I to semester IV.

Total Marks – 100 marks

SYLLABUS- B.Sc. IT

SEMESTER I

IT1CRT01-Computer Fundamentals and Basics of PC Hardware (Core)
Theory: 4 hrs. per week
Credits: 4
Unit I:

Introduction to Computers: Generations of Computer (I-V), Classification of Computers: Analog, Digital and Hybrid Computers, Micro, Mini, Mainframe, Super Computers, Servers, Laptop and Block Diagram of a Computer, Functions of the Different Units: Input unit, Output unit, Memory unit, CPU (ALU+CU). Booting Process- POST, BIOS, clock speed, memory speed, memory capacity.

Unit II:

Introduction to Computer Hardware, DC regulated power supply- Block Diagram, Concepts of Switch Mode Power supply, Inverters, UPS and their applications. Basic Components of CPU, Mother Board.

Unit III:

Expansion Slots- ISA, EISA, MCA, VESA, PCI local bus, Processor, Connectors, CMOS memory, SMPS, Serial and Parallel Ports, USB, BIOS chip, Steps for assembling a PC.

Unit IV:

Input Devices: Keyboard, Point and draw devices: mouse, joystick, track ball, light pen, Data Scanning devices: image scanner, OCR, OMR, MICR, Bar code reader, Voice Recognition Device: Microphone, Output Devices: Monitor- CRT displays, Non-CRT displays, TFT: LED, LCD, Plasma. Printer, Impact and non-impact, Character, line and Page Printers.

Unit V:

Memory: Primary Memory, RAM- SRAM, DRAM, ROM, PROM, EPROM, EEPROM, flash memory, Secondary memory: Hard Disk: Structure of a hard disk, how data is stored in a hard disk, concept of tracks, sectors, clusters, cylinders, CD-R, RW, DVD-RW, Blue-ray disk, HVD, PC memory Units: SIMM, DIMM, RIMM.

Book of study:

1.Pradeep Sinha and Priti Sinha - Computer Fundamentals, Fourth Edition- 2007, BPB Publications

2.B. RAM, “Computer Fundamentals: Architecture and Organization”, New age International (P) Limited.

.

Reference:

1. Balagurusamy - Fundamentals of Computer, First Edition- 2009, McGraw-Hill
2. Anita Goel - Computer Fundamentals, First Edition-2010, Pearson.
3. Peter Norton, "Introduction to Computers", McGraw Hill

IT1CRT02 : Digital Electronics
Theory: 4 hrs. per week
Credits: 3

Unit I: Number Systems, Operations and Codes (15 hrs.)
Decimal Numbers, Binary Numbers, Decimal to Binary Conversion, Binary Arithmetic, 1's and 2's complement of binary numbers, Signed numbers, Arithmetic operations with signed numbers, Hexadecimal numbers, Binary to hexadecimal conversion, Hexadecimal to binary conversion, hexadecimal to decimal conversion, Decimal to Hexadecimal conversion, Hexadecimal addition and subtraction, Octal numbers, Octal to decimal conversion, Decimal to Octal conversion, Octal to binary conversion, Binary to Octal conversion, Binary coded decimal, 8421 BCD code, BCD addition,
Digital codes- gray code, binary to gray code conversion, Alphanumeric codes, parity codes.

Unit II: Logic Gates, Logic Levels and Waveforms(12 hrs.)
Logic Levels and Digital waveforms, Logic Gates: AND, OR, NOT, XOR, XNOR, NAND (Definition, Symbols, Truth Tables and Operation). Universal Property of NAND and NOR gates. Logic gate operations with pulse waveforms.

Unit III: Boolean Algebra and Logic Simplifications. (15 hrs.)
Boolean operations and expressions, Laws and rules of Boolean algebra, De-morgans theorems, Boolean analysis of logic circuits, simplification using Boolean algebra, standard forms of Boolean expression, Boolean expressions and truth tables. The Karnaugh Map, Karnaugh SOP minimization, Karnaugh POS minimizationFour variable Karnaugh maps.

Unit IV: Combinational Logic and its functions. (15 hrs.)
Basic combinational Logic circuits, Implementing combinational logic, combinational logic using NAND and NOR gates, Basic overview of logic functions, Basic adders, parallel binary adders, comparators, decoders, encoders, code converters, multiplexers, demultiplexers, parity generators/ checkers.

Unit V: Sequential Circuits.(15 hrs.)
Latches, RS flip flop using NAND/ NOR gates, Clocked RS, D, JK and T flip flops, Edge triggered flip flops, Master slave flip flops, Asynchronous counter operation, Synchronous counter operations, Up/ Down Synchronous counter, Design of synchronous counters. Basic shift register functions. Serial in-Parallel out shift registers, Parallel in -Serial out shift registers, Serial in- Serial out shift registers,

Parallel in Parallel out shift registers.

Book of Study:

1. Floyd and Jain- Digital Fundamentals, Eighth Edition, Pearson Education

Reference:

1.A P Malvino and D P Leach - Digital Principles and Applications, Fourth edition, Tata McGraw Hill Publishers, co Ltd.

IT1CRT03-Methodology Of Programming And C Language (Core)

Theory:4 hrs. per week

Credits:3

UNIT 1 (12 hrs.)

Introduction to programming, Classification of computer languages, Language translators (Assembler, Compiler, Interpreter), Linker, Characteristics of a good programming language, Factors for selecting a language, Subprogram, Purpose of program planning, Algorithm, Flowchart, Pseudocode, Control structures (sequence, selection, Iteration), Testing and debugging

UNIT 2:(12 hrs.)

C Character Set, Delimiters, Types of Tokens, C Keywords, Identifiers, Constants, Variables, Rules for defining variables, Data types, C data types, Declaring and initialization of variables, Type modifiers, Type conversion, Operators and Expressions- Properties of operators, Priority of operators, Comma and conditional operator, Arithmetic operators, Relational operators, Assignment operators and expressions, Logical Operators, Bitwise operators

UNIT 3: (15 hrs.)

Input and Output in C – Formatted functions, unformatted functions, commonly used library functions, Decision Statements If, if-else, nested if-else, if-else-if ladder, break, continue, goto, switch, nested switch, switch case and nested if. Loop control- for loops, nested for loops, while loops, do while loop.

UNIT 4:(15 hrs.)

Array, initialization, array terminology, characteristics of an array, one dimensional array and operations, two dimensional arrays and operations. Strings and standard functions, Pointers, Features of Pointer,

Pointer and address, Pointer declaration, void wild constant pointers, Arithmetic operations with pointers, pointer and arrays, pointers and two dimensional arrays.

UNIT 5 :(18 hrs.)

Basics of a function, function definition, return statement, Types of functions, call by value and reference. Recursion -Types of recursion, Rules for recursive function, direct and indirect recursion, recursion vs iterations, Advantages and disadvantages of recursion. Storage class, Structure and union, Features of structures, Declaration and initialization of structures, array of structures, Pointer to structure, structure and functions, typedef , bitfields , enumerated data types, Union, Dynamic memory allocation, memory models, memory allocation functions.

Book Of Study:

1. Ashok Kamthane - Programming in C, Third Edition, Pearson Education
2. P K Sinha & Priti Sinha - Computer Fundamentals , Fourth Edition, BPB Publications.

Reference :

1. E. Balaguruswamy -Programming in ANSI C ,Seventh Edition , McGraw Hill Education
2. Byron Gotfried - Programming with C, Second Edition, Schaums Outline series. McGraw Hill

IT1CRP01-Software Lab I (Core)

Software Lab: 4 hrs. per week

Credits:2

Syllabus

1. Programs to familiarize printf() and scanf() functions.

2. Programs Based on Decision statements , break, goto, continue, switch and Loop controls statements.

3. Programs Based on One dimensional and two dimensional arrays.

4. Programs on Strings and string handling functions.

5. Programs based on Pointers, operations on pointers, Arrays & Pointers,

6. Programs based on functions, Call by value, Call by reference, Recursion,

7. Programs based on structure and union, array of structures, Pointer to structure, structure and functions

8. Simple programs using pointers and malloc().

Scheme of Evaluation for software lab I external is as follows:

Division of Marks (Practical - 3 hours External)

First program from part 1& 2 **- 25 marks**

1.Flowchart - 5 marks

2.Logic – 10 marks

3.Successful compilation – 5 marks

4.Result – 5 marks

Second program should be based on advanced concepts ,part 3 to part 8 **- 35 marks**

1.Logic – 20 marks

2.Successful compilation – 10 marks

3. Result – 5 marks)

Viva Voce **- 10 marks**

Lab Record (minimum of 25 Programs) **- 10 marks**

Total Marks **- 80 marks**

B.Sc. IT - SEMESTER II

IT2CRT04-Operating Systems (Core)

Theory:4 hrs. per week

Credits:4

Unit 1: (10 hrs.)

Introduction: OS Definition, Functions, Evolution of OS,OS Structure Operating System Operations, Operating System Services, User Operating System Interface, System Calls, Types of System Calls.

Unit 2: (14 hrs.)

Process: Basic Concepts, Process Scheduling, Operations on Processes, Inter process communication, Process Scheduling - Scheduling Criteria, Scheduling Algorithms, Multiple Processor Scheduling.

Unit 3: (18 hrs.)

Process Coordination: Synchronization - The Critical Section problem, Semaphores, Classic Problems of Synchronization, Monitors. Deadlocks: System Model, Deadlock Characterization, Methods of handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

Unit 4: (16 hrs.)

Memory Management: Memory Management Strategies - Swapping, Contiguous memory allocation, Paging, Segmentation. Virtual Memory Management- Demand paging, Page Replacement.

Unit 5: (14 hrs.)

Storage Management: File System: - File Concept, Access Methods, Directory structure. Implementing File Systems:-File System Structure, Allocation Methods, Free Space Management, Disk Scheduling.

Book of study:

1. Abraham Silberschatz, Peter Galvin and Greg Gagne - Operating System Principles, Seventh Edition, John Wiley
2. William Stallings - Operating Systems, Sixth Edition, Prentice Hall of India, Pearson

Reference:

1. Milan Kovic - Operating Systems, Second Edition, TMH.

IT2CRT05-Computer Organization and Architecture (Core)

Theory:4 hrs. per week

Credits:3

Unit 1: (12 hrs.)

Basic computer organization and design

Operational concepts, Instruction codes, Computer Registers, Computer Instructions, Memory locations and addresses, Instruction cycle, Timing and control, Bus organization.

Unit 2: (15 hrs.)

Central Processing Unit:

General Register Organization, Stack Organization, Addressing modes, Instruction Classification, Program control.

Unit 3: (16 hrs.)

Memory Organization

Memory Hierarchy, Main Memory, Organization of RAM, SRAM, DRAM, Read Only Memory-ROM-PROM,EROM,EEPROM, Auxiliary memory, Cache memory, Virtual Memory, Memory mapping Techniques.

Unit 4: (15 hrs.)

Parallel Computer Structures:

Introduction to parallel processing, Pipeline computers, Multi processing systems, Architectural classification scheme-SISD, SIMD, MISD, MIMD.

Unit 5: (14 hrs.)

Pipelining and Vector processing: Introduction to pipelining, Instruction and Arithmetic pipelines (design) Vector processing, Array Processors.

Book of study :

1.M.Morris Mano-Computer Systems Architecture, Third Edition, Pearson Education
2.Kai Hwang and F A Briggs-Computer Architecture and parallel processing, McGraw Hills,1990

Reference

1.Carl Hamacher -Computer Organization, Fifth Edition, Tata McGraw Hill.
2.John P Hayes -Computer Architecture & Organization–Mc Graw Hill
3.William Stallings-Computer Organization and Architecture , Seventh Edition, Pearson Education

IT2CRT06- Object Oriented Programming using C++ (Core)

Theory:3 hrs. per week

Credits:4

Unit 1: (10 hrs.)

Principles of Object Oriented Programming, Beginning with C++

Procedure Oriented Programming-Object Oriented Programming-Basic concepts of object-oriented programming- Benefits of OOP- Applications of OOP-A simple C++program-Structure of C++ program-C++ data types- Symbolic constants- Reference by variables-Operators in C++- Operator precedence-Control structures- Function in C++ - The main function, Function prototyping- Call by reference- Return by reference- Inline function- Default arguments- Function overloading.

Unit 2: (10 hrs.)

Classes and Objects : Specifying a class- Defining member functions- Nesting of member functions - Private member functions - Arrays within a class - Memory allocation for objects-Static data members - Static member functions -Arrays of objects - objects as function arguments -Friendly functions- Returning Objects.

Unit 3: (12 hrs.)

Constructers and Destructors, Overloading

Constructors- Default constructor-Parameterized constructor-Copy constructor- Multiple constructors-Constructors with default arguments- Dynamic constructor-Destructors- Operator overloading- Unary and Binary operator overloading- Overloading using friends- Rules for overloading- Type conversion.

Unit 4: (10 hrs.)

Inheritance: Inheritance - Defining derived classes-Visibility modes-Single, Multilevel, Multiple, Hierarchical and Hybrid inheritance- Virtual base classes- Abstract classes- Constructors in derived classes- Nesting of classes.

Unit 5: (12 hrs.)

Pointers, Virtual Functions and Polymorphism, Working with Files : Pointers- Pointers to objects- this pointer-Pointers to derived classes- Virtual functions- Pure virtual functions- File Stream classes, Opening and closing a file- File opening modes- File pointers and their manipulations- Sequential input and output operations.

Book of Study:

1. E. Balagurusamy - Object Oriented Programming with C++, Fifth edition, Tata McGraw Education Hill , 2011.

Reference:

1. Ashok N. Kamthane, Object oriented Programming with ANSI & Turbo C++, First Edition, Pearson India
2. Robert Lafore, Object Oriented Programming in Turbo C++, First Edition, Galgotia Publications.
3. D Ravichandran, Programming with C++, Second edition, Tata McGraw- Hill.

IT2CRP02-Software Lab II (Core)

Software Lab: 4 hrs. per week

Credits:2

I.Object Oriented Programming using C++ (3 hrs. per week)

1.Programs based on default arguments, function overloading.

2.Programs based on array of objects, friend functions, passing objects as arguments to function.
3.Programs based on operator overloading (binary, unary) using member functions and friend functions.
4.Programs based on constructors, different types of constructors.
5.Programs based on inheritance, different types of inheritance.

B.Sc. IT - SEMESTER III

IT3CRT07 : Software Engineering(Core)
Theory: 4 hrs. per week
Credits: 4

Module I: (12)
System Development Life Cycle- Introduction to system development life cycle (SDLC): Various phases- Study, Analysis, Design, tools, Development, Implementation and Maintenance. Introduction-Software Engineering - The Software process - Software Myths - Prescriptive Process Models-Agile Development- What is an Agile Process?-Agility Principles ,The Politics of Agile Development, Human Factors

Module II: (15)
Requirements Engineering-Software Engineering Knowledge-Core Principles- Principles that guide each Framework Activity- Requirements Engineering- Eliciting Requirements-Requirements Analysis-Scenario Based Modeling-UML Model That Supplement the Use Case-Data Modeling Concepts-Class Based Modeling

Module III: (18)
Software Design-The Design process- Design Concept-Design Model-Component Level Design-What is a Component? ,Designing Class Based Components, Designing Traditional Components.

Module IV: (15)
Testing- A Strategic Approach to Software Testing-Test strategies for Conventional Software-Test Strategies for Object Oriented Software-Validation Testing-System Testing

Module V: (12)
Quality Management-Software Configuration Management(SCM),SCM Process- Metrics in the Process and Project Domain-Software Measurement- Metrics for Software Quality.Project Scheduling- Basic Concepts-Project Scheduling-Defining a Task Set for the Software Projects-Defining a Task Network. Risk Management- Software Risks- Risk Identification- Risk Projection-Risk Refinement-Risk Mitigation Monitoring and Management.

Book of Study:
1. Elias M. Awad**,** Systems Analysis And Design, Second Edition, Galgotia Publications Pvt Ltd.
2. Richard Fairley, Software Engineering Concepts , 1997, Tata McGraw Hills.

Reference*:*

1. K K Aggarwal, Yogesh Singh, Software Engineering, Third Edition, New Age International Publications.
2. Eve Anderson, Philip greenspun & Andrew Grumet, Software Engineering for Internet Applications, 2006, MIT press.

3. Ian Sommerville, Software Engineering, Seventh Edition, Pearson Education
4. Software Engineering Project Management – 2nd Edition, Wiley India.
5. Software Quality Engineering – Jeff Tian, Student edition, 2006, Wiley India
6. Pankaj Jalote, An Integrated approach to Software Engineering, Second Edition,Narosa PublishingCompany, Pearson Education

IT3CRT08-Computer Graphics (Core)

Theory:4 hrs. per week

Credits:4

Unit 1 : (12 hrs.)

Introduction: A survey of Computer Graphics, overview of graphics systems-Video display devices- Refresh CRT, Raster-Scan and Random-Scan Displays ,Color CRT Monitors, DVST, Flat-Panel Displays , Raster Scan systems, Random scan systems, Input devices, Hard copy devices, Graphics software.

Unit 2: (14 hrs.)

Output primitives: Line drawing algorithms: DDA algorithm, Bresenham's line algorithm, Circle generating algorithm- Midpoint circle algorithm, Character generation.

Unit 3: (18 hrs.)

2D geometric Transformations: Basic transformations: Translation, Rotation, Scaling; Other transformations-Reflection and shear, Matrix representation and homogenous coordinates, Composite transformation, Interactive picture construction Techniques.

Two-dimensional viewing: viewing pipeline, window and viewport, window to viewport transformation. Clipping operations- Point clipping, Line clipping:- Cohen Sutherland line clipping, Polygon clipping:- Sutherland- Hodgeman polygon clipping, Text Clipping.

Unit 4: (14 hrs.)

Three-dimensional concepts: Three dimensional display methods, Three dimensional object representations- Polygon surfaces, Sweep representations, Constructive solid geometry methods, octrees and quadtrees.

Unit 5: (14 hrs.)

Computer Animation: Design of animation sequences, raster animations, computer animation languages, key-frame systems, morphing, motion specifications.

***Book of study* :**

1 .Donald D.Hearn & M. Pauline Baker, Computer Graphics C Version, Second Edition,, PHI Pvt. Ltd.

References:

1.Newman W M & R F Sproul, Principles of Interactive Computer Graphics, Second Edition Mc-Graw Hill Publishers.

2.Plastock R & Xiang Z, Theory and problems of computer Graphics, Second Edition Schaum Series, McGraw Hill Publishers.

IT3CRT09 Database Management Systems (Core)

Theory:4 hrs. per week

Credits:3

Unit 1: Introduction (12 hrs.)

Characteristics of the Database Approach – Database users :DBA , Database Designers ,End users – Advantages of using the DBMS Approach – Data models, Schemas , and Instances – Three-Schema Architecture and Data Independence.

DBMS Languages: DDL, DML – The Database System Environment: DBMS Component Modules.

Unit 2: Relational Model (16 hrs.)

Entity Relationship Modeling: Introduction –Entity Types , Entity Sets , Attributes and Keys – Relationship Types ,Relationship Sets, Roles , and Structural Constraints – Weak Entity Types – Notation for ER diagrams – Sample ER diagrams.

Relational Model concepts: Domains ,Attributes , Tuples , and Relations – Characteristics of Relations – Relational Model Constraints and Relational Database Schemas : Domain Constraints, Key Constraints , Relational Database Schemas , Entity Integrity , Referential Integrity, and Foreign Keys .

Unit 3: SQL(14 hrs.)

Data Types – Data Definition commands : CREATE , ALTER ,DROP - Adding constraints in SQL –

Basic SQL Queries : INSERT ,SELECT ,DELETE ,UPDATE - Substring comparison using LIKE operator ,BETWEEN operator – Ordering of rows – SQL set operations UNION , EXCEPT , INTERSECT – Complex Queries : Comparison involving NULL and Three-valued logic ,Nested queries , EXISTS and UNIQUE functions, Renaming of attributes and Joining of tables, Aggregate functions ,Grouping – Managing Views.

Unit 4: Normalization and Indexing Structures for Files(15 hrs.)

Normalization: Informal Design Guidelines for Relational Schemas –Functional Dependencies – Normal forms : First Normal Form , Second Normal Form , Third Normal Form – General Definitions of Second and Third Normal Forms –BCNF.

Indexing Structures for files: -Types of Single-Level Ordered Indexes: Primary Indexes, Clustering Indexes, and Secondary Indexes.

Unit 5: Transaction Processing and Database Security (15 hrs.)

Transaction Processing: Introduction to Transaction Processing - Transaction and System Concepts – Desirable properties of Transactions.

Database Security and Authorization: Types of Security – Control measures – Database Security and DBA – Access Control , User Accounts, and Database Audits –Access Control based on Granting and Revoking Privileges.

***Books of study*:**

1.Ramez Elmasri and Shamkant B.Bavathe - DATABASE SYSTEMS , Sixth Edition, Pearson Education.

***References**:*

1. C.J Date- An Introduction to Database Systems, Eighth edition, Pearson Education,2003

2. Reghu Ramakrishnan and Johannes Gehrke- Database Management Systems , Third edition, Mc Graw Hill International Edition.

3. Dipin Desai , An Introduction to Database Systems , First Edition, Galgoria Publications .

IT3CRT10- Data Structures using C++

Theory:4 hrs. per week

Credits:3

Unit 1 (12 hrs. **)**

Concept of Structured data - Data structure definition, Different types and classification of data structures, Arrays – Memory allocation and implementation of arrays in memory, array operations, Applications - sparse matrix representation and operations, polynomials representation and addition, Concept of search and sort – linear search, binary search, selection sort, insertion sort, quick sort.

Unit 2 (12 hrs.**)**

Stacks – Concepts, organization and operations on stacks using arrays (static), examples, Applications - Conversion of infix to postfix and infix to prefix, postfix evaluation, subprogram calls and execution, Multiple stacks representation.

Queues - Concepts, organization and operations on queues, examples.

Circular queue – limitations of linear queue, organization and operations on circular queue. Double ended queue, Priority queue.

Unit 3 (18 hrs.**)**

Linked list: Concept of dynamic data structures, linked list, types of linked list, linked list using pointers, insertion and deletion examples, circular linked list, doubly linked lists

Applications- linked stacks and queues, memory management basic concepts, garbage collection.

Unit 4 (15)

Trees - Concept of recursion, trees, tree terminology, binary trees, representation of binary trees, strictly binary trees, complete binary tree, extended binary trees, creation and operations on binary tree, binary search trees, Creation of binary search tree, tree traversing methods – examples, binary tree representation of expressions.

Unit 5 (15)

File - Definition, Operations on file (sequential), File organizations - sequential, Indexed sequential, random files, linked organization, inverted files, cellular partitioning, hashing – hash tables, hashing functions, collisions, collision resolving methods.

Books of study :

1. G.S Baluja - Data Structures Through C++ (A Practical Approach), Second Edition-2004, Danapat Rai & Co.
2. Ellis Horowitz and Sartaj Sahni - Fundamentals of Data Structures in C++ , Second Edition, Galgotia Publications.

References:

1. Seymour Lipschutz, Theory and Problems of Data Structures, Schaums Outline Series,2006, McGraw Hill
2. Yedidyah Langsam, Moshe Augustein, Aaron M Tenenbaum- Data structures using C and C++ Second Edition, Prentice Hall

IT3CRP03- Software Lab III

I. SQL Commands (2 hours)

1. Data definition commands - CREATE, ALTER, DROP, Adding Constraints Primary key, foreign key, unique key, check, not null.
2. Basic SQL queries INSERT, SELECT, DELETE, UPDATE, Using multiple tables, ordering of rows using ORDER BY option, Set operations using UNION, EXCEPT, INTERSECT, Substring Comparison using LIKE operator, BETWEEN operator.
3. Complex Queries Nested Queries, EXISTS and UNIQUE/DISTINCT functions, NULL values, Renaming of attributes and Joining of tables, Aggregate functions and grouping.
4. Managing views, Simple stored procedures.

II. Data Structures using C++. (3 hours per week)

1. Array sort Bubble sort, selection sort, insertion sort, Quick sort, merge sort, linear search, binary search, operations on - sparse matrix, polynomial addition etc.(with and without user defined functions)

2. Stack- push and pop operations, implementation, Application of stacks Conversion of infix expression to postfix, infix expression to prefix, postfix expression evaluation (with and without user defined functions)
3. Queue- insertion and deletion operations, implementation, Implementation of circular queue (with and without user defined functions)
4. Linked list- implementation, concatenation, interchange nodes etc., circular list and doubly linked list implementation, implementation of stacks and queue using linked lists. Polynomial addition using linked list etc.
5. Creation and traversal of binary tree and binary search trees etc.
6. File operations using sequential files.

Scheme of Evaluation for software lab III external is as follows:

Division of Marks (Practical - 3 hours External)

First program - questions from DBMS **- 20 marks**
(Logic – 10 marks, Successful compilation – 6 marks, Result – 4 marks)
Second program should be based on advanced concepts in Data Structure(2 to 5) **- 35 marks**
(Logic – 20 marks, Successful compilation – 10 marks, Result – 5 marks)
Viva Voce **- 15 marks**
Lab Record
(Minimum of 15 Programs from section I and 20 programs from section II) **- 10 marks**
Total Marks - 80 marks

B.Sc. IT- SEMESTER IV

IT4CRT12-Design and Analysis of Algorithms (Core)

Theory:4 hrs. per week

Credits:4

Unit 1: (12 hrs.)

Introduction, Definition of Algorithm, Algorithm design techniques, Algorithm Analysis, performance analysis - space complexity, time complexity, Best, Worst, And average case complexity.

Unit 2 (14 hrs.)

Divide and Conquer General method, Binary search, finding the maximum and minimum, merge sort, quick sort, performance measurement of quick sort, Selection, Strassen's matrix multiplication.

Unit 3 (18 hrs.)

Greedy Algorithm General Characteristics of greedy algorithms, Problem solving using Greedy Algorithm - Knapsack problem, Minimum Spanning trees (Kruskal's algorithm, Prim's algorithm).

Unit 4: (16 hrs.)

Dynamic programming The general method, multistage graphs, all-pairs shortest path, Single source shortest path, 0/1 Knapsack problem, Traveling Sales person problem.

Unit 5: (12 hrs)

Basic traversal and search techniques - BFS and traversal, DFS and traversal, Bi-connected components and DFS, Backtracking General method, 8-queens problem, Sum of subsets problem, Graph coloring, Hamiltonian cycles.

Book of study:

1. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekharan, Computer algorithms/C++,Second Edition, Universities Press.

References:

1. Anany Levitin- Introduction to design and analysis of algorithms, Third Edition, Addison Wesley Low price edition.
2. Richard Neapolitan & Kumarss Naimipour, Foundation of Algorithms using C++ Pseudocode, Third edition, Jones And Bartlett Publishers.

IT4CRT12-Linux Administration

Theory:4 hrs. per week

Credits:4

Unit-1 (12 hrs.)

Overview of Linux : What is Linux, Linux's root in Unix, Common Linux Features, advantage of Linux, Overview of Unix and Linux architectures, Linux files system, hardware requirements for Linux, Linux standard directories. Commands for files and directories cd, ls, cp, rm, mkdir, rmdir, pwd, file, more, less, Creating and viewing files using cat, file comparisons.

Unit 2 (15 hrs.)

Essential Linux commands: Processes in Linux, process fundamentals, connecting processes with pipes, redirecting input/output, Background processing, managing multiple processes, process scheduling – (at, batch), nohup command, kill, ps, who, find, sort, touch, file, file processing commands - wc, cut, paste etc Mathematical commands - expr, factor etc. Creating and editing files with vi editor.

Unit 3 (15 hrs.)

Shell programming - Basics of shell programming, various types of shell available in Linux, comparisons between various shells, shell programming in bash.Conditional and looping statements, case statement, parameter passing and arguments, Shell variables, system shell variables, shell keywords, Creating Shell programs for automating system tasks

Unit-4 (18 hrs.)

System administration - Common administrative tasks, identifying administrative files configuration and log files, Role of system administrator, Managing user accounts-adding & deleting users, changing permissions and ownerships, Creating and managing groups, modifying group attributes, Temporary disabling of users accounts, creating and mounting file system, checking and monitoring system performance - file security & Permissions, becoming super user using su. Getting system information with uname, host name, disk partitions & sizes, users, kernel, installing and removing packages with rpm command.

Unit-5: (12 hrs.)

Simple filter commands: pr, head, tail, cut, sort, uniq, tr - Filter using regular expression grep, egrep, sed **Understanding various Servers :**DHCP, DNS, Squid, Apache, Telnet, FTP,Samba.

Book of study :

1. Cristopher Negus - Red Hat Linux Bible, Wiley Dreamtech India 2005 edition.
2. Yeswant Kanethkar - UNIX Shell Programming, First edition, BPB.

References :

1. Official Red Hat Linux Users guide by Redhat, Wiley Dreamtech India
2. Graham Glass & King Ables - UNIX for programmers and users, Third Edition, Pearson Education.

3.Neil Mathew & Richard Stones - Beginning Linux Programming, Fourth edition, Wiley Dreamtech India.

IT4CRT13-Parallel Processing(core)

Theory: 4 hrs. per week
Credits: 4

Unit I:(12)
Introduction to parallel processing: Parallelism in uniprocessor systems, parallel computer structures, Architectural classification schemes (Flynn's, Feng's and handler's), parallel processing applications.

Unit II:(16)
Pipelining and vector processing: Linear pipelining, classification of pipeline processors, Instruction and arithmetic pipelines, principles of designing pipelined processors, characteristics of vector processing

Unit III: (14)
Structures and algorithms for Array processors: SIMD array processors, SIMD interconnection networks, parallel algorithms for array processors

Unit IV:(16)

Multiprocessor architecture and programming: functional structures of multiprocessor systems, interconnection networks, multiprocessor operating systems, interprocessor communication mechanisms

Unit V:(14)

Dataflow computers: Distinction between control flow and data flow computers, data flow graphs and languages, advantages and disadvantages of dataflow computers, dataflow computer architectures

Book of study:

1. Kai Hwang and F A Briggs - Computer Architecture and parallel processing, McGraw Hill Education

References:

1. Stone H S -Introduction to Computer Architecture-Stone H S,Galgotia publishers.
2. Peter M. Kogge - The Architecture of pipelined computers, First Edition, Mc Graw Hill

IT4CRT14 -WEB PROGRAMMING USING PHP

Theory:3 hrs. per week

Credits:3

Unit 1 (8 hrs.)

Introduction to web, WWW architecture, Fundamentals of HTML, text formatting tags, marquee, inserting images, links, lists, creating tables, frames, working with form elements.

Unit 2 (10 hrs.)

CSS introduction, <link> and <style> elements, CSS properties, Controlling Fonts, Text formatting, Text- pseudo classes, Selectors, Links, Backgrounds, lists

Introduction to Java Script, Java Script variables, operators, decision control statements, looping, functions, arrays, events, popup boxes-alert, prompt, conform box, built-in objects, writing JavaScript, form validation

Unit 3 (10 hrs.)

Introduction to PHP, server side scripting, role of web server software, php comments, variables, echo and print, PHP operators, data types, branching statements, loops, arrays

Unit 4 (12 hrs.)

PHP functions, PHP form, Passing information between pages, $_GET, $_POST, $_REQUEST. String functions, include and require, session and cookie management, error handling in PHP, Object Oriented Programming using PHP

Unit 5 (14 hrs.)

Introduction to MySQL, datatypes, SQL commands-CREATE, UPDATE, INSERT, DELETE, SELECT, PHP functions for MySQL connectivity and operation- mysql_connect, mysql_select_db, mysql_query, mysql_fetch_row, mysql_fetch_array, mysql_result, mysql_list_fields, mysql_num_fields, insertion, updation and deletion of data using PHP, displaying data from MySQL in webpage.

Book of Study:

1. Dave W Mercer, Allan Kent, Steven D Nowicki, David Mercer, Dan Squier, Wankyu Choi - "Beginning PHP", Wiley Publishing, Inc
2. Ivan Bayross - "HTML, DHTML, JavaScript, Pearl & CGI ", Fourth Revised Edition, BPB Publication.
3. "Programming PHP",Rasmus Lerdorf and Kevin Tatore, Shroff Publishers & Distributors Pvt. Ltd
4. "Beginning PHP", Dave W Mercer, Allan Kent, Steven D Nowicki, David Mercer, Dan Squier, Wankyu Choi, Wiley Publishing, Inc

IT4CRP04 - Software Lab IV (Core)

Software Lab: 6 hrs. per week

Credits:2

II. Linux (2 hrs. per week)

Sl.No	Topic and Details
1	Getting started –Commands

2	The Linux Architecture and command usage – Commands, General-purpose utilities
3	The File system –Commands
4	Process related commands
5	Handling ordinary files, Basic file attributes
6	The vi editor
7	Simple Filters, Filters using regular expressions-use of grep command
8	Introduction to shell concept and writing shell script
9	Introduction to shell concept and writing shell script, Essential Shell Programming
10	User management, monitoring system performance, disk usage etc.

II. Web Programming using PHP (2 hrs. per week)

1. Creating programs based on HTML

2.Creating Java script based programs

3.Creating simple programs based on PHP

4.Programs using PHP functions

5.Programs based on MY SQL

B.Sc. IT - SEMESTER V

IT5CRT15-Computer Networks (Core)

Theory:3 hrs. per week

Credits:4

Unit 1: (10 hrs.)

Introduction to Networks, Data and signals-analog and digital, periodic analog signals, digital signals, bit rate, baud rate, bandwidth. Transmission impairments- attenuation, distortion and noise.

Data communication protocols and standards, Network models - OSI model-layers and their functions. TCP/IP protocol suite.

Unit 2: (10 hrs.)

Bandwidth utilization Multiplexing: FDM, TDM, spread spectrum. Transmission Media- guided media and unguided media. Switching: message, Circuit and packet switched networks, datagram networks, virtual- circuit networks.

Unit 3: (12 hrs.)

Data link layer: Error Detection and Correction, Framing, flow and error control, Protocols - Noiseless channels (Simplest, Stop and Wait) and Noisy channels (Stop and Wait and Piggy Backing).

Multiple Access Protocols. Random Access-ALOHA, CSMA. Wired LANs-IEEE standards, wireless LANs-Bluetooth, Cellular Telephony

Unit 4: (12 hrs.)

Network layer and Transport layer: Repeaters, Bridges, Gateways and routers. Logical addressing – IPV4 and IPV6 addressing, Internet protocol - IPV4 and IPV6. Connectionless and Connection Oriented Services: UDP and TCP. Congestion Control, Quality of Service.

Unit 5: (10 hrs.)

Application layer: HTTP, FTP, SMTP, DNS. Network security: Common Threats- Firewalls (advantages and disadvantages), Cryptography.

Book of study:

1. B. A. Forouzan - Data communication and Networking, Fourth edition-,TMH
2. Andrew S Tanenbaum - Computer Networks ,Fourth Edition, Prentice Hall of India.

IT5CRT16 – Java Programming using Linux (Core)

Theory:3 hrs. per week

Credits:3

UNIT 1 (10 hrs.)

Concepts of Object oriented programming, Benefits of OOP, Features of java. Java environment, java tokens, Constant, variables, data types, operators, Control Statements-branching statements, looping statements, jump statements, labeled loops.

UNIT 2 (10 hrs.)

Defining a Class, Fields declaration, Method declaration, Creating object, Accessing class members, method overloading, Constructors, constructor overloading, super keyword, static Members, Inheritance, overriding methods, dynamic method dispatch, final(variables, methods and classes), abstract methods and classes, interfaces, visibility control.

UNIT 3 (12 hrs.)

Arrays- One dimensional arrays, declaration, creation, initialization of arrays, two dimensional arrays, String class. Packages: - java API packages overview (lang, util, io, awt, swing, applet), user defined packages-creating packages, using packages

Exception Handling Techniques-try-catch-throw-throws-finally -Multithreading- creation of multithreaded program-Thread class-Runnable interface, Thread life cycle.

UNIT 4 (10 hrs.)

Event Handling-Delegation Event Model-Event Classes-Sources of Events-Event Listeners- Event classes- Swing- architecture, components of swing- JLabel, JButton, JCheckBox, JRadioButton, JList, JComboBox, JTextField, JText Area, JPanel, JFrame, Layout Managers(Flow Layout, Grid Layout, Card Layout, Border Layout, Box Layout, Null Layout).

UNIT 5 (10 hrs.)

Applet Fundamentals -applet tag, applet life cycle, passing parameters to applets. Working with graphics -Line, Rectangle, Oval, Arc, color setting. JDBC architecture- JDBC connection, JDBC statement object, JDBC drivers.

Book of study :

1. E. Balagurusamy- Programming with Java , Third Edition, McGraw Hill Companies.

2. K. Somasundaram - PROGRAMMING IN JAVA2, First Edition, Jaico Publishing House.

Reference:

1. Patrick Naughton - Java2 The Complete Reference, Seventh Edition:
2. Cay S Horstmann & Gary Cornell - Core Java Volume 1- Fundamentals, Eighth edition.
3. Java 6 Programming Black Book 2007 Edition, Dreamtech press.

IT5CRT17 - IT & Environment (Core)

Theory:4 hrs. per week

Credits:4

Unit 1 : (18 hrs.)

Multidisciplinary nature of environmental studies : Definition, scope and importance, Need for public awareness. (**2 hrs**)

Natural Resources: Renewable and non-renewable resources: Natural resources and associated problems. a) **Forest resources**: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. b) **Water resources**: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. c) **Mineral resources**: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. d) **Food resources**: World food problems, changes caused by agriculture and

overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. e) **Energy resources**: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources, Case studies. f) **Land resources**: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. **Role of individual in conservation of natural resources. Equitable use of resources for sustainable life styles.**

(**10hrs**)

Ecosystems : Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids., Introduction, types, characteristic features, structure and function of the given ecosystem:- Forest ecosystem

(**6 hrs**)

Unit 2: (26 hrs)

Biodiversity and its conservation: Introduction, Biogeograhical classification of India, Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values., India as a mega-diversity nation, Hot-sports of biodiversity, Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India

(**8 hrs**)

Environmental Pollution : Definition, Causes, effects and control measures of: - Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards, Solid waste Management: Causes, effects and control measures of urban and industrial wastes., Role of an individual in prevention of pollution, Pollution case studies, Disaster management: floods, earthquake, cyclone and landslides. (**8 hrs**)

Social Issues and the Environment : Urban problems related to energy, Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation of people: its problems and concerns, Case studies, Environmental ethics: Issues and possible solutions, Climate change, global warming, acid rain, ozone layer depletion , nuclear accidents and holocaust, Case studies, Consumerism and waste products, Environment Protection Act , Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation, Public awareness

(**10hrs**)

Unit 3: (10 hrs.)

Internet as a knowledge repository, academic search techniques, creating cyber presence. Academic websites, open access initiatives, opens access publishing models, Introduction to use of IT in teaching and learning -Educational software, Academic services–INFLIBNET, NPTEL, NICNET, BRNET

(**10hrs**)

Unit 4: (10 hrs.)

IT & Society- issues and concerns- digital divide, IT & development, the free software movement , IT industry: new opportunities and new threats, software piracy, cyber ethics, cyber crime, cyber threats, cyber security, privacy issues, cyber laws, cyber addictions, information overload, health issues- guide lines for proper usage of computers, internet and mobile phones. e-wastes and green computing, impact of IT on language & culture-localization issues- Unicode- IT and regional languages, Green Computing Concept

(**10hrs**)

Unit 5: (8 hrs.)

Human Rights– An Introduction to Human Rights, Meaning, concept and development, Three Generations of Human Rights (Civil and Political Rights; Economic, Social and Cultural Rights).

Human Rights and United Nations – contributions, main human rights related organs - UNESCO,UNICEF, WHO, ILO, Declarations for women and children, Universal Declaration of Human Rights. **Human Rights in India** – Fundamental rights and Indian Constitution, Rights for children and women, Scheduled Castes, Scheduled Tribes, Other Backward Castes and Minorities

Environment and Human Rights - Right to Clean Environment and Public Safety: Issues of Industrial Pollution, Prevention, Rehabilitation and Safety Aspect of New Technologies such as Chemical and Nuclear Technologies, Issues of Waste Disposal, Protection of Environment **Conservation of natural resources and human rights**: Reports, Case studies and policy formulation. Conservation issues of western ghats- mention Gadgil committee report, Kasthurirengan report. Over exploitation of ground water resources, marine fisheries, sand mining etc.

(8 Hrs)

Internal: Field study

- Visit to a local area to document environmental grassland/ hill /mountain
- Visit a local polluted site – Urban/Rural/Industrial/Agricultural Study of common plants, insects, birds etc
- Study of simple ecosystem-pond, river, hill slopes, etc

(Field work Equal to 5 lecture hours)

References:

1. Technology in Action" Alan Evans, Kendall Martin, Mary Anne Poatsy, Pearson

2. Bharucha Erach, Text Book of Environmental Studies for undergraduate Courses. University Press, IInd Edition 2013 (TB)
3. Clark.R.S., Marine Pollution, Clanderson Press Oxford (Ref)
4. Cunningham, W.P.Cooper, T.H.Gorhani, E & Hepworth, M.T.2001 Environmental Encyclopedia, Jaico Publ. House. Mumbai. 1196p .(Ref)
5. Dc A.K.Enviornmental Chemistry, Wiley Eastern Ltd.(Ref)
6. Down to Earth, Centre for Science and Environment (Ref)
7. Heywood, V.H & Watson, R.T. 1995. Global Biodiversity Assessment, Cambridge University Press 1140pb (Ref)
8. Jadhav.H & Bhosale.V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284p (Ref)
9. Mekinney, M.L & Schock.R.M. 1996 Environmental Science Systems & Solutions. Web enhanced edition 639p (Ref)
10. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co. (TB)
11. Odum.E.P 1971. Fundamentals of Ecology. W.B. Saunders Co. USA 574p (Ref)
12. Rao.M.N & Datta.A.K. 1987 Waste Water treatment Oxford & IBII Publication Co.Pvt.Ltd.345p (Ref)
13. Rajagopalan. R, Environmental Studies from crisis and cure, Oxford University Press, Published: 2016 (TB)
14. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut (Ref)
15. Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science (Ref)
16. Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Stadards, Vol I and II, Enviro Media (Ref)
17. Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (Ref)
18. Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p (Ref)
19. M-Magazine, R-Reference TB- Text Book

IT5OPT01 -Informatics and Cyber Ethics (Open Course)

Theory:4 hrs. per week

Credits:4

Unit I (12 hrs.)

The Internet, TCP/IP, IP Addressing, Client Server Communication, Intranet, WWW, Web Browser and Web Server, Hyperlinks, URLs, Electronic mail.

Unit II (16 hrs.)

Internet as a knowledge repository, academic search techniques, creating cyber presence. Academic websites, open access initiatives, opens access publishing models, Introduction to use of IT in teaching and learning -Educational software, Academic services–INFLIBNET, NPTEL, NICNET, BRNET.

Unit III (16 hrs.)

Introduction to purchase of technology, License, Guarantee, Warranty, Basic concepts of IPR, copyrights and patents, plagiarism. IT & development, the free software movement

Unit IV (14 hrs.)

Cyber space, information overload, cyber ethics, cyber addictions, cybercrimes– categories –person, property, Government–types-stalking, harassment, threats, security & privacy issues.

Unit V(14 hrs.)

Cyber Addiction, Information Overload, Health Issues, e-Waste and Green computing impact of IT on language & culture-localization issues- Unicode- IT and regional languages e-Governance in India, IT for National Integration, Role of IT.

Book of Study:

1. Alan Evans, Kendall Martin, Mary Anne Poatsy - "Technology in Action", Pearson

References:

1. Dinesh Maidasani "Learning Computer Fundamentals, MS Office and Internet & Web Technology", Firewall Media, Lakshmi Publications.

2. V Rajaraman - "Introduction to Information Technology", Prentice- Hall of India.

3. Barkhs and U. Rama Mohan - HTML Black Book 3. “Cyber Law Crimes”, Asia Law House, New Edition

4. Peter Nortons- Introduction to Computers, Sixth Edition, Published by Tata McGraw Hill

IT5OPT02 - Computer Fundamentals, Internet & MS Office (Open Course)

Theory:4 hrs. per week

Credits:4

Unit I (12 hrs.)

Computer Fundamentals: History, Generations, Classifications, Operating Systems, Types of Networks

Unit II (12 hrs.)

The Internet, TCP/IP, IP Addressing, Client Server Communication, Intranet, WWW, Web Browser and Web Server, Hyperlinks, URLs, Electronic Email

Unit III (14 hrs.)

Word processing: Introduction, Microsoft Word, Basic Menus, Formatting the text & paragraph, Working with Index

Unit IV (18 hrs.)

Spread Sheet: Introduction, Microsoft Excel, Basic Menus, Formulas, Basic functions, Charts and Graphs.

Unit V (16 hrs.)

Microsoft PowerPoint: Introduction, Basic Menus, Template, Slide Basics, Charts, Adding Multimedia & Animation.

Book of Study:

1. Dinesh Maidasani, Firewall Media - “Learning Computer Fundamentals, MS Office and Internet & WebTechnology”, , Lakshmi Publications.

References:

1. Harley Hahn - “Internet Complete Reference”, , Second Edition, Tata McGraw Hill Education

2. Gary B. Shelly, Misty E. Vermaat - “Microsoft Office 2010: Advanced” , CENGAGE Learning 2010

IT5CRP05 : Software Lab V (core)

Software Lab**: 5** hrs. per week

Credits: 2

Syllabus

Part I. Applet, JDBC connection and swing based Programs

Part II (using class and read inputs from keyboard)

Java Programs: Method Overloading- Method Overriding-inheritance-abstract class interfaces- packages-Exception Handling-Multithreading

Scheme of Evaluation for software lab V external is as follows:

(There will be two questions; the first from Part I and second from Part II)

Division of Marks (Practical - 3 hours External)

First program - questions from Part I **- 25 marks**

1. Logic – 10 marks
2. Successful compilation – 8 marks
3. Result – 7 marks

Second program – questions from Part II **- 35 marks**

1. Logic – 20 marks
2. Successful compilation –10 marks
3. Result – 5 marks

Viva Voce	**- 10 marks**
Lab Record	**- 10 marks**
(Minimum of 25 Programs)	
Total Marks	**- 80 marks**

IT5CRP06 : Software Development Lab I (core)

Software Development Lab: 6 hrs. per week

Credits: 2

Mini project can be a small complete application project, to make the student confident in designing a system based on Software engineering course. The internal and external evaluation is to be done with the project demonstration and presentation, viva and modification. It must be done in the college lab under the guidance of a faculty.

Scheme of Evaluation for Software Development Lab I external is as follows:

Division of Marks (Software Development Lab I)

Project demonstration and Presentation	**- 25 marks**
Modification	**- 15 marks**
Viva Voce	**- 15 marks**
Project report with proper content and binding	**- 25 marks**
Total Marks	**- 80 marks**

B.Sc. IT - SEMESTER VI

IT6CRT18-**Mobile Application Development – Android** (Core)

Theory:4 hrs. per week

Credits:4

Unit 1 (10 hrs.)

Introduction to Android, Android Versions, Android Activity, Android Features and Architecture, Java JDK, Android SDK, Android Development Tools, Android Virtual Devices, Emulators, Dalvik Virtual Machine, Layouts – Linear, Absolute, Frame, Relative and Table.

Unit 2 (16 hrs.)

Android User Interface- Fundamental UI design , User interface with View- Text View, Buttons, Image Button, Edit Text, Check Box, Toggle Button, Radio Button and Radio Group, Progress Bar, Autocomplete Text View, Spinner, List View, Grid View, Image View, Scroll View, Custom Toast Alert and Time and Date Picker.

Unit 3 (14 hrs.)

Activity - Introduction, Intent, Intent_filter, Activity Life Cycle, Broadcast Life Cycle, Services,

multimedia-Android System Architecture, Play Audio and Video, Text to Speech.

Unit 4 (16 hrs.)

SQLite Database in Android- Introduction to SQLite Database, Creation and Connection of the

Database, Extracting values from Cursors, Transactions, Telephoning and Messaging-SMS Telephony, Sending SMS, Receiving SMS, Wi-Fi Activity.

Unit 5 (16 hrs.)

Introduction to JSON and XML, Use of JSON, Syntax and Rule of JSON, JSON Name, JSON Values, JSON Objects, JSON Arrays, Parsing JSON and XML.

Google Play services, Location services, Maps

Book of Study:

1. Prasanna Kumar Dixit - ANDROID, Vikas Publishing House.

2. Anubhav Pradhan, Anil Deshpande, Composing Mobile Apps using Android, Wiley India Pvt.Ltd,2014

References:

1. Kevin Grant and Chris Haseman, Beginning Android Programming – Develop and Design, Pearson.

IT6CRT19- System Software (core)
Theory: 4 hrs. per week
Credits: 4

Unit 1 (12)
Language processing concepts: Introduction, Language processing activities, Fundamentals of Language processing, Fundamentals of language specification. Programming Language Grammar, Classification of grammar, Regular Expression.

Unit 2 (12)
Assemblers: Elements of assembly language programming – two pass and one pass assembler- forward reference problem- cross assemblers.

Unit 3 (15)
Compilers Phases of compiler- Aspects of compilations- memory allocation – Compilation of expression, Compilation of control structures.

Unit 4 (15)
Scanning: finite state alternate, Building DFA's, Parsing, Parse trees, Abstract syntax trees, topdown parsing, predications and back tracking, top down parsing without backtracking, practical topdown parsing, bottom up parsing, operator precedence ,grammars, operator precedence parsing.

Unit 5 (18)
Macros: Macro definition- macro call- Macro expansion- nested macro calls – macro processors.
Linkers and Loaders, Relocation and linking concepts- Design of linker- Functions of loaders- Type of loaders.

Book of study:
1.D M Dhamdhere System programming and operating Systems B y, Tata McGraw Hill

References :
1. John J Donovan - System Programming , First edition, Tata McGraw Hill
2. A V Aho & J D Ullman - Principles of compiler Design, Second edition,Pearson education

B.Sc. IT - Elective Papers

IT6PET01- DATA MINING

Theory:4 hrs. per week

Credits:4

Unit 1: (12 hrs.)

Introduction Data Mining, Data Ware House, Transactional Databases, Data Mining Functionalities Characterization and Discrimination, Mining frequent patterns, Association and correlation, Classification and Prediction, Cluster Analysis, Classification of Data Mining Systems, Data Mining Task Primitive, Integration of Data Mining systems, Major issues in Data Mining, Data integration and transformation, Data reduction, Data discretization.

Unit 2: (12 hrs.)

Data Warehouse and OLAP technology Data Warehouse, Multidimensional data Model, Data warehouse architecture, Data Warehouse implementation, OLAP, Data Warehouse and data mining

Unit 3: (18 hrs.)

Association Rules and Classification Concepts Efficient and Scalable Frequent item set Mining methods, Mining various kind of association rules, from association mining to Co-relation analysis, Classification and prediction, Issues, Classification by Decision tree induction, Bayesian Classification, Rule-based classification, Support Vector Machines, Learning from your neighbors, Prediction

Unit 4: (18 hrs.)

Cluster Analysis Definition, Types of data in cluster analysis, A categorization major Clustering methods- Partitioning methods, K-means and k-medoids, from k-medoids to CLARANS, Hierarchical methods, Density based methods

Unit 5: (12 hrs.)

Mining Complex Data Spatial Data Mining, Multimedia Data Mining, Text Mining and Mining WWW.

Book of study:

1. Jiawei Han and Micheline Kamber - Data Mining - Concepts and Techniques,Second Edition, Elsevier, 2006

Reference:

1. Witten and Frank - Data Mining Practical Machine Learning Tools and Techniques, Second Edition, Elsevier, 2005

2. Soman, Divakar and Ajay, Data Mining Theory and Practice, PHI, 2006

3. Margaret H Dunham- Data Mining –Introductory and Advanced Topics, Fourth Edition, Person 2006

IT6PET02 -Digital Image Processing

Theory:4 hrs. per week

Credits:4

Unit 1: (10 hrs.)

Digital Image Fundamentals

Image, Digital Image, Digital image processing-definitions, Examples of fields that use Digital Image Processing, Fundamental steps in Digital Image Processing, Components of Image processing system.

Unit 2 : (14 hrs.)

Elements of visual perception

Elements of visual perception- Image Formation, Brightness adaptation and Discrimination, Image sampling and quantization- basic concepts, spatial and Intensity resolution, Basic relationship among Pixels.

Unit 3: (16 hrs.)

Image Enhancement in Spatial and Frequency Domain

Intensity Transformation and spatial Filtering Basics, Intensity transformation functions- Image Negatives, Log Transformations, Power Law Transformations, Histogram Processing, Spatial filtering-correlation and convolution; Fourier transform and frequency domain.

Unit 4: (15 hrs.)

Morphological Image Processing

Introduction, basis of set theory, Dilation, Erosion, Structuring elements, Opening and

Closing, Hit or miss transformation.

Unit 5: (17 hrs.)

Image Segmentation

Point, Line, Edge detection-detection of isolated points, Basic edge detection- Gradient operators; Pixel based approach-Basics of intensity thresholding, Basic global thresholding; Region based segmentation-region growing, region splitting and merging.

Book of Study:

1. Rafael C. Gonzalez, Richard E. Words, Digital Image Processing, Third Edition, Pearson

References:

1.Anil K Jain, Fundamentals of Digital Image Processing , Pearson Education.
2.Er. Rishabh Anand, Digital Image Processing, MEDTEC Publications.

IT6PET03- Soft Computing Techniques

Theory:4 hrs. per week

Credits:4

Unit 1 (14 hrs.)

Soft Computing, Difference between soft computing and hard computing. **Neural Networks:** Basic concepts of Neural Networks, Human Brain, Artificial Neuron model, Activation functions,Neural network architecture,Single layer and multilayer feedforward networks, Recurrent networks, Neural network characteristics, Learning methods, Rosenblatt's perceptron,Perceptron and linearly separable tasks, XOR problem, Neural network applications.

Unit 2 : (14 hrs.)

Back Propagation Networks: Architecture- perceptron model, solution, single layer artificial neural network, multilayer perception model, back propagation learning- input layer computation, hidden layer computation, output layer computation, calculation of error, Training of neural network, effect of learning rate coefficient, Back propagation algorithm.

Unit 3: (15 hrs.)

Fuzzy Set Theory: Fuzzy versus crisp, Crisp sets, Operations on crisp sets, Properties of crisp sets, Partition and covering, Fuzzy sets, Membership functions, Basic fuzzy set operations, Properties of fuzzy sets, Crisp relations, Operations on crisp relations, Fuzzy relations, Fuzzy cartesian product, Operations on fuzzy relations.

Unit 4 : (15 hrs.)

Fuzzy Systems: Crisp logic, Laws of propositional logic, Inference in propositional logic, Predicate logic, Interpretations of predicate logic formula, Inference in predicate logic, Fuzzy logic, Fuzzy propositions, Fuzzy connectives, Fuzzy quantifiers, Fuzzy inference, Fuzzy rule based system, Defuzzification methods, Applications.

Unit 5: (14 hrs.)

Genetic Algorithm: History, Basic concepts, Biological background, Creation of offsprings, Encoding, Fitness function, Reproduction, **Genetic Modeling**:Crossover, Inversion and deletion,Mutation,Bit-wise operators used in geneticalgorithm, Generational cycle, Convergence of a genetic algorithm, Issues and benefits of GA, Application domains.

Book of study:

1.S. Rajasekaran and G.A VijayalakshmiPai- Neural Networks, Fuzzy Logic, and Genetic AlgorithmsSynthesis and Applications, Prentice-Hall of India Pvt.Ltd ,2004.

References

1.S. N. Sivanandan and S. N. Deepa, Principles of Soft Computing, Wiley India 2nd Ed, 2011.
2.B K Tripathy, J. Anuradha, Soft computing Advances and Applications, Cengage Learning.
3.B Yegnanarayana, Prentice, Artificial Neural Network, Hall of India Pvt.Ltd ,2012.

COMPLEMENTARY/VOCATIONAL COURSES

I. B.Com COMPUTER APPLICATION VOCATIONAL MODEL II

Complementary Course 3: -Semester V

Programming in C

(Computer Application Stream)

Instructional hours- (54 theory and 36 practical) Credit -4

Unit 1:
Basic concepts of programming. Algorithm and flowchart. Importance of C, Basic structure of C programs, C character set, Identifiers and keywords, Constants, variables, Data types- primary, derived and user defined datatypes. Defining symbolic constants, Declaration of variables, Operators and expressions- Arithmetic, Relational, Logical, Assignment, Increment & decrement and conditional operators, Evaluation of expressions, operator precedence. Input and output operations- Formatted input and formatted output.
(10 Hours)

Unit 2: Decision making and Branching : Simple If statement, if else , nesting of if .. else statement, Else if ladder, switch statements. Looping- while, do while, for statements,nested loop, break, continue and go to statements.
(24 Hours)

Unit 3:
Arrays- one dimensional and two dimensional arrays, Character arrays and strings, declaring string variables, Reading strings from terminal and writing strings to screen String handling functions.
(24 Hours)

Unit 4:
User defined functions – Need for user defined functions, Elements of function, Definition of functions, function call, Function declaration, Category of functions, Recursion, Scope, visibility and lifetime of variables. library functions: - Math.h, String.h, Conio.h and Stdio.h.
(12 Hours)

Unit *5:*
Structures and Unions : Defining structure, Declaring structure variables, Accessing structure members, Unions- Definition, Difference between structure and Union, Pointer: Fundamentals - Understanding pointers, Declaration of pointer , Pointer expressions, **(20 Hours)**

Practical Session

1. Programs using branching statements
2. Programs using loops
3. Programs using one dimensional array and two dimensional array
4. Programs using User defined functions
5. Simple programs using pointers

Book of Study:

1.E Balaguruswamy Programming in ANSI C , Seventh Edition,Mc GrawHill Education

References:

1. Let Us C – Yashavant Kanetker – BpB Publications

2. Ashok Kamthane - Programming in C, Third Edition, Pearson Education

3.Byron Gotfried - Programming with C, Second Edition, Schaums Outline series. McGraw Hill

Complementary course 4: Semester VI

(For Computer Application Stream)

Data Base Management System

Instructional Hours 90 (Theory 54 and Practical 36) Credit 4

Module I

Database Concepts: Meaning – Character- Field-Record-File-Database- Types of Databases- Entities, Attributes, Keys – DBMS - Advantages of Database Systems – Entity Relationship Concepts -Data Independence - Components of DBMS.

(10Hours)

Module II

RDBMS & Relationships in Database : Data Models - Relational Data Model - RDBMS - Relationships - Types of Relationships - One to One - One to Many - Many to Many – Functional Dependency - Normalization : Meaning , Schemas (1NF, 2NF, 3NF)- Defining Relationships -Referential Integrity- Key: Candidate key , Primary key Foreign Key.

(14 Hours)

Module III

Basic Elements of Ms- Access 2013 : Introduction - Objects in Ms- Access - Create, Open, and Close a Database - Creating a Data Table - Different ways of Creating Tables - Data Types - The Primary Key - Properties of the Fields - Saving a Table - Closing a Table - Modifying Data Tables - Creating Table Relationships -Editing Relationships.

(24 Hours)

Module IV

Queries & Forms in Access: Types of Queries - Creating a Query - Saving Queries -Summary Queries - Cross Tab Queries - Action Queries - Forms - The Form Wizard - Editing the Data in a Form - The Form Design View - The Form Design Bar - The Toolbox - Working with Controls.

(24 Hours)

Module -V

Reports in Access: The Report Wizard - The Report Design View - The Report Design Bar - The Toolbox - The Preview Window - Grouping and Sorting - Printing a Report

(18 Hours)

Practical Training: Creating and Modifying Data base - Creating Relationship between Tables - Using Queries for Viewing and Modifying Data from Tables -Working with Forms - Managing Controls in Forms -Generating Reports.

Book of Study:

1. Ritchie, Collin, Data base Principles and Design, Third edition, Thomson Learning.
2. C.J. Date, A.Kannan & S.Swamynathan -An Introduction to Database Systems: Pearson Education.
3. Elmasri,Ramez and Navathe ,Shamkant B, Fundamentals of Database Systems, Sixth Edition, Addison-Wesley
4. Viescas, John L and Conrad Jeff , Microsoft Office Access 2013 Inside Out.
5. Connolly, Thomas and Begg, Carolynn , Learning SQL A step-by-step guide.
6. Michael Alexander, Richard Kusleika, Access 2013 Bible, Wiley Books.
7. Joan Lambert & Joyce Cox, Microsoft Access 2013 Step by step, Microsoft

Optional Courses- B.Com Computer Applications

SEMESTER III

Optional Core I-INFORMATION TECHNOLOGY FOR BUSINESS

Instructional Hours: 90 (54 theory and 36 practical) **Credit: 4**

Unit I

Introduction to Information Technology -Informatics - Information Technology -E-World -Information Systems–Hardware and Software: Input, Processing, Storage, Output and Communication Hardware– Software: System Software and Application Software – Operating System: WINDOWS, UNIX and LINUX – Versions. Free Software Movement – Futuristic IT – Artificial Intelligence – Virtual Reality.

(16 Hours)

Unit II

Social Informatics - IT and Society –IT Applications in Commerce, Business and Industry – IT Applications in Education, Teaching and Learning – Computer and Health Issues – Proper Usage of Computers and Internet – Cyber Ethics - Cyber Addiction –Cyber Crime -E-waste and Green Computing. **(12 Hours)**

Unit III

Network and Communications - Computer Networks – Types of Networks: WAN, MAN, LAN, PAN, CAN- Benefits of Networks, Network Topology –Work Group Computing & Groupware - Telecommuting & Virtual Offices - Network Security –Firewalls. Communication Medium: Wired and Wireless – Generations in Communication. **(15 Hours)**

Unit IV

HTML and Webpage - Introduction to HTML – Essentials- Static & Dynamic Web Pages - Structure of a Web Page - Designing Web Pages- HTML Tags -Text Formats- Working with Text- Presenting and Arranging Text-Paragraphs- Animated Effects: Marquee – using White Space - Tables in HTML- Working with Links, E-mail Links, Lists, Images, Thumbnails, Rollover Images, Audio & Video-Forms & Frames - Website Management. **(34 Hours)**

Unit V

Internet -Working Concepts -Devices, History, Benefits and Drawbacks - Internet Structure, Internet Protocols: TCP/IP, FTP, HTTP, etc., IP Address, Domain Name System (DNS), URL, Web Browsers, WWW Consortium, Search Engines – Types, Academic Search Techniques - Business Applications of Internet, Internet Access Methods - Intranet and Extranet. **(13 Hours)**

Practical Training:

1. Designing a web page for your Department
2. Designing a web page for a Retail Marketing Firm.
3. Design a web page for a Hotel

Suggested Readings

1. Alexis Leon & Mathews Leon, Fundamentals of Information Technology, *Vikas Publishing House, New Delhi.*
2. Williams &Sawyer, Using Information Technology (6th Edition*), Tata McGraw Hill Company.*
3. Avi Silberschatz Peter Galvin & Greg Gagne, Operating System Concepts (Windows XP update) .Wille*y India.*
4. *Uyless Black,*Computer Networks, Protocols, Standards and Interface*, Prentice Hall India Pvt. Ltd.*
5. Nagpal, D.P., Web Design Technology Theory and Techniques on the Cutting Edge, *S.Chand& Company Ltd*

SEMESTER IV

Optional Core II:INFORMATION TECHNOLOGY FOR OFFICE

Instructional Hours: 90 (54 theory and 36 practical)

Credit: 4

Module-I

Word Processing Package: MS-Word 2013- Introduction-Features- Word User Interface Elements-Creating New Documents- Basic Editing- Saving a Document- Printing a Document- Print Preview-Page Orientation- Viewing Documents- Setting Tabs-Page Margins- Indents- Ruler- Formatting Techniques-Font Formatting- Paragraph Formatting- Page Setup- Headers &Footers-Bullets and Numbered List-Borders and Shading- Find and Replace-Page Break Page Numbers-Mail Merging-Spelling and Grammar Checking- Thesaurus- Macros- Tables- Side-By-Side and Nested Tables- Formatting Tables- Drawing-Word art- Paint Brush Document Templates – Email Editor. **(18 Hours)**

Module-II

Desktop Publishing- PageMaker 7.0 - Introduction to Desktop Publishing as a Process- PageMaker Tools and Palettes- Working With Objects -Type Styling Options - Working With Text - Formatting Options-Leading, Margins and Indents - Scaling Text-Paragraph Formatting Options -Working With Grids - Creating Frames - Layers**.** **(18 Hours)**

Module-III

Spreadsheet Package: MS -Excel 2013-Introduction-Excel User Interface- Working With Cell and Cell Addresses- Selecting a Range, Moving, Cutting, Copying With Paste-Inserting and Deleting Cells-Freezing Cells- Adding, Deleting and Copying Worksheet Within a Workbook- Renaming a Worksheet-Cell Formatting Options- Formatting Fonts- Aligning-Wrapping and Rotating Text- Using Borders-Boxes and Colors- Centering a Heading, Changing Row/Column Height / Width-Formatting a Worksheet Automatically- Insert Comments- Clear Contents in a Cell- Using Print Preview- Preparing Worksheet for the Printer- Selecting Print Area-Margin and Orientation- Centering a Worksheet- Using Header and Footer- Inserting Page Breaks- Sorting Data. **(22 Hours)**

Module-IV

Advanced Features of Excel: All Functions in Excel- Using Logical Functions-Statistical Functions-Mathematical Functions - Linking Data between Worksheet- Elements of Excel Charts-Categories- Create a Chart- Choosing Chart Type- Edit Chart Axis - Titles, Labels, Data Series and Legend- Adding a Text Box- Rotate Text in a Chart- Converting a Chart on a Web Page- Saving a Chart- Designing of Templates in Excel. **(20 Hours)**

Module-V

Presentation Package: Ms-Power Point 2013-Advantages of Presentation- Screen Layout- Creating Presentation- Inserting Slides-Adding Sounds and Videos-Formatting Slides -Slide Layout Views in

Presentation - Colour Scheme- Background Action Buttons- Slide Transition- Custom Animation- Creating Master Slides- Managing Slide Shows - Using Pen Setting Slide Intervals.

(12 Hours)

Practical Training:

1. Create a small poster using PageMaker
2. Create a Brochure using PageMaker
3. Prepare Pay rolls in Excel
4. Conditional Cell Formatting
5. Analysis and presentation of data using charts in Excel
6. Usage of Functions in Excel
7. Mail merging feature of Word.

Book of Study:

1. Gini, Courter & Annette Marquis, Ms-Office *2013, BPB Publications*
2. Patrick Blattner, Louie Utrich. Ken Cook & Timothy Dyck, *Special Edition Ms Excel 2013, Prentice Hall India Pvt. Ltd.*
3. Atman Rebecca & Atman Rich, Mastering PageMaker, *BPB Publications*
4. *Building a Foundation with Microsoft Office 2013*
5. *Welcome to Microsoft Office*

SEMESTER V

Optional Core III: COMPUTERIZED ACCOUNTING

Instructional Hours: 90 (54 theory and 36 practical)

Credit :4

Module I

Introduction to Computerized Accounting- Computerized Accounting Vs. Manual Accounting- Merits of Computerized Accounting –Tally ERP 9-Features of Tally ERP 9– Screen Components-Creation of Company- Selecting a Company – Altering/ Modifying Company Creation Details – Deleting a Company – F 11 Features – F 12 Configuration.

(6 Hours)

Module II

Accounts and Vouchers– Account Groups – Pre-Defined Groups – Creating Single& Multiple Groups – Creation of Primary Account Groups – Creating Ledger Accounts in Single & Multiple – Displaying-Altering and Deleting Account Groups and Ledgers –Accounting Vouchers- Entering Transactions in Accounting Vouchers – Bill Wise Details -Altering and Deleting a Voucher Entry – Creating New Voucher Types – Modifying an Existing Voucher – Duplicating a Voucher – Optional Vouchers – Post-Dated Vouchers – Reverse Journal – Bank Reconciliation Statement - Creating Budget - Generating Reports - Configuring Reports Balance Sheet – Profit and Loss Account – Trial Balance – Day Books – Account Books –Statement of Accounts – Ratio Analysis - Cash Flow - Fund Flow – List of Accounts – Exception Reports. (**20 Hours)**

Module III

Accounts With Inventory– Enabling F 11 and F 12 - Stock Category – Stock Group Single/Multiple Creation of Stock Category and Stock Group – Creation of Units of Measurement – Creating Single/Multiple Stock Items – Creating Godowns - Displaying, Altering and Deleting Stock Groups, Units, Items and Godowns – Cost Categories- Cost Centres – Creating Cost Categories and Cost Centres - Displaying, Altering and Deleting Cost Categories and Cost Centres – Purchase / Sales Orders - Inventory Vouchers - Using Inventory Vouchers – Using Accounting Vouchers With Inventory Details (Invoice Mode) - Tally Security - Tally Vault –Tally Audit – Advanced Security Control – Back-Up and Restore – Inventory Reports – Stock Summary - Inventory Books – Statement Of Inventory.

(22 Hours)

Module IV

Accounting With Tax– F 11 &F 12 Settings For Taxation – TDS – Ledgers Related to TDS – Creating TDS Voucher Types - TDS Reports – TCS – Service Tax - VAT –VAT Terminologies – Computing VAT – Ledgers and Vouchers Pertaining to VAT – VAT Reports – VAT Forms – Interstate Trade and CST.

(20 Hours)

Module V

Payroll: Enabling Payroll – Creating Pay Heads – Single/Multiple Creation of Employee Groups - Single/Multiple Creation of Employee Head – Salary Details – Configuration of Salary Details - Creating Units of Work – Managing and Creating Attendance / Production Types – F 12 Payroll Configuration – Payroll Vouchers – Creating Payroll Voucher Types -Displaying, Altering and Deleting Payroll Documents – Payroll Reports (Full) – Configuring All Payroll Reports – Statutory Deductions – PF – Employers Contribution to PF – PF Ledger Heads– PF Related Heads in Pay Structure –Gratuity Calculation, Creation and Accounting - Generating a Sample Pay Slip – Employee Loan & Salary Advance Management. **(22 Hours)**

Practical Training

- Prepare final accounts of a Company in Tally ERP 9 with Inventory
- Prepare final accounts of a company in Tally ERP 9 incorporating VAT and TDS
- Preparation of payroll

Book of Study:

1. Roopa, Tally for Every one - *ATC Publishing Chennai*.
2. Nadhani, A.K. Implementing Tally ERP 9
3. A Comprehensive Guide to Tally ERP 9, Tally Manual

SEMESTER VI

Optional Core IV: SOFTWARE FOR BUSINESS AND RESEARCH

Instructional Hours 90 (54 theory and 36 practical)

Credit 4

Module I

Data Analysis: Data – Meaning and Definition – Sources of Data – Data Life Cycle – Processing – Methods and Types- EDP – Information – Value of Information in Decision Making - Information and Analysis of Business Research – Data Processing Software.(**6 Hours)**

Module II

Introduction to SPSS: Menus, tool bar – SPSS layout- Variable View – Data View – Output View – Terminology - Basic Steps for Performing any Statistical Procedure – Creating a Data file- Defining Variables- Variable Characteristics- Default Values - Entering the Data – Inserting Variable and Cases – Selecting Cases - Listing Cases – Identifying Duplicate Cases and Unusual Cases- Sorting Cases.

(24 Hours)

Module – III

Data Transformation: Computing New Variables – Recoding Variables – Automatic Recode – Visual Binning – Rank cases – Types of Measurement Scales – Summary Measures - Frequency, Explore and Cross Tabs – Describing Data Graphically - Descriptive Data Analysis- Number of cases, Minimum, Maximum, Sum, Mean, Standard Deviation, Variance, Kurtosis, Skewness - Bivariate Correlation.

(20 Hours)

Module – IV

Libre Office Writer: Free Software – Libre Office - Writer – User Interface – Creating new Document – Page setup - Saving Documents – Basic Editing – Find and Replace - Formatting Text – Copying and Moving Text – Indenting and Spacing – Headers and Footers – Bulleted and Numbered lists – Tables - Previewing and Printing.

(20 Hours)

Module – V

Libre Office Calc: Spread Sheet – Features – User Interface – Cells – Selecting – Moving and Copying – Text Alignment – Formatting Text – Inserting and Deleting Columns and Rows – Adding and Renaming Worksheets – Borders, Boxes and Colors – Formatting Worksheet – Entering Formulae – Functions – Charts – Previewing and Printing.

(20 Hours)

Practical Training

- List out frequency table, cross tab and graphs related with the marks and details of students in a class.
- Prepare a report on descriptive analysis of any relevant Socio demographic details related with social issue.
- Prepare a letter using Writer
- Prepare a mark sheet using Calc

Suggested Readings

1. Tutorial of IBM SPSS Statistics.
2. Kiran Panya, Smruti Bulsari & Sanjay Sinha., *SPSS in Simple Steps,* First edition, Durga Enterprises, Delhi.
3. Field A., *Discovering Statistics Using SPSS,* Fourth Edition, SAGE Publishers, 2013
4. Libre Office Handbook
5. Keith Gordon, Principles of Data Management, BCS Publications, UK

II. BSc Mathematics Model II Computer Application

SEMESTER – I

CA1VOT01 :: Computer Fundamentals

Theory: 4 hrs. per week Credits: 4

Total Marks - 80 marks

Module I (15hours)

Fundamentals of Computers:

Definition of computer and Characteristics, Generations of computers, Types of Computer- Desktop, Laptop, Mainframe, Super Computer, work stations.

Module II (15hours)

Number systems:

Binary, Octal and Hexadecimal, Converting from one number system to another,decimal to a new base, converting to decimal from another bases, converting from base other than ten to base other than ten, short cut method for converting from binary to octal, octal to binary, binary to hexadecimal and hexadecimal to binary, Computer Codes (BCD, EBCDIC, ASCII)

Module III (15hours)

Hardware Components:

Logical Organization of a Digital Computer, Bit/Byte/Word, input unit ,Output unit ,Storage unit ,Arithmetic logic unit,Control unit ,CPU. Input devices – keyboard,point and draw devices, data scanning devices ,output devices-monitors ,printers,plotters.

Module IV (15hours)

Software Components:

Definition of software ,Types of software-system software -Application software,Logical system architecture,Software development steps. Machine language ,Assemblylanguage,Highlevellanguage.DefineProgram,purpose of program,algorithms,flowcharts,flowchartsymbols,flowchartingrules,advantagesang limitations of flowcharts.

Module V (12hours)

Introduction to Computer Networks:

Uses – Physical Communication Media – Network Types – Network Topologies – Communication Protocols. Basic internet services- email, FTP,TELNET ,WWW

Book of Study :

1. P.K Sinha and Priti Sinha , Computer Fundamentals, Sixth Edition, BPB Publications.

Reference

1.Rohit Khorana, Introduction to Computer Science, 2nd Edition, Pearson Publishers.

2. V. Rajaraman and T. Radhakrishnan , An introduction to Digital Computer design, Fifth Edition, Prentice Hall India Learning Private Limited.

3. B. Ram , Computer fundamentals: Architecture and Organization, Fifth Edition, New Age International.

4. Sanjay Saxena , A First Course in Computers, Second Edition, VIKAS Publishers.

CA01VOP01 : Software Lab –I- Introduction to WEB Technologies

Practical: 4 hrs. per week Credits: 3

Total Marks - 80 marks

Getting Started With HTML:-

1. Basics of HTML- Document Body Text, Hyperlink, Adding more formatting, LISTS, Tables,, Frames, forms- MARQUEE. Cascading style sheets, Attributes specified to

   the style tag, CLASS, <SPAN> tag, <DIV> tag, LAYERS.

   Create HTML document with following formatting – Bold, Italics, Underline, Colors, Headings, Title, Font and Font Width, Background, Paragraph, Line Brakes, Horizontal Line, Blinking Text as well as marquee Text.
2. Create HTML document with Ordered and Unordered lists, Inserting Images, Internal and External linking
3. Create HTML document with Table: Some image here
4. Create Form with Input Type, Select and Text Area in HTML.
5. Create an HTML containing Roll No., student's name and Grades in a tabular form.
6. Create an HTML document (having two frames) which will appear as follows:
   About
   Department 1
   Department 2
   Department 3
   This frame would show the
   contents according to the link
   clicked by the user on the left
   frame.
7. Create an HTML document containing horizontal frames as follows:
   Department Names (could be along with Logos)
   Contents according to the Link clicked
8. Create a website of 6 – 7 pages with different effects as mentioned in above problems.
9. Create HTML documents (having multiple frames) in the following three formats:
   Frame1
   Frame2
   Frame1
   Frame2 Frame3
10. Create a form using HTML which has the following types of controls:
    I. Text Box
    II. Option/radio buttons
    III. Check boxes
    IV. Reset and Submit buttons

How PHP scripts work:-

The building blocks of PHP: variables, data types, arrays-basic array, associative array

, multidimensional array; array functions, program control, type casting, regular

expression. User-defined functions, built-in functions, Using files. Forms in PHP:

Creating a simple input form, combining HTML & PHP code on a single page.

References:

1. Luke welling & Laura Thomson,"PHP and MySQL web Development", fourth edition,

Pearson.

2. Chris Bates, Web Programming, 3 rd Edition; Pub: John Wiley & Sons

3. HTML Black Book, Steven Holzner, Dreamtech Publishers

4. PHP and MySQL for Dynamic Web Sites, Fourth Edition: Visual QuickPro Guide Kindle Edition by Larry Ullman.

5. PHP & MySQL in easy steps, Kindle Edition by Mike McGrath.

Minimum 25 Experiments using HTML and PHP .

Scheme of Evaluation for Software Lab Iexternal is as follows:

Division of Marks (Practical - 3 hours External)

First program based on HTML	**- 30 marks**
Second program based on PHP	**-30 marks**
Viva Voce	**- 05 marks**
Lab Record (minimum of 12 Programs from each section)	**- 15 marks**
Total Marks	**- 80 marks**

BSc Mathematics Model II Computer Application- SEMESTER – II

CA2VOT02 : Object Oriented Programming with C++

Theory: 4 hrs. per week Credits: 4

Total Marks - 80 marks

Module I (10 hours)

The object oriented technology, Key concept of object oriented programming, Advantages of OOP, structure of C++ program, Tokens, variables, data types, operators in C++, memory management operators, comments ,simple C++ programme, header files and libraries, unformatted console I/O operations, setw() manipulator.

Module II (18 hours)

Decision statements, control loop structure, arrays

Functions : introduction, parts of a function, passing arguments, return by reference, returning more values, default arguments, const arguments, inline functions, function overloading, recursion

Module III (18 hours)

Classes and Objects

Constructers and Destructors , Constructors- parameterized constructors-multiple constructors-constructors with default argument- copy constructor-dynamic constructorDestructors- calling Constructers and Destructors, Constructers and Destructors with static members.

Module IV (14 hours)

Operator overloading:

introduction, the keyword operator, overloading unary operator, operator return type, overloading binary operator, overloading with friend function, overloading assignment operator

Module V (12 hours)

Inheritance, Pointers-Virtual Functions a and Polymorphism

Files and Exception handling

Book of Study:

1. E. Balagurusamy, Object Oriented Programming with C++ , Sixth Edition, McGraw Hill Education.

Reference :

1. D Ravichandran, Programming with C++, Second edition, Tata McGraw- Hill.

2. Mahesh Bhave and Sunil Pateker , Object Oriented Programming with C++, Second edition, Pearson

3. Ashok N Kamthane and Amit Ashok Kamthane, Programming in C++, Second Edition, Pearson.

CA2VOP02 :Software Lab-II using C++

Practical : 4 hrs. per week Credits: 3

Total Marks - 80 marks

1. Programs based on class, objects and manipulation of objects using member functions

2. Programs based on friend functions, passing objects as arguments to function.

3. Programs based on array of objects.

4. Programs based on function overloading, Default arguments.

5. Programs based on operator overloading (binary, unary) using member functions and friend functions.

6. Programs based on constructors, different types of constructors.

7. Programs based on Inheritance, different types of inheritance.

Scheme of Evaluation for Software Lab IIexternal is as follows:

Division of Marks (Practical - 3 hours External)

First program based	1 to 5	**- 30 marks**
Second program based	6 & 7	**-30 marks**
Viva Voce		**- 05 marks**
Lab Record (minimum of 25 Program)		**- 15 marks**
	Total Marks	**- 80 marks**

BSc Mathematics Model II Computer Application - SEMESTER – III

CA3VOT03 : Database Management Systems

Theory: 6 hrs. per week Credits: 4

Total Marks - 80 marks

Module I (15 hours)

Basic concepts :

Database, need for DBMS, users, architecture of DBMS, data models, views of data, data Independence, , attributes, relationship attributes, relationship set, generalization, aggregation, structure of relations

Module II (15 hours)

Data model :

conventional data models & systems, ER model, structure of relational Database and different types of keys;Data base languages.

Module III(20 hours)

The relational algebra modification of database – Views. SQL – Basic structures , Data definition in SQL, Views and Queries in SQL, – Programming using SQL

Module IV (25 hours)

Object – Oriented data base, Object – Oriented data model, Object – oriented languages.

File structures – File organization – Organization of records in files – Data dictionary.

Module V (15 hours)

Query processing – Overview – Section of operation – Sorting, Database architecture – Different type of systems – Network types.

Book of study:

1.Abraham Silberschatz, Henry K. Korth, S, Sudarshan , Data Base System Concepts , Sixth Edition, McGraw Hill.

Reference:

1. R. Elmarsi, S. B. Navathe , Fundamentals of Database System , Fourth Edition, Addison Wesley
2. Jeffrey D Ullman, Principles of Database Systems, Second Edition, Computer Science Press.

CA3VPOP03 : Software Lab -III using SQL

Practical : 6 hrs. per week Credits: 3

Total Marks - 80 marks

1. Data definition commands - CREATE, ALTER, DROP, Adding Constraints Primary key, foreign key, unique key, check, not null.

2. Basic SQL queries INSERT, SELECT, DELETE, UPDATE, Using multiple tables, ordering of rows using ORDER BY option, Set operations using UNION, EXCEPT, INTERSECT, Substring Comparison using LIKE operator, BETWEEN operator.

3. Complex Queries Nested Queries, EXISTS and UNIQUE/DISTINCT functions, NULL values, Renaming of attributes and Joining of tables, Aggregate functions and grouping.

Scheme of Evaluation for Software Lab III external is as follows:

Division of Marks (Practical - 3 hours External)

First program based on 1&2	**- 30 marks**
Second program based on 3	**-30 marks**
Viva Voce	**- 05 marks**
Lab Record (minimum of 30 Programs)	**- 15 marks**
Total Marks	**- 80 marks**

BSc Mathematics Model II Computer Application -SEMESTER – IV

CA4VOT04 : Operating System

Theory: 6 hrs. per week Credits: 4

Total Marks - 80 marks

Module I: (15 hrs.)

INTRODUCTIONTO OPERATING SYSTEM:

Operating System: Objectives and functions; Different views of an operating system; Types of operating systems-batch os, mainframe os, server os, multiprocessor os, personal computer os, handheld computer os, embedded os, sensor node os, real-time os, smart card os; Operating system services .

Module II (25 hours)

PROCESSES MANAGEMENT & CPU SCHEDULING:

Process Management: Process concept- The process, Process states, Process Control Block; Process Scheduling- Scheduling Queues, Schedulers;

CPU scheduling: Schedulingconcepts- Process behaviour, When to schedule, Dispatcher; Scheduling Criteria; Scheduling algorithms-FCFS, SJFS, Priority scheduling, Round-robin scheduling, Multilevel Queue Scheduling, Multilevel feedback queue scheduling.

Dealing with deadlocks: introduction; deadlock characterization-deadlock conditions, resource allocation graph; deadlock prevention.

Module III (15 hours)

MEMORY MANAGEMENT BASICS:

Introduction- Address binding, Logical and physical address space, Program relocation; Storage allocation and management techniques-Contiguous storage allocation-fixed partition, variable partition; Non-contiguous storage allocation-paging, segmentation.

Module IV(15 hours)

FILE SYSTEMS:

Files: Basic concept- file attributes, file operations, file types, file structures, file access; directories- single-level directory system, two-level directory system, hierarchical directory system, directory operations.

Module V (20 hours)

PROTECTION AND SECURITY:

Why protection; goals of protection; security and its goals; authentication- passwords, artifact-based authentication, biometrics techniques; encryption; virus, worms and Trojans- dealing with viruses, dealing with worms; threat monitoring.

Book of study:

1. RohitKhurana, Operating System, Second Edition,Vikas Publishing house Pvt Ltd.
2. EktaWalia, Operating Systems Concepts, Second Edition, Khanna Book Publishing.

References:

1. Silberschatz, Galvin, Gagne, Operating System Concepts, 6th edition, Wiley Publishers.
2. Gary Nutt, NabenduChaki, SarmishthaNeogy, Operating Systems, Third edition, Pearson

CA4VOP04 : Software Lab – IV Project Practical

6 hrs. per week Credits: 3

Total Marks - 80 marks

Scheme of Evaluation for Software Lab – IV Project Practical external is as follows:
Division of Marks (external)

Project demonstration and Presentation	**- 40 marks**
Viva related to project	**-20 marks**
Project report with proper content and binding	**- 20 marks**
Total Marks	**- 80marks**

III. B.Sc Physics Model II Computer Application

VOCATIONAL COURSES - MODEL II - COMPUTER APPLICATIONS

Vocational Paper I: CA1VOT01 - COMPUTER FUNDAMENTALS

Credits – 2 **No. of contact Hours. –36**

Scope: This course provides the basic knowledge about computers.

Prerequisites: Basic Mathematics, Fundamentals of Electronics.

Module I – (10 Hours.)

Fundamentals of Computers:

Evolution of Computers: Abacus, Napier's Logs and Bones, Mechanical Calculators, Babbage's Engines, Hollerith's Machine, Generation of Computers, Purpose of using computers. Data & Information, Characteristics of a Computer, Capabilities & Limitations of Computers. Type of Computers: Analog-Digital-Hybrid. Classification based on memory size: Micro, Mini and Mainframes, Supercomputers.

Module II – (6 Hours.)

Basic Computer Organization and Number System

Basic Organization & Working of a Computer: Arithmetic Logic unit-Control unit-Central Processing unit.

Number system arithmetic – octal addition, octal Subtraction, hexadecimal addition, hexadecimal subtraction

Computer Codes (BCD, EBCDIC, ASCII), BCD Addition

Module III - (10 Hours.)

Components of a Computer

Input unit: Different types of Keyboards, Mouse and its working, Joystick, Trackball,

Scanner: Flat bed, Sheet-fed and Hand-held scanners, Graphic Tablets, Light Pen Output unit: Working of monochromatic and color CRT, LCD Panel, Plotters, Audio output devices, Printers – Working of Dot Matrix, Laser, Inkjet, Color Thermal printer Motherboard, Expansion Buses, BIOS

Storage unit: Primary Memory-RAM, ROM, PROM, EPROM and EEPROM, Cache Memory Secondary Memory-Magnetic storage devices, Optical storage devices, Semiconductor memory.

Module IV – (10 Hours.)

Software Components and Computer Languages:

What is software, Relation between Hardware and Software?

Types of Software: System software: Operating System, Language Translators- Assembler, Compiler & Interpreter

Application software: General Purpose Application Software, Customized Application software.

Utility Software: Antivirus, Disk Defragmenter, Backup Software, Compression Software

Classification of software based on license: Proprietary, Shareware, Freeware, Open source, Free Software

Computer Languages-Machine Language, Assembly Language, High-Level Language, Define program, purpose of program, flowcharts, flowchart symbols, flowcharting rules, advantages and limitations of flowcharts

Book of Study

1. *Computer Fundamentals sixth edition by P.K Sinha,BPB Publications*

2. *Fundamentals of Computers, V Rajaraman, Prentice-Hall of India, New Delhi.*

Reference Books

1. *Introduction to Computer Science 2nd Edition, Rohit Khorana, Pearson Publishers*

2. An introduction to Digital Computer design by V. Rajaraman and T. Radhakrishnan

3. Computer fundamentals by B. Ram

4. A First Course in Computers 2003, Saxena, VIKAS

Vocational Paper II: CA1VOT02 - COMPUTER NETWORKS & INTERNET TECHNOLOGIES

Credits – 2 **No. of contact Hours. –36**

Scope: This course is expected to provide knowledge of various networking technologies and its applications.

Prerequisites: Basic mathematics, Fundamentals of Computers.

Module I: (8 Hours.)

Computer Networks: Introduction to computer network, data communication, Components of data communication, data transmission mode, Network topologies, LAN, MAN, WAN, Client Server Model-Peer-to-Peer, Uses of networks

Module II: (10 Hours.)

Transmission Media: Introduction, Guided Media: Twisted pair, Coaxial cable, Optical

fiber. Unguided media: Microwave, Radio frequency propagation. LAN Topologies: Ring, bus, star, mesh and tree topologies. Network Devices: NIC, repeaters, hub, bridge, switch, gateway and router, Multiplexing – FDM, TDM, WDM

Module III: (11 Hours.)

Network Models: The OSI Model- Layers -Physical Layer, Data Link Layer, Network Layer, Transport Layer, Session Layer, Presentation Layer, Application Layer. TCP/IP Protocol suite-Physical and Data Link Layer, Network Layer, Transport Layer, Application Layer.

Module IV: (7 Hours.)

INTERNET- Basics of internet, features of internet, E-mail, Email Architecture, SMTP, POP,IMAP, WWW Architecture, URL, File transfer, The TELNET, Gopher, Web server, Web Browser.

Book of study

1. *Andrew S. Tanenbaum, David J. Wetherall Computer Networks (5th Edition),PHI, 2010*
2. *Forouzan, Data Communication and Networking, TMH,2003.*

Reference Books:

1. *Computer Networking: A Top-Down Approach 5th Edition, by James F Kurose*
2. *Computer Networks- A system approach, by Peterson*

Semester II

Vocational Paper III: CA2VOT03 - WORD AND DATA PROCESSING PACKAGES

Credits – 2 **No. of contact Hours. –36**

Scope: This course provides the detailed knowledge of Word and data processing software's

Prerequisites: Basic Computer Knowledge.

Module I

MS Word: (12 Hours.)

Word Processing Package: MS-Word: Introduction; Features- Word User Interface Elements; Creating new Documents; Basic editing, Saving a Document; Printing a Document; Print Preview, Page orientation – Viewing Documents; Setting tabs- Page Margins; Indents; Ruler, Formatting Techniques; Font Formatting, Paragraph Formatting; Page Setup; Headers & Footers; Bullets & Numbered List; Borders & shadings; Find & Replace; Page Break & Page Numbers; Mail Merging ; Spelling & Grammar Checking; Thesaurus; Automating Documents; Macros; Tables- Side by Side & Nested Tables; Formatting Tables; Word Art, E-mail editor

Module II

PageMaker (12 Hours.)

Desktop Publishing: PageMaker: Introduction to Desktop Publishing as a Process-Advantages of PageMaker- PageMaker User Interface Elements; Creating new Documents - PageMaker Tools &

Palettes-Master Pages- Page Setup, Page Orientation, Inserting Pages, Removing Pages; Headers & Footers, Page Number - Working with objects- Type Styling Options- Working with text-Formatting Options: Leading, Margins & indents- Scaling Text- Changing Line Specifications, Changing Fill Specifications, Fill & Stroke-Paragraph Formatting Options- Working with Grids-Creating Frames-Adding Graphics to a Frame- Layers- Creating a new layer, moving an object to another layer, hiding layers, locking layers, deleting layers

Module III

MS Excel: (12 Hours.)

Spreadsheet package: MS-Excel Introduction, Excel User interface, working with cell and cell addresses, Selecting a range, Moving, Cutting, Copying & Paste, inserting &

deleting cells, freezing cells, adding deleting & copying worksheet within a workbook, Renaming a worksheet. Cell formatting options-Formatting Fonts, Aligning, Wrapping and Rotating Text, Using Borders, Boxes and Colors, Centering a heading, Changing row/column and height/width, Formatting a work sheet automatically, Insert Comments, Clear contents in a cell, using Print preview, Preparing worksheet for the printer, Selecting Print area, Margin and Orientation, Centering a worksheet, Using header & Footer, inserting page breaks, creating list, sorting data, Logical & Mathematical functions in excel, Linking data between work sheets, pie chart, converting a pie chart on a webpage, Use of Pivot Tables

References

1. *An Introduction to Business Data Processing, Sardino, Prentice Hall.Microsoft Office 97, Ned Snell, PustakMahal, New Delhi.*

2. *Windows and MS Office 2000 with Database Concepts, N Krishnan, Scitech Publications Pvt. Ltd, Chennai.*

3. *Adobe PageMaker 7.0 (Illustrated Series: Complete) by Kevin Proot.*

4. *Discovering Computers and Microsoft Office 2010: A Fundamental Combined Approach (Shelly Cashman Series) by Gary B Shelly and Misty Vermaat*

5. *PageMaker(r) 7: The Complete Reference(Paperback) Carolyn Connally*

6. *PageMaker for Macintosh and windows David D Busch BPB Publications.*

Vocational Paper IV: CA2VOT04 - PROGRAMMING IN ANSI C

Credits – 2 **No. of contact Hours. –36**

Scope: To gain the skills of Programming and to learn the programming concepts in C Language.

Prerequisites: Basic mathematics, basic computer knowledge.

Module-I: (8 Hours.)

Basic concepts of programming. Language classification. Steps in developing a program, Algorithm and flowchart. C language basics: C character set, tokens, Identifiers and keywords, Data types, constants, variables, declarations, qualifiers-long, short and unsigned declarations, expressions, symbolic constants, Input and output operators/functions , compound statements, arithmetic operators, unary operators, relational and logical operators, assignment operators, increment and decrement operators, conditional operators.

Module -II: (10 Hours.)

Decision making and Branching: If statement, if else statement, nested if...else statement, Else if ladder, switch statements, looping - for loop, while loop, do..while statements, nested loop structure, break, continue and go to statements, scope of variables.

Module -III: (8 Hours.)

Arrays one dimensional and two dimensional arrays, initializing, reading, writing, strings, string functions, Library functions: Math.h, Conio.h and Stdio.h.

Module -IV: (10 Hours.)

User defined functions - Elements of functions, different arguments, Return values and their types, Function declaration, Function calls, different types /category of functions. Recursive functions, Call by value and reference methods.

Book of study:

1. *Programming in ANSI C – E Balaguruswamy - Mc GrawHill Education*

References:

1. *Mastering C – K R Venugopal& S R Prasad – Mc GrawHill Education*
2. *Programming in C – Ashutosh Pandey – Cyber Tech Publications*
3. *Let Us C – YashavantKanetker – BPB Publications*

Semester III

Vocational Paper V: CA3VOT05 - CONCEPTS OF OBJECT ORIENTED PROGRAMMING

Credits – 4 **No. of contact Hours. – 54**

Scope: This course is expected to provide sound knowledge in object oriented **p**rogramming.

Module I: (9 Hours.)

Basic concepts of Object Oriented Language

Basic concept of object oriented programming- benefits of OOPs- A simple C++ programme, structure of C++ program. Basic data types and declarations, symbolic constants- Reference by variables, operators in C++, Special Assignment Expressions, operator precedence and associatively, control structures- function in C++ - the main function, function prototyping- call by reference- return by reference- inline function Default argument,- function overloading – friend and virtual function.

Module II: **(12 Hours.)**

Classes and Objects

Specifying a class- Defining member functions- nesting of member functions – private member functions – arrays within a class – Memory allocation for object- static data members – static member functions – arrays of objects – friendly functions.

Module III: (10 Hours.)

Constructors and Destructors

Constructors- parameterized constructors-multiple constructors- copy constructor-dynamic constructor, Destructors.

Module IV:

Inheritance and operator overloading (12 Hours.)

Operator overloading- Defining operator overloading-Overloading unary and binary operators-Inheritance- Defining derived classes- single, multiple, multilevel, hierarchical and hybrid inheritance - virtual base classes.

Pointers, Virtual Functions and Polymorphism (11 Hours.)

Pointers- Declaring and initializing pointers, Manipulation of pointers, Arrays of pointers, Dynamic memory allocation, Pointers and strings, Pointers to functions, Virtual functions, pure virtual function

Book of Study:

1. *E. Balagurusamy , Object Oriented Programming with C++, Fifth edition, McGraw Hill publications*
2. *Object-Oriented Programming in Turbo C++, Robert Lafore, Galgotia.*

Reference:

1. *Mahesh Bhave and Sunil Pateker Object Oriented Programming with C++, Second edition, Pearson*

2. *Ashok N Kamthane and Amit Ashok Kamthane, Programming in C++, Second Edition, Pearson*.

Vocational Paper VI: CA3VOT06 - OPERATING SYSTEM

Credits – 3 **No. of contact hours – 54**

Scope: This course provides a basic knowledge about the role of Operating System in the functioning of computers

Prerequisites: Basic knowledge of computer fundamentals and computer networks

Module I (10 Hours.)

Introduction to operating system:

Operating System: Objectives and functions; Different views of an operating system; Types of operating systems-batch OS, mainframe OS, time sharing OS, multiprocessor OS, personal computer OS, handheld computer OS, embedded OS, real-time OS, Operating system services

Module II (8 Hours.)

Processes management:

Process concept- The process, Process states, Process Control Block; Process Scheduling- Scheduling Queues, Schedulers;

Module III (18Hours.)

CPU Scheduling:

Scheduling concepts- Process behavior, When to schedule, Dispatcher; Scheduling Criteria; Scheduling algorithms-

CPU Scheduling Problems

First Come First Serve (FCFS)-Shortest Job First (SJF) - Priority Non Preemptive (P-NP)-Shortest Remaining Time First (SRTF)-Priority Preemptive - Round Robin (RR)

Module IV (18 Hours.)

Memory Management Basics:

Basic ideas-Memory Management requirements, Address binding, Dynamic address space binding, Fixed partition memory strategies, Variable partition memory strategies, Dynamic Storage allocation problems: First Fit, Best Fit, Worst Fit, Next Fit, Fragmentation, Swapping, Virtual memory, Page Replacement problems- FIFO, LRU and Optimal replacement

Deadlock:

Introduction, deadlock characterization-deadlock conditions, resource allocation graph; deadlock prevention.

File systems: Files- Basic concept- file attributes, file operations, file types, file structures, file access

Book of Study:

1. *RohitKhurana, Operating System, 2nd edition,Vikas Publishing house pvt ltd.*
2. *EktaWalia, Operating Systems Concepts, Khanna Book Publishing.*

References:

1. *Silberschatz, galvin, gagne, Operating System Concepts, 6th edition.*
2. *Gary Nutt, NabenduChaki, SarmishthaNeogy, Operating Systems, 3rd edition, Pearson.*

Semester IV

Vocational Paper VII: CA4VOT07 - VISUAL BASIC PROGRAMMING

Credits – 4 **No. of contact hours – 54**

Scope: This course is designed to provide basic ideas of VB programming

Prerequisites: Basic knowledge of computer fundamentals and computer programming.

Module I

Introduction (12 hours)

VB Introduction-VB Developing Environment – VB Menu Bar –Toolbars –Project Explorer- Tool Box-Form Designer-Form Layout.

Visual Basic Program Elements: Variables, Data Types, Scope and Lifetime of Variables, Declaring and using Constants; Operators – Arithmetic Operators, Relational or Comparison Operators, Logical operators; User Defined Data Type, Arrays, Multi-dimensional Arrays, Dynamic Arrays, Comments in VB.

Control Flow Statements- if ....then, if...then...else, select case; Loop Statements- do loop, for next, for each next; Input Box and Message Box functions

Using intrinsic controls (10 hours)

Pointer – Label – Frame – Check box – Combo box – Scroll Bar – Timer – Dir list box – Shapes – Image – OLE – Picture box – Text box – Command button – Option button – List box – Drive List Box-Directory List Box-File List Box-Shape Control & Line Control-Horizontal Scroll bar – Vertical Scroll Bar-Adding check box controls – Adding combo box– Standard MDI form features – Building the MDI form.

Module II

Methods, Properties, and Events (14 hours)

Learn about properties and how to manage them – Discover how to call methods –Learn how Visual Basic enables program to respond to events, System Events and User Events.

Debugging Window- Immediate Window, Locals Window, Watch Window, Quick Watch Window, Call Stack Window, creating a toolbar in VB

Module III

Functions and File Handling (8 hours)

Control Arrays, Procedures, Event Procedure, General Procedures-Sub Procedures, Functions; Arguments to functions or sub procedures, Passing arguments by reference and value, Optional arguments , Using named Arguments, Exiting Procedures, Event-Driven Programming, String Functions

Module IV (10 Hours.)

File Handling

File Handling-File, Field, Records, Sequential Access Files, Opening and closing of Sequential Access Files, Editing (Reading & Writing) Files opened for Sequential Access, Random Access Files, Opening and closing of Random Access Files, Editing (Reading & Writing) Files opened for Random Access, Deleting records in Random Access- Binary Access Files, Opening and closing of Binary Access Files, Editing (Reading & Writing) Files opened for Binary Access, Deleting records in Binary Access

Reference Books:

1. *Visual Basic 6 - Clayton Walnum, Prentice- Hall of India, New Delhi.*
2. *Microsoft Visual Basic 6.0 Professional: Step by Step by by Halvorson*
3. *Visual Basic 6.0, N Krishnan and N Saravanan, Scitech Publications, Pvt Ltd, Chennai.*
4. *Programming With Visual Basic 6.0 by M. Azam*

Vocational Paper VIII: CA4VOT08 - WEB DEVELOPMENT AND PHP PROGRAMMING

Credits – 3 **No. of contact hours – 54**

Scope: This course is designed to provide basic ideas of HTML, JavaScript and MYSQL

Prerequisites: Basic knowledge of computer fundamentals and computer programming.

Module I

HTML & CSS (18 hours)

Basics of HTML:- Html tags, HTML Editors, HTML Documents, Heading Tags, Paragraph Tags, Centering Contents, HTML Elements, frames element, marquee text,

HTML Attributes:- lang, href, size, align, valign, bgcolor, background, width, height, title

HTML styles, HTML symbols, HTML layout, HTML Text formatting elements, HTML comments, HTML Links, Anchor, HTML elements, HTML Tables, HTML List, HTML Block elements, HTML head, HTML forms, GET & POST Methods, Form Attributes,

Organization of HTML Document, Creating a webpage using html, HTML editors (Microsoft Front page, dream weaver), Introduction to HTML Web server (IIS - Internet Information Server, PWS - Personal Web Server).

CSS:- Basics, Syntax, CSS Comments, CSS Selectors, External style sheet, Internal style sheet, Inline style, CSS Text

Module II

JavaScript (12 hours)

Basics, Static webpage, Dynamic webpage, Advantages & Limitations of JavaScript, JavaScript Development Tools, External JavaScript, JavaScript Output, JavaScript Data Types, Variables and its scope, JavaScript Reserved Words. JavaScript Operators, Conditional Statements-if statement, if...else statement, if...else if ... statement, Switch statement, JavaScript Loops:- while loop, for loop, do-while loop, for-in loop, break & continue statements, various mouse and keyboard events

Module III

PHP& MYSQL (15 hours)

The Structure of PHP- Using Comments, Basic Syntax, Variables, Operators, Variable Assignment, Multiple-Line Commands, Constants, Predefined Constants, The Difference Between the echo and print Commands, Functions, Variable Scope. Conditional Statements-if statement, if...else statement, if...else if...else statement, Switch statement, PHP Loops:- while loop, for loop, do-while loop, for each loop, break statement, functions, arrays, super globals, PHP sessions and cookies, PHP file handling.

Module IV

Implementing MYSQL using PHP (9 Hours.)

Introduction, Database, opening a connection, closing a connection, Create Database, drop database, select database, MYSQL Data types, tables, Drop tables, insert, select tables, Where clause, update, delete records, Like clause, Order By, Joins, alter, dropping adding or repositioning a column,

References

1. *Learning Web Design 2nd Edition by Jennifer Niederst*

2. *DHTML and JavaScript by Gilorien*
3. *PHP and MySQL for Dynamic Web Sites: Visual QuickPro Guide by Larry Ullman*
4. *HTML & CSS: The Complete Reference, Fifth Edition by Thomas Powell*
5. *HTML and CSS: Design and Build Websites by Jon Duckett*
6. *PHP: The Complete Reference by Steven Holzner*
7. *Learning PHP, MySQL & JavaScript with j Query, CSS & HTML by Robin Nixon*

VOCATIONAL SUBJECT COMPUTER APPLICATIONS PRACTICAL SYLLABUS

SEMESTER I& II

Vocational Practical 1

CA2VOP01: INTRODUCTION TO COMPUTERS & ANSI C PROGRAMMING

1. Introduction to various hardware components of a computer.
2. Preparation and printing of a simple document using DOS TEXT Editor.
3. Development of a batch file to copy the contents of a text file into another text file.
4. Development of a batch file to create a directory named “Computer” and any two subdirectories inside “Computer
5. Development of a batch file to copy all files from a source drive to a target drive.
6. Development of a batch file to copy all the files, directories and all hidden files (if any) from one disk to another identical disk.

7. Development of a batch files to rename any existing directory by giving a new name with all possible error messages.
8. Composing and sending an E-Mail message.
9. Program to find the sum and average of n numbers.
10. Obtain roots of a quadratic equation in all possible cases.
11. Program that read a four digit number from keyboard and then prints it in reverse case.
12. Program to compute x to the power n using for loop.
13. Program to calculate the standard deviation of an array of values. The array elements are read from terminal. Use function to calculate standard deviation and mean.
14. Program to read the elements of the given two matrices of order n x n and to perform the matrix multiplication.
15. Program to print the first n Fibonacci numbers using function.
16. Program to find the sum of the following series using a function declaration. Sum = x

    $- x^3/3! + x^5/5! - x^7/7! + \ldots x^n/n!$. Where n and x are entered from the keyboard.
17. Program that uses a function to sort an array of integers.
18. Program to reverse a string without using string function
19. Program to find the length of the given string without using string function
20. Program to print prime numbers within a range.
21. Program to print the following pattern by using any loop. Range of star (*) must be entered from keyboard.

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References

1. *Operating systems Gary Nutt 3rd Edn. Pearson.*
2. *Microsoft MS-DOS User's Guide & Reference.*
3. *Programming in ANSI C – E Balaguruswamy - Mc GrawHill Education*
4. *Visual Basic 6 - Clayton Walnum, Prentice- Hall of India, New Delhi.*

SEMESTER III & IV

Vocational Practical II

CA4VOT01 - DATA PROCESSING PACKAGES, OPERATING SYSTEM & VISUAL BASIC PROGRAMMING

(Minimum 14 experiments)

1. Implement the concept of First Come First Serve (FCFS) using C or C++
2. Implement the concept of Shortest Job First (SJF) using C or C++
3. Implement the concept of First Fit algorithm.
4. Create a worksheet which contain Employee no, Emp. name, Salary, department, Designation. Calculate the gross salary. Gross Salary = (Salary+HRA+DA) - PF. HRA = 50% of salary, DA = 30% of salary, PF = 10% of salary. Extract all employees who are managers. Extract all the employees whose salary is between 20000 and 40000. List the total salary and gross salary in each department.
5. Create the following work sheet. Marks of 4 subjects of 15 students and calculate the total mark, Average mark, Result and Grade. Sort the total marks in the descending order. All the numeric fields in the left alignment. Centralize the name of the Institute that you are studying.
6. Create a work sheet for preparing merit list for BSc admission in your college.

7. Create two documents using MS WORD exactly the way they are seen.
8. Create a document and type 30 lines in it. Spell-check the document and create five AutoCorrect entries on your own. Then create five Auto text entries. Print only the current page of the document.
9. Create a file, inviting your friends to a dinner. Use the Mail Merge facility so that you do not have to re-type the letter with their names and addresses.
10. Create two documents using PageMaker exactly the way they are seen.
11. Create two documents using PageMaker. Change its character width, indents, space around paragraphs; add special characters, figures, tables etc.
12. Design a text book cover page with title and pictures using page maker.
13. Create a VB project that will display pictures in a PictureBox and ImageBox controls, when the user click display button
14. Using a text box and a command button in the form, enter a number in the text box and on clicking on command button display whether the number a single, two or three-digit number in a message box.
15. Create a project to change the shape of a shape control at the interval of one second using Timer control.
16. Create an event procedure to convert a text from lowercase to uppercase.
17. Create a function procedure to calculate the sum of "n" Fibonacci numbers
18. Create a function procedure to find simple interest.
19. Create a program to accept a number and print it in the reverse order.
20. Create a program to accept a set of numbers and find the largest and smallest number.
21. Create a program to count the number of vowels in a string and replace with '*' symbol.
22. Create a program to check whether a given string is palindrome or not.
23. Create a function procedure to find prime numbers within a range
24. Implement traffic system demonstration

References

1. *E. Balagurusamy , Object Oriented Programming with C++, Fifth edition, McGraw Hill publications.*
2. *Visual Basic 6 - Clayton Walnum, Prentice- Hall of India, New Delhi.*
3. *Operating systems Gary Nutt 3rd Edn. Pearson.*
4. *Discovering Computers and Microsoft Office 2010: A Fundamental Combined Approach (Shelly Cashman Series) by Gary B Shelly and Misty Vermaat*

Vocational Practical III

CA4VOP03: C++ PROGRAMMING & WEB DEVELOPMENT

(Minimum 14 experiments)

1. Write a function called reversit() that reverses a string (an array of char). Use a for loop that swaps the first and last characters, then the second and next –to-last characters, and so on .The string should be passed to reversit() as an argument. Write a program to exercise reversit().The program should get a string from the user, call reversit(), and print out the result.
2. A program to perform simple arithmetic operations of two complex numbers using operator overloading.
3. Create a class called employee that contains a name and an employee no: Create another class called scientist that inherits the properties of employee and it contains the function for entering the name of the award he gets and display it. Create objects for class scientist that contain their name, no and the award they get. Implement single inheritance.
4. Imagine a publishing company that markets both book and audio-cassette versions of its works. Create a class "publication" that stores a title (a string) and price (type float) of a publication. From this class derive two classes; "book", which adds a page count (type int); and "tape", which adds a playing time in minutes (type float). Each of these three classes should have a getdata() function to get its data from the user at the keyboard, and a putdata() function to display its data. Write a main() program to test the "book" and "tape" classes by creating instances of them, asking the user to fill in their data with getdata(), and then displaying the data with putdata().

5. Declare a class to represent bank account of 10 customers and the following data members: Name of the depositor, Account Number, Type of Account (S for saving and C for current Account), Balance Amount. The class also contains the following member functions. a). To initialize data members, b) To deposit money. c) For withdrawal of money after checking the minimum balance (minimum balance is Rs1000) d) To display the data members.
6. A program to concatenate using two strings into one string using a pointer method.
7. Write a program that read a group of numbers from the user and places them in an array of type float. Once the numbers are stored in the array, the program should average them and print the result. Use pointer notation wherever possible
8. Program to find Armstrong numbers within a range.
9. Write any program to implement the concept of friend function.
10. Write an HTML code for a webpage for your college with the following details and features
    - A heading followed by a paragraph of 5 sentences about your college using text formatting tags and attributes.
    - Provide yellow color to the background of the page.
    - Include an image of the college.
    - Include a marquee that "Admission for the new academic year commences on 1st June"
11. Write an HTML code to display an online application form for BSc admission. The application form must contains columns for name, address, parent's name, age, sex, caste, marks, photo etc.
12. Write an HTML code to create a list of 3 bikes of your choice in a frame. Link each one to display the description with a picture in another frame.
13. Create an HTML document with following formatting – Bold, Italics, Underline, Color, Headings, Title, Font and Font Width, Background, Paragraph, Line Brakes, Horizontal Line, Blinking Text as well as marquee Text.

14. Develop a website to display an email login page. The page must contain one text box for entering the username and one password box for entering the password. The username must contain at least 4 characters and the password must contain at least 6 characters. The first two characters in the password must be numbers. On clicking show login button, if the valid data are given in the boxes, a message
    "Correct Data" should be displayed. Otherwise "Wrong Data" message should be displayed.

15. Develop a webpage to implement a simple calculator. The page should have two textboxes to enter two numbers. It should also have 4 buttons to add, subtract, multiply and divide the two numbers. The answer should be displayed in a third text box on clicking the button.

16. Design an HTML page that contains five text boxes, three textboxes for marks of three subjects, and remaining for total marks and average marks. Provide validations for this textbox in a separate JavaScript file and link it with the HTML file. The validations are (i) Textboxes should not be empty (ii) It should be a number (iii) It should be between 0 and 99.

17. A webpage contains a button. Write HTML code for the button which executes a function Message() on the occurrence of the following events. (a) When user clicks the mouse on the button. (b) When user moves the mouse over the button.
18. Write HTML codes to create two web pages to show some information about the science and the commerce department of your college. Create another webpage to divide the browser window horizontally into two. In the first frame, a brief introduction of the college and two links are to be provided- one for science and other for commerce. On clicking these links the respective webpage is to be opened in the second frame.

19. Create a form using HTML which has the following types of controls:

    I. Text Box

    II. Option/radio buttons III. Check
    boxes

    IV. Reset and Submit buttons

References

1. *E. Balagurusamy , Object Oriented Programming with C++, Fifth edition, McGraw Hill publications*
2. *Object-Oriented Programming in Turbo C++, Robert Lafore, Galgotia.*
3. *Learning Web Design 2nd Edition by Jennifer Niederst*
4. *HTML & CSS: The Complete Reference, Fifth Edition by Thomas Powell*

IV. SYLLABUS OF MODEL- I COMPLEMENTARY PAPER FOR B.SC.STATISTICS, BSc.MATHEMATICS

Semester I

CA1CMT01 : Computer Fundamentals

Theory: 2 hrs. per week

Credits: 2

Module I – (10 Hrs)

Fundamentals of Computers: Define computer, introduction to bit, byte, data,information, program, hardware and software. Generations of computers , Types of Computers, Logical Organization of a Digital Computer - Input unit ,Output unit ,Storage unit ,Arithmetic logic unit, Control unit ,CPU.Input devices – keyboard, point and draw devices, data scanning devices.Output devices-monitors ,printers, plotters.Primary and Secondary storage devices.

Module II -(6 Hrs)

Number systems- Binary, Octal and Hexadecimal, Converting from one number systemto another-decimal to a new base, converting to decimal from another bases, converting from base other than ten to base other than ten, short cut method forconverting from binary to octal, octal to binary, binary to hexadecimal and hexadecimalto binary, Computer Codes (BCD, EBCDIC, ASCII)

Module III – (8 Hrs)

Boolean Algebra and Logic circuits- Fundamental concepts of BooleanAlgebra,Postulates of Boolean algebra,Theorems of boolean algebra, Logic Gates- AND,OR, NOT, NAND, NOR, XOR and XNOR, logic circuits, converting expression to logiccircuit.

Module IV - (6Hrs)

Computer Software and Languages : Define software, Relationship between hardwareand software, Types of software-System software and Application software,Machine language, Assembly language, High-level language, Language Translators - Assembler, Compiler, Interpreter

Module V – (6 Hrs)

Operating system: Definition, functions of an operating system, types of Operatingsystem: (batch, multiprogramming, time sharing etc.), features of UNIX,LINUX,MS DOS,WINDOWS operating systems.

Book of Study:

1. P.K Sinha and Priti Sinha , Computer Fundamentals, Sixth Edition, BPB Publications.

2. Rohit Khorana, Introduction to Computer Science, 2nd Edition, Pearson Publishers.

Reference:

1. V. Rajaraman and T. Radhakrishnan , An introduction to Digital Computer design, Fifth Edition, Prentice Hall India Learning Private Limited.

2. B. Ram , Computer fundamentals: Architecture and Organization, Fifth Edition, New Age International.

3. Sanjay Saxena , A First Course in Computers, Second Edition, VIKAS Publishers.

Practical LAB –I

Practical : 2 hrs. per week

MS WORD

1. Page formatting

2. Paragraph formatting, header and footer, page number etc.

3. Table creation, chart, shapes, hyperlinks, cross-reference etc.

4. Mail merge

MS EXCEL

1. Working with excel formula , different type of cell references and linking data betweenworksheet Logical functions – IF, AND, OR and Nested IF function.

2. Math functions – ROUND, RAND, CELING, FLOOR, INT, LCM, MOD, EVEN, SUNIF, SQRTand Trigonometric functions

3. Statistical functions- AVERAGE, AVERAGEA, AVERAGEIF, COUNT, COUNTA,COUNTBLANK, COUNTIF, SUM , SUMA, MIN, MINA, MAX and MAXA

4. Formatting cells

5. Create a chart, choosing chart type, edit chart axis-titles, labels, data series and legend

MS POWERPOINT

1. Creating presentation

2. Animations & Transition

3. Different type of design, Sound

4. Inserting picture, table, shapes, charts etc.

MODEL- I B.SC.STATISTICS, BSc.MATHEMATICS - SEMESTER II

CA2CMT02 : Programming in C language

Theory: 2 hrs. per week Credits: 3

Module-1:

Basic concepts of programming.Language classification.Steps in developing a program, Algorithm and flowchart.

C language basics: C character set, tokens, Identifiersand keywords, Data types, constants, variables, declarations, qualifiers- long, short andunsigned declarations, expressions, symbolic constants, Input and outputoperators/functions ,compound statements, arithmetic operators, unary operators,relational and logical operators, assignment operators, increment and decrementoperators, conditional operators.

(Theory 6 hrs)

Module -2:

Decision making and Branching : If statement, if else statement, nested if...elsestatement, Else if ladder, switch statements, looping - for loop , while loop, do..whilestatements, nested loop structure, break, continue and go to statements, scope ofvariables.

(Theory 10 hrs)

Module -3:

Arrays one dimensional and two dimensional arrays, initializing, reading, writing. Strings, standard library string functions Library functions: Math.h, Conio.h and Stdio.h.

(Theory 8 hrs)

Module -4:

User defined functions - Elements of functions, different arguments, Return values andtheir types, Function declaration, Function calls, different types /category of functions.Recursive functions, Call by value and reference methods.Storage classes: automatic, external(global),static and registers.

(Theory 8 hrs)

Module -5:

Structure: definition, Declaring structure variables, Accessing structure membersConcept of Union. Pointers: Fundamentals - Understanding pointers, Addressoperators, Pointer declaration.

(Theory 4 hrs)

Book of study:

1.E Balaguruswamy , Programming in ANSI C , Sixth Edition, Mc GrawHill Education.

References:

1. K R Venugopal & S R Prasad , Mastering C , First Edition, Mc GrawHill Education
2. Ashutosh Pandey , Programming in C, First Edition, Cyber Tech Publications
3. YashavantKanetker , Let Us C , Fourteenth Edition, BpB Publications

Practical LAB –II **--** Practical : 2 hrs. per week

SYLLABUS

1. Fundamental data types, input/output functions scanf(), printf(), Arithmetic expressions,Evaluation of integer, real and mixed mode arithmetic expressions, truncation effect, typecasting.

2. Programs using control structures: If statement, if else statement, nested if...else statement,Else if ladder, switch, for, while, do…while, break and continue. Using nested loops.

3. Programs using one dimensional array: Creation of array, linear array operations,search, sort, Static initialization of arrays etc.Two dimensional array, matrix addition, matrix multiplication, transpose of a matrix.

4. User Defined Functions: Programs using different categories of functions return typefunctions, void type functions, program using recursive functions (factorial) etc.

Semester II

CA2CMP01 : Software Lab I

Scheme of Evaluation for software lab I external (Practical Lab – I and PracticalLab-II) is as follows: (in Second Semester)

Division of Marks (Practical - 3 hours External)

First program based on Lab I word/excel **- 15 marks**

Second program should be based on Lab II c program **- 15 marks**

Viva Voce **– 03 marks ,** Lab Record (minimum of 15 Programs from each section) **- 7 marks**

Total Marks - 40 marks

MODEL- I B.SC.STATISTICS, BSc.MATHEMATICS - SEMESTER III

CA3CMT03 : Web Technology and Programming

Theory: 2 hrs. per week Credits: 2

Module I - 6 Hrs.

Computer networks- Advantages of networking, Network topologies (Bus, Ring, Star,Tree, Mesh, Hybrid), types of networks - LAN, MAN, WAN, intranet and Internet ,Communication Media – Guided: Twisted Pair, Coaxial Cable and Optic Fiber, Unguided:infrared, microwave & satellite, Concept of the point to point and Broadcast Network,Networking Tools-MODEM, Repeater, Hub, Switches, Routers, Bridge, Gateway, Firewall

Module II - 6 Hrs.

Concept of ISP (Internet Service Provider), Internet Backbone, Concept of URL Address,Domain Names, Hypertext Concepts and World Wide Web, Protocols- FTP, NNTP, SMTP,HTTP, POP, PPP, Email-Electronic Post Service, ISO OSI Reference Model

Module III - 8 Hrs.

Web server and proxy server, Internet Viruses (Trojan, WORM), Internet security issues(Malware, Spyware, Hacking etc.), types of firewall, Basics of Data compression anddata encryption, Digital Signatures, Digital Certificates

Module IV - 10 Hrs.

The art of creating the website, WWW, website, webpage, and home page, The HTMLprogramming basics, General structure of HTML document, HTML tags and attributes,Formatting Tags, Choice of page color, including banners, Tables, Lists, Example ofHTML page. Tags - <HTML>, <BODY>, <HEAD>, <TITLE>, <H1>, <H2>, ……<H6>, <BR>,<B>, <I>, <U>, Adding hyperlinks

Module V - 6 Hrs.

Introduction web browsers (like Internet Explorer, Mozilla Firefox, Google Chrome),Basic tools in the browser(back, forward, homepage, stop, refresh), search engine forinternet, meta search engine

Books of study:

1. P.K Sinha and Priti Sinha , Computer Fundamentals, Sixth Edition, BPB Publications.

2. Andrew S. Tanenbaum, David J. Wetherall, Computer Networks , Fifth Edition, Pearson

Reference:

1. Raj Kamal ,Internet & Web Technologies,2002 Edition , Tata McGraw Hill

2. HTML Black Book, Steven Holzner, 2000 edition, Dreamtech Publishers

3. Joel Sklar , Principles of web page design, Sixth Edition, Vikas publications

4. Behrouz A Forouzan , Data Communication & Networking, Fourth Edn. McGraw Hill

Semester III

Practical LAB –III

Practical : 2 hrs. per week

 Internet browsing

 email - creation of account, reception, compilation, sending etc

 Web page designing using HTML tags and linking with other pages.

1. Create HTML document with following formatting – Bold, Italics, Underline, Colors,Headings, Title, Font and Font Width, Background, Paragraph, Line Brakes,Horizontal, Line, Blinking Text as well as marquee Text.

2. Create HTML document with Ordered and Unordered lists, Inserting Images, Internaland External linking

3. Create HTML document with Table:

Some image here

4. Create Form with Input Type, Select and Text Area in HTML.

5. Create an HTML containing Roll No., student's name and Grades in a tabular form.

6. Create an HTML document (having two frames) which will appear as follows:

About

Department 1

Department 2

Department 3

This frame would show thecontents according to the linkclicked by the user on the leftframe.

7. Create an HTML document containing horizontal frames as follows:

Department Names (could be along with Logos)

Contents according to the Link clicked

8. Create a website of 6 – 7 pages with different effects as mentioned in aboveproblems.

9. Create HTML documents (having multiple frames) in the following three formats:

Frame1

Frame2

Frame1

Frame2 Frame3

10. Create a form using HTML which has the following types of controls:

I. Text Box

II. Option/radio buttons

III. Check boxes

IV. Reset and Submit buttons

11. A. Create a web site for ICC world cup tournament which contain

1. A home page

2. Tournament schedule should be present in a table.

3. Details of previous world cups

4. Details of all teams.

Include form, Image, tables, list, according to their needs

12.Create a web site for your college which contain

a. A home page

b. About your management

c. About your Staffs

d. About your course

e. About your Facilities

All this pages contain appropriate pictures and links between them.

MODEL- I B.SC.STATISTICS, BSc.MATHEMATICS - SEMESTER IV

CA4CMT04 : Visual Programming Techniques

Theory: 2 hrs. per week

Credits: 2

Unit 1: 4 Hrs.

Data Base Management System: basic concepts & structure, Data definition and data manipulation using MS ACCESS

Unit 2 : 10 hrs.

Visual Basic - Basic Concepts: Getting Started with Visual Basic advantages of VB, VB Development Overview, Designing and building the User Interface, creation of forms and adding controls to the form, Setting control properties, Writing Event Driven Code

Visual Basic Projects : Using different types of Projects, Project Explorer Window, VB procedures, subroutines & functions, Comments, Controlling Program Flow IF.. THEN…ELSEIF, SELECT…CASE, Loops-FOR…NEXT, DO, WHILE…WEND. Visual Basic Variables-Data Types Byte, Integer, Long, Single, Double, Currency, Boolean, Date, Object, String & Variant. Variable Declaration-Implicit & Explicit

Unit 3 : 8 Hrs.

Designing the User Interface : VB Form, Adding Forms, Form Properties, Setting Properties with Code, Using Form Drawing Methods, Loading & Unloading Forms, Form Events, Dialog Boxes-Message Box & Input Box, MDI Applications-MDI Parent Form/ChildForms.

Unit 4 : 8 Hrs.

Controls: Tool Box-Label, Text Box, Frame, Command Button, Check Box, Option Button, List Box, Combo Box, Horizontal Scrollbar, Vertical Scrollbar, Timer, Drive List Box, Directory List Box, File List Box, Line, Shape, Image Box, Picture Box, Data Control, OLE Control, Customizing Tool Box, Adding Controls to Forms, Naming Controls, Copying Controls, Control Arrays

Unit 5: 6 Hrs.

Mastering Menus and Toolbars : Menus, Menu Editor, Pop-up Menus, Customising Toolbar, Jet, DAO, Advanced Data Access Methods, ADO, OLEDB Working with other Applications & Database Access: Visual Basic Data Control, Creating Queries in Visual Basic

Books of study:

Peter Norton's Guide to Visual Basic 6 by Peter Norton and Michael Groh, Techmedia publications Chapters: 1-7, 18, 19, (2007)

References:

1. Visual Basic 6 from the Ground Up by Gary Cornell, TataksMcGraw-Hill (2008)

2. Programming in Visual Basic 6.0 by Julia Case Bradley and Anita C Millspaugh, Tata

McGraw-Hill (2005)

3. Using Visual Basic 6 by Bob Roselman, Richard Peasley and Wayne Prunchiah, PHI

Practical LAB –IV

Practical : 2 hrs. per week

1. Designing User Interface using- List Box, Combo Box, Image and Picture Box,

Directory-File-Drive list boxes, Rich text box, etc

2. Creating Menus- Creating Menus and writing Codes, Linking Menus with MDI forms.

3. Database Connectivity using Controls - Designing user interface with forms and

controls and create database connectivity by DAO and ADO Control.

4. Creating Reports - Create reports using Data Report in VB

Semester IV

CA4CMP02 : Software Lab II

Scheme of Evaluation for software lab II external (Practical Lab – III and Practical Lab-IV) is as follows:

Division of Marks (Practical - 3 hours External)

First program based on Lab III HTML **- 15 marks**

Second program should be based on Lab IV VB **- 15 marks**

Viva Voce **– 03 marks**

Lab Record (minimum of 15 Programs from each section) **- 7 marks**

Total Marks - 40 marks

V. B.Sc Petrochemicals Complementary papers

Semester I

CA1CMT01 : Computer Fundamentals

Theory: 2 hrs. per week

Credits: 2

Module I – (10 Hrs)

Fundamentals of Computers: Define computer, introduction to bit, byte, data,information, program, hardware and software. Generations of computers , Types of Computers, Logical Organization of a Digital Computer - Input unit ,Output unit ,Storage unit ,Arithmetic logic unit, Control unit ,CPU.Input devices – keyboard, point and draw devices, data scanning devices.Output devices-monitors ,printers, plotters.Primary and Secondary storage devices.

Module II -(6 Hrs)

Number systems- Binary, Octal and Hexadecimal, Converting from one number systemto another-decimal to a new base, converting to decimal from another bases, converting from base other than ten to base other than ten, short cut method forconverting from binary to octal, octal to binary, binary to hexadecimal and hexadecimalto binary, Computer Codes (BCD, EBCDIC, ASCII)

Module III – (8 Hrs)

Boolean Algebra and Logic circuits- Fundamental concepts of BooleanAlgebra,Postulates of Boolean algebra,Theorems of boolean algebra, Logic Gates- AND,OR, NOT, NAND, NOR, XOR and XNOR, logic circuits, converting expression to logiccircuit.

Module IV - (6Hrs)

Computer Software and Languages : Define software, Relationship between hardwareand software, Types of software-System software and Application software,Machine language, Assembly language, High-level language, Language Translators - Assembler, Compiler, Interpreter

Module V – (6 Hrs)

Operating system: Definition, functions of an operating system, types of Operatingsystem: (batch, multiprogramming, time sharing etc.), features of UNIX,LINUX,MS DOS,WINDOWS operating systems.

Book of Study:

1. P.K Sinha and Priti Sinha , Computer Fundamentals, Sixth Edition, BPB Publications.

2. Rohit Khorana, Introduction to Computer Science, 2nd Edition, Pearson Publishers.

Reference:

1 V. Rajaraman and T. Radhakrishnan , An introduction to Digital Computer design, Fifth Edition, Prentice Hall India Learning Private Limited.

2. B. Ram , Computer fundamentals: Architecture and Organization, Fifth Edition, New Age International.

3. Sanjay Saxena , A First Course in Computers, Second Edition, VIKAS Publishers.

Practical LAB –I Practical : 2 hrs. per week

MS WORD

1. Page formatting

2. Paragraph formatting, header and footer, page number etc.

3. Table creation, chart, shapes, hyperlinks, cross-reference etc.

4. Mail merge

MS EXCEL

1. Working with excel formula , different type of cell references and linking data betweenworksheet Logical functions – IF, AND, OR and Nested IF function.

2. Math functions – ROUND, RAND, CELING, FLOOR, INT, LCM, MOD, EVEN, SUNIF, SQRTand Trigonometric functions

3. Statistical functions- AVERAGE, AVERAGEA, AVERAGEIF, COUNT, COUNTA,COUNTBLANK, COUNTIF, SUM , SUMA, MIN, MINA, MAX and MAXA

4. Formatting cells

5. Create a chart, choosing chart type, edit chart axis-titles, labels, data series and legend

MS POWERPOINT

1. Creating presentation

2. Animations & Transition

3. Different type of design, Sound

4. Inserting picture, table, shapes, charts etc.

BSc Petrochemicals Complementary papers - Semester II

CA2CMT02 : Programming in C language

Theory: 2 hrs. per week Credits: 3

Module-1:

Basic concepts of programming.Language classification.Steps in developing aprogram, Algorithm and flowchart.

C language basics: C character set, tokens, Identifiersand keywords, Data types, constants, variables, declarations, qualifiers- long, short andunsigned declarations, expressions, symbolic constants, Input and outputoperators/functions ,compound statements, arithmetic operators, unary operators,relational and logical operators, assignment operators, increment and decrementoperators, conditional operators.

(Theory 6 hrs)

Module -2:

Decision making and Branching : If statement, if else statement, nested if...elsestatement, Else if ladder, switch statements, looping - for loop , while loop, do..whilestatements, nested loop structure, break, continue and go to statements, scope ofvariables.

(Theory 10 hrs)

Module -3:

Arrays one dimensional and two dimensional arrays, initializing, reading, writing.
Strings, standard library string functions
Library functions: Math.h, Conio.h and Stdio.h.

(Theory 8 hrs)

Module -4:

User defined functions - Elements of functions, different arguments, Return values andtheir types, Function declaration, Function calls, different types /category of functions.Recursive functions, Call by value and reference methods.Storage classes: automatic, external(global),static and registers.

(Theory 8 hrs)

Module -5:

Structure: definition, Declaring structure variables, Accessing structure membersConcept of Union. Pointers: Fundamentals - Understanding pointers, Addressoperators, Pointer declaration.

(Theory 4 hrs)

Book of study:

1.E Balaguruswamy , Programming in ANSI C , Sixth Edition, Mc GrawHill Education.

References:

1. K R Venugopal & S R Prasad , Mastering C , First Edition, Mc GrawHill Education
2. Ashutosh Pandey , Programming in C, First Edition, Cyber Tech Publications
3. YashavantKanetker , Let Us C , Fourteenth Edition, BpB Publications

Practical LAB -II

Practical : 2 hrs. per week

SYLLABUS

1. Fundamental data types, input/output functions scanf(), printf(), Arithmetic expressions,Evaluation of integer, real and mixed mode arithmetic expressions, truncation effect, typecasting.

2. Programs using control structures: If statement, if else statement, nested if...else statement,Else if ladder, switch, for, while, do…while, break and continue. Using nested loops.

3. Programs using one dimensional array: Creation of array, linear array operations,search, sort, Static initialization of arrays etc.Two dimensional array, matrix addition, matrix multiplication, transpose of a matrix.

4. User Defined Functions: Programs using different categories of functions return typefunctions, void type functions, program using recursive functions (factorial) etc.

Semester II

CA2CMP01 : Software Lab I

Scheme of Evaluation for software lab I external (Practical Lab – I and PracticalLab-II) is as follows: (in Second Semester)

Division of Marks (Practical - 3 hours External)

First program based on Lab I word/excel **- 15 marks**

Second program should be based on Lab II c program **- 15 marks**

Viva Voce **– 03 marks ,** Lab Record (minimum of 15 Programs from each section) **- 7 marks**

Total Marks - 40 marks

BSc Petrochemicals Complementary papers - Semester III

CA3CMT03 : Web Technology and Programming

Theory: 2 hrs. per week Credits: 2

Module I - 6 Hrs.

Computer networks- Advantages of networking, Network topologies (Bus, Ring, Star,Tree, Mesh, Hybrid), types of networks - LAN, MAN, WAN, intranet and Internet ,Communication Media – Guided: Twisted Pair, Coaxial Cable and Optic Fiber, Unguided:infrared, microwave & satellite, Concept of the point to point and Broadcast Network,Networking Tools-MODEM, Repeater, Hub, Switches, Routers, Bridge, Gateway, Firewall

Module II - 6 Hrs.

Concept of ISP (Internet Service Provider), Internet Backbone, Concept of URL Address,Domain Names, Hypertext Concepts and World Wide Web, Protocols- FTP, NNTP, SMTP,HTTP, POP, PPP, Email-Electronic Post Service, ISO OSI Reference Model

Module III - 8 Hrs.

Web server and proxy server, Internet Viruses (Trojan, WORM), Internet security issues(Malware, Spyware, Hacking etc.), types of firewall, Basics of Data compression anddata encryption, Digital Signatures, Digital Certificates

Module IV - 10 Hrs.

The art of creating the website, WWW, website, webpage, and home page, The HTMLprogramming basics, General structure of HTML document, HTML tags and attributes,Formatting Tags, Choice of page color, including banners, Tables, Lists, Example ofHTML page. Tags - <HTML>, <BODY>, <HEAD>, <TITLE>, <H1>, <H2>, ……<H6>, <BR>,<B>, <I>, <U>, Adding hyperlinks

Module V - 6 Hrs.

Introduction web browsers (like Internet Explorer, Mozilla Firefox, Google Chrome),Basic tools in the browser(back, forward, homepage, stop, refresh), search engine forinternet, meta search engine

Books of study:

1. Fundamentals of Computers by P. K Sinha

2. Computer Networks by Andrew S. Tanenbaum, David J. Wetherall

Reference:

1. Internet & Web Technologies, Raj Kamal, Tata McGraw Hill

2. HTML Black Book, Steven Holzner, Dreamtech Publishers

3. Principles of web page design by Joel Sklar, Vikas publications

4. Data Communication & Networking by Behrouz A Forouzan Fourth Edn. McGraw Hill

Semester III

Practical LAB –III

Practical : 2 hrs. per week

 Internet browsing

 email - creation of account, reception, compilation, sending etc

 Web page designing using HTML tags and linking with other pages.

1. Create HTML document with following formatting – Bold, Italics, Underline, Colors,Headings, Title, Font and Font Width, Background, Paragraph, Line Brakes,Horizontal, Line, Blinking Text as well as marquee Text.

2. Create HTML document with Ordered and Unordered lists, Inserting Images, Internaland External linking

3. Create HTML document with Table:

Some image here

4. Create Form with Input Type, Select and Text Area in HTML.

5. Create an HTML containing Roll No., student's name and Grades in a tabular form.

6. Create an HTML document (having two frames) which will appear as follows:

About

Department 1

Department 2

Department 3

This frame would show thecontents according to the linkclicked by the user on the leftframe.

7. Create an HTML document containing horizontal frames as follows:

Department Names (could be along with Logos)

Contents according to the Link clicked

8. Create a website of 6 – 7 pages with different effects as mentioned in aboveproblems.

9. Create HTML documents (having multiple frames) in the following three formats:

Frame1

Frame2

Frame1

Frame2 Frame3

10. Create a form using HTML which has the following types of controls:

I. Text Box

II. Option/radio buttons

III. Check boxes

IV. Reset and Submit buttons

11. A. Create a web site for ICC world cup tournament which contain

1. A home page

2. Tournament schedule should be present in a table.

3. Details of previous world cups

4. Details of all teams.

Include form, Image, tables, list, according to their needs

12.Create a web site for your college which contain

a. A home page

b. About your management

c. About your Staffs

d. About your course

e. About your Facilities

All this pages contain appropriate pictures and links between them.

B.Sc Petrochemicals Complementary papers - Semester IV

CA4CMT04 : Visual Programming Techniques

Theory: 2 hrs. per week

Credits: 2

Unit 1: 4 Hrs.

Data Base Management System: basic concepts & structure, Data definition and data manipulation using MS ACCESS

Unit 2 : 10 hrs.

Visual Basic - Basic Concepts: Getting Started with Visual Basic advantages of VB, VB Development Overview, Designing and building the User Interface, creation of forms and adding controls to the form, Setting control properties, Writing Event Driven Code

Visual Basic Projects : Using different types of Projects, Project Explorer Window, VB procedures, subroutines & functions, Comments, Controlling Program Flow IF.. THEN…ELSEIF, SELECT…CASE, Loops-FOR…NEXT, DO, WHILE…WEND. Visual Basic Variables-Data Types Byte, Integer, Long, Single, Double, Currency, Boolean, Date, Object, String & Variant. Variable Declaration-Implicit & Explicit

Unit 3 : 8 Hrs.

Designing the User Interface : VB Form, Adding Forms, Form Properties, Setting Properties with Code, Using Form Drawing Methods, Loading & Unloading Forms, Form Events, Dialog Boxes-Message Box & Input Box, MDI Applications-MDI Parent Form/ChildForms.

Unit 4 : 8 Hrs.

Controls: Tool Box-Label, Text Box, Frame, Command Button, Check Box, Option Button, List Box, Combo Box, Horizontal Scrollbar, Vertical Scrollbar, Timer, Drive List Box, Directory List Box, File List Box, Line, Shape, Image Box, Picture Box, Data Control, OLE Control, Customizing Tool Box, Adding Controls to Forms, Naming Controls, Copying Controls, Control Arrays

Unit 5: 6 Hrs.

Mastering Menus and Toolbars : Menus, Menu Editor, Pop-up Menus, Customising Toolbar, Jet, DAO, Advanced Data Access Methods, ADO, OLEDB Working with other Applications & Database Access: Visual Basic Data Control, Creating Queries in Visual Basic

Books of study:

Peter Norton's Guide to Visual Basic 6 by Peter Norton and Michael Groh, Techmedia publications Chapters: 1-7, 18, 19, (2007)

References:

1. Visual Basic 6 from the Ground Up by Gary Cornell, TataksMcGraw-Hill (2008)

2. Programming in Visual Basic 6.0 by Julia Case Bradley and Anita C Millspaugh, Tata

McGraw-Hill (2005)

3. Using Visual Basic 6 by Bob Roselman, Richard Peasley and Wayne Prunchiah, PHI

Practical LAB –IV

Practical : 2 hrs. per week

1. Designing User Interface using- List Box, Combo Box, Image and Picture Box,

Directory-File-Drive list boxes, Rich text box, etc

2. Creating Menus- Creating Menus and writing Codes, Linking Menus with MDI forms.

3. Database Connectivity using Controls - Designing user interface with forms and

controls and create database connectivity by DAO and ADO Control.

4. Creating Reports - Create reports using Data Report in VB

Semester IV

CA4CMP02 : Software Lab II

Scheme of Evaluation for software lab II external (Practical Lab – III and Practical Lab-IV) is as follows:

Division of Marks (Practical - 3 hours External)

First program based on Lab III HTML **- 15 marks**

Second program should be based on Lab IV VB **- 15 marks**

Viva Voce **– 03 marks**

Lab Record (minimum of 15 Programs from each section) **- 7 marks**

Total Marks - 40 marks

VI. Bachelor of Business Administration

INFORMATION TECHNOLOGY FOR BUSINESS

UNIT I

Excel window components, Set Up a Workbook- Creating Workbooks, Modifying Workbooks, Modifying Worksheets, Customizing the Excel 2010 Program Window, Zooming In on a Worksheet, Arranging Multiple Workbook Windows,Adding Buttons to the Quick Access Toolbar, Customizing the Ribbon, Maximizing Usable Space in the Program Window,Work with Data and Excel Tables- Entering and Revising Data, Moving Data within a Workbook, Finding and Replacing Data, Correcting and Expanding Upon Worksheet Data.

UNIT II

Perform Calculations on Data- Naming Groups of Data, Creating Formulas to Calculate Values, Summarizing Data That Meets Specific Conditions, Finding and Correcting Errors in Calculations, Excel Functions-Financial functions(PMT,RATE, NPER, PV, FV),Logical functions(IF,AND,FALSE,TRUE), Mathematical functions(SUM, PRODUCT, POWER, QUOTIENT, SQRT, SUBTOTAL,ABS, ROUND, GCD, LCM),Statistical functions(AVERAGE, AVERAGEIF, MEDIAN, MODE, STEDV, MIN, MAX , LARGE, SMALL),Excel Charts(Column Chart, Line Chart, Pie Chart, Doughnut Chart, Bar Chart, Area Chart, XY (Scatter) Chart, Bubble Chart.), Chart layout.

UNIT III

Change Workbook Appearance - Formatting Cells, Defining Styles, Applying Workbook Themes and Excel Table Styles, Making Numbers Easier to Read , Changing the Appearance of Data Based on Its Value, Adding Images to Worksheets. Focus on Specific Data by Using Filters- Limiting Data That Appears on Your Screen , Manipulating Worksheet Data , Selecting List Rows at Random, Summarizing Worksheets with Hidden and Filtered Rows , Finding Unique Values Within a Data Set, Defining Valid Sets of Values for Ranges of Cells

UNIT IV

Introduction to Electronic Commerce: Defining Electronic Commerce.-Brief History of Electronic Commerce-Forces Fueling Electronic Commerce.-Electronic Commerce Industry Framework.Types of Electronic Commerce.-Inter-organizational Electronic Commerce.Intra-organizational Electronic Commerce-Consumer-to-Business Electronic Commerce.-Intermediaries and Electronic Commerce.

UNIT V

Firewalls and Transaction Security: Firewalls and Network Security-Transaction Security-Encryption and Transaction World Wide Web and Security. **Electronic Payment Systems:** Overview of the Electronic Payment Technology-Electronic or Digital Cash-Electronic Checks-Online Credit Card-Based Systems-Types of Credit Card Payments-Other Emerging Financial Instruments. Consumer, Legal, and Business Issues.

Reference book

1. Step by Step- Microsoft office professional 2010 , Joyce Cox, Joan Lambert and Curtis Frye, Microsoft
2. Electronic Commerce-A Manager's guide,RaviKalakota, Andrew B. Whinston, Addison-Wesley.

VII. Syllabus- BA Economics Vocational Model II Computer Application

Semester I

CA1CMT01 : Computer Fundamentals
Theory: 5 hrs. per week
Credit: 4

Module I – (12 Hrs)
Fundamentals of Computers: Define computer, introduction to bit, byte, data, information, program, hardware and software, Generations of computers, categories and Types of Computer based on performance - Super Computer, Mainframe, Mini Computer & Micro Computers, Data & Process based – Analog, Digital & Hybrid Computers, Network service based – Server computer, workstation / client computer, Size & usage based - Desktop, Laptop, palmtop, Logical Organization of a Digital Computer, input unit ,Output unit ,Storage unit ,Arithmetic logic unit, Control unit ,CPU. Input devices – keyboard, point and draw devices, data scanning devices, output devices-monitors ,printers, plotters.

Module II -(10 Hrs)
Number systems- Binary, Octal and Hexadecimal, Converting from one number system to another-decimal to a new base, converting to decimal from another bases, converting from base other than ten to base other than ten, short cut method for converting from binary to octal, octal to binary, binary to hexadecimal and hexadecimal to binary, Computer Codes (BCD, EBCDIC, ASCII).

Module III – (12 Hrs)
Boolean Algebra and Logic circuits- fundamental concepts of Boolean Algebra, Postulates of Boolean algebra,Theorems of boolean algebra, Logic Gates- AND, OR, NOT, NAND, NOR, XOR and XNOR, logic circuits, converting expression to logic circuit, The universal NAND gate, universal NOR gate. Exclusive OR and equivalence functions.

Module IV - (10 Hrs)
Computer Software and Languages :define software, relationship between hardware and software, Types of software-system software -Application software, Logical system architecture, Software development steps. Machine language, Assembly language, High-level language. Define Program, purpose of program, algorithms, flowcharts, flowchart symbols, flowcharting rules, advantages and limitations of flowcharts.

Module V – (10 Hrs)
Operating system: Definition, functions of an operating system, types of Operating system: (batch, multiprogramming, time sharing etc.), features of UNIX,LINUX,MS DOS,WINDOWS operating systems.Basic internet services- email, FTP, TELNET, WWW.

Book of Study:
1. Rohit Khorana - Introduction to Computer Science 2nd Edition, Pearson Publishers

2. P.K Sinha, Priti Sinha - Computer Fundamentals , Fourth Edition by, BPB Publications.
3. Comdex Computer Course Kit: Windows 7 with Office 2010

Reference:

1. V. Rajaraman and T. Radhakrishnan An introduction to Digital Computer design
2. B. Ram - Computer fundamentals- Organization and Architecture, First edition
3. A First Course in Computers 2003, Saxena, VIKAS Publications

Semester I

Practical – I Office Automation
Practical: 2 hrs. per week

I. Familiarization of Computer System: Demonstration of various units of Computer system, handling of devices, demo on hardware units, Login process, Booting Process. **MS WORD:** Page formatting, Paragraph formatting , Table creation, Familiarize with Spell check and mail merge facility(10 hrs)

II. MS POWERPOINT: Creating presentation, Animations & Transition, different type of design, Sound , Inserting picture, table, shapes, charts etc.

III. Practicing Operating System Commands: Linux- dir, copy, del, ren, copy con, date, time, chkdsk, mkdir, cd, rmdir, EDIT etc. MS-WINDOWS – using start menu, desk top, task bar, word pad, note pad, file management - creation, copy, delete, moving of files in directories, selecting and executing a program - demonstration of editing. (16 hrs)

BA Economics- Semester II

CA2CMT02 : Computerized Techniques for Office
Theory: 3 hrs. per week
Credit: 3

Module 1: Word processing package- MS Word 2013
Introduction: word user interface elements, creating new documents, basic editing, saving a document, printing a document, print preview, page orientation, viewing documents, setting tabs, page margins, indents, Ruler, Formatting techniques - Font formatting, paragraph formatting, page setup, headers and footers, Bullets and numbered list, borders and shadings, table: placing tables, side-by-side and nested tables, formatting tables, drawings, word art, document templates, find and replace, page break and page numbers, mail merge, spelling and grammar checking, thesaurus, automating documents- macros, E-mail editor. **(14 Hrs.)**

Module 2: Spreadsheet package- MS Excel 2013
Introduction: Excel user interface, Working with cell & cell addresses, Selecting range, Moving, Cutting, Copying with paste, Inserting & deleting cells, Freezing cells, Adding, Deleting & copying worksheet within a work book, Renaming a worksheet. cell formatting options, Formatting fonts, Aligning, wrapping & rotating text, Using borders, Boxes & colors, changing row/column height/width, formatting a worksheet automatically, Insert comments. Using print preview, preparing worksheet for the printer, selecting print area, margin & orientation, using header & footer ,Inserting page breaks.
Conditional formatting – Applying conditional formatting to cells, using multiple cell rules, using color scale and icon set, creating new rule and managing existing rules. Creating list, using custom list, sorting and filtering of data and advanced filters. **(10Hrs.)**

Module 3: Formula, functions and charts
Working with excel formula, different type of cell references and linking data between worksheet
Logical functions – IF, AND, OR and Nested IF function.

Math functions – ROUND, RAND, CELING, FLOOR, INT, LCM, MOD, EVEN, SUNIF, SQRT and Trigonometric functions
Date Time functions – DATE, TIME, NOW, DATEVLAUE, WEEKDAY, DAY, MONTH AND YEAR
Statistical functions- AVERAGE, AVERAGEA, AVERAGEIF, COUNT, COUNTA, COUNTBLANK, COUNTIF, SUM , SUMA, MIN, MINA, MAX and MAXA
String functions – LEFT, RIGHT, MID, TRIM, LTRIM, RTRIM, UPPER, LOWER, PROPER, SEARCH, REPLACE and CONCATENATE. Database functions – DSUM, DAVERAGE, DMIN, DMAX, and DPRODUCT
Information functions – CELL, ERROR, ISERROR, ISBLANK, ISNONTEXT, ISTEXT, ISNUMBER and TYPE

Create a chart, choosing chart type, edit chart axis-titles, labels, data series and legend, adding a text box, rotate text in a chart, saving a chart. use of pivot tables-designing of templates in excel and sharing data with other applications. **(16 Hrs.)**

Module 4: Advanced Excel Features
Introduction to VBA macro, recording macro and understanding code behind the macro What if Analysis - Creating Scenarios, Creating a Scenario Report. Working with Data Tables, Using Goal Seek, Data Forms - Adding Data using the Data Form, Totals and Subtotals. **(8 Hrs.)**

Module 5: Presentation Package -MS PowerPoint 2013
Advantages of presentation packages, screen layout, creating presentations, inserting – deleting - moving slides, adding sound and video, formatting slides, slide layout, presentation views, color, scheme, background, action buttons, slide transition, custom animation, creating master slide, -managing slide shows, rehearsing slide show, setting intervals, using pen. **(6 Hrs.)**

Book of Study:

1. John Walkenbach, Herb Tyson – Office 2013 Bible– Wiley India Pvt Ltd

Semester II

Practical –II Computerised Techniques for Office
Practical: 2 hrs. per week
1 Preparing Word Documents with all the formatting and the mail merge feature
2 Use of formulae, built in functions and Charts in spreadsheet
3 Preparing attractive presentations in PowerPoint

Semester II

CA2CMP01 : Practical-I & II external
Credit: 2

Scheme of Evaluation for Practical-I & II external is as follows: (in Even Semesters)

Division of Marks (Practical - 3 hours External)
First program from practical -I **- 15 marks**
Second program from practical – II excel **- 15 marks**

Viva Voce **-03 marks**
Lab Record (minimum of 15 Programs from each section) **- 07 marks**

Total Marks - 40 marks

BA Economics –Computer Application -Semester III

CA3CMT03 : DATABASE MANAGEMENT SYSTEM
Theory: 2 hrs. per week
Credit: 3

Module 1: Database Concepts
Introduction to DBMS concepts. Advantages of DBMS over file based system, Operation on files, Structure of DBMS, Data Model Classifications, Entity-Relationship Concept. Data independence. Components of DBMS, Database users, User classification and responsibilities, Role of DBA. **(8 Hrs)**

Module 2: Relational Database Management System
RDBMS & Relationships. Concept of Relational data model. Relations and Properties, Components of – RDBMS. Advantages of RDBMS. Concept of table, filed & record. Keys – Primary, candidate, alternate and foreign keys. Relationships, Type of relationships one to one, one to many and many to many, defining relationships, Referential integrity. Normalisation- 1st , 2nd and 3rd normal forms. **(8 Hrs)**

Module 3: Introduction to MS Access 2013
Basic elements of MS-Access 2013: Introduction-objects in Ms Access-create, open, and close Database, creating a database table-different ways of creating tables, data types, setting the primary key, Properties of the fields-saving, closing and modifying tables, creating table Relationships-editing relationships.
(14 Hrs)

Module 4: Queries and Forms
Queries & forms in Access: types of queries-creating a query-saving queries –Select query, summary queries, cross tab queries, action queries. Forms –The forms wizard editing the data in a form- The form design view-The form design bar-The tool box- Working with controls. **(14 Hrs)**

Module 5: Reports and Other Features
Reports in Access: The report wizard-The Report design view-The report design bar-The tool box-The preview window-grouping and sorting-Printing a report. Saving as ACCDE Format, Importing and Exporting data with MS Excel Worksheet, Setting Database password, Backup Database, Analyse Table Tool. **(10 Hrs)**

Book of study:

1. C J Date- Introduction to Database Management Systems, Pearson Education
2.Michael R Groh- MS Access 2013 Bible, Wiley Publications

Semester III

Practical – III DATABASE CONCEPTS and MS-ACCESS

Practical :2 hrs. per week
1. Creation of database and setting of properties and other attributes such as primary key, foreign key and relationships
2. Creation of all type of queries through design view and wizard
3. Creation of forms and reports

Note:
A record with minimum fifteen exercises covering the main types of queries, forms and reports is essential

BA Economics –Computer Application -Semester IV

Unit 1: 4 Hrs.

Data Base Management System: basic concepts & structure, Data definition and data manipulation using MS ACCESS

Unit 2 : 10 hrs.

Visual Basic - Basic Concepts: Getting Started with Visual Basic advantages of VB, VB Development Overview, Designing and building the User Interface, creation of forms and adding controls to the form, Setting control properties, Writing Event Driven Code

Visual Basic Projects : Using different types of Projects, Project Explorer Window, VB procedures, subroutines & functions, Comments, Controlling Program Flow IF.. THEN…ELSEIF, SELECT…CASE, Loops-FOR…NEXT, DO, WHILE…WEND. Visual Basic Variables-Data Types Byte, Integer, Long, Single, Double, Currency, Boolean, Date, Object, String & Variant. Variable Declaration-Implicit & Explicit

Unit 3 : 8 Hrs.

Designing the User Interface : VB Form, Adding Forms, Form Properties, Setting Properties with Code, Using Form Drawing Methods, Loading & Unloading Forms, Form Events, Dialog Boxes-Message Box & Input Box, MDI Applications-MDI Parent Form/ChildForms.

Unit 4 : 8 Hrs.

Controls: Tool Box-Label, Text Box, Frame, Command Button, Check Box, Option Button, List Box, Combo Box, Horizontal Scrollbar, Vertical Scrollbar, Timer, Drive List Box, Directory List Box, File List Box, Line, Shape, Image Box, Picture Box, Data Control, OLE Control, Customizing Tool Box, Adding Controls to Forms, Naming Controls, Copying Controls, Control Arrays

Unit 5: 6 Hrs.

Mastering Menus and Toolbars : Menus, Menu Editor, Pop-up Menus, Customising Toolbar, Jet, DAO, Advanced Data Access Methods, ADO, OLEDB Working with other Applications & Database Access: Visual Basic Data Control, Creating Queries in Visual Basic

Books of study:

Peter Norton's Guide to Visual Basic 6 by Peter Norton and Michael Groh, Techmedia publications Chapters: 1-7, 18, 19, (2007)

References:

1. Visual Basic 6 from the Ground Up by Gary Cornell, TataksMcGraw-Hill (2008)

2. Programming in Visual Basic 6.0 by Julia Case Bradley and Anita C Millspaugh, Tata McGraw-Hill (2005)

3. Using Visual Basic 6 by Bob Roselman, Richard Peasley and Wayne Prunchiah, PHI

Practical LAB –IV

Practical : 2 hrs. per week

1. Designing User Interface using- List Box, Combo Box, Image and Picture Box, Directory-File-Drive list boxes, Rich text box, etc

2. Creating Menus- Creating Menus and writing Codes, Linking Menus with MDI forms.

3. Database Connectivity using Controls - Designing user interface with forms and controls and create database connectivity by DAO and ADO Control.

4. Creating Reports - Create reports using Data Report in VB

Semester IV

CA4CMP02 : Practical-III & IV external

Credit: 2

Scheme of Evaluation for Practical-III & IV external is as follows: (in Even Semesters)
Division of Marks (Practical - 3 hours External)
First program from practical –III **- 15 marks**
Second program from practical – IV **- 15 marks**
Viva Voce **-03 marks**
Lab Record (minimum of 15 Programs from each section) **- 07 marks**
Total Marks - 40 marks

VIII. Syllabus – B.Sc. BIOINFORMATICS (Complementary paper)

SEMESTER I

CA1CMT01 : Computer Fundamentals

Module I

Fundamentals of Computers: Define computer, introduction to bit, byte, data, information, program, hardware and software, Generations of computers, categories and Types of Computer based on performance - Super Computer, Mainframe, Mini Computer & Micro Computers, Data & Process based – Analog, Digital & Hybrid Computers, Network service based – Server computer, workstation / client computer, Size & usage based - Desktop, Laptop, palmtop, Logical Organization of a Digital Computer, input unit ,Output unit ,Storage unit ,Arithmetic logic unit, Control unit ,CPU. Input devices – keyboard, point and draw devices, data scanning devices, output devices-monitors ,printers, plotters.

Module II -

Number systems- Binary, Octal and Hexadecimal, Converting from one number system to another-decimal to a new base, converting to decimal from another bases, converting from base other than ten to base other than ten, short cut method for converting from binary to octal, octal to binary, binary to hexadecimal and hexadecimal to binary, Computer Codes (BCD, EBCDIC, ASCII)

Module III

Boolean Algebra and Logic circuits- fundamental concepts of Boolean Algebra, Postulates of Boolean algebra,Theorems of boolean algebra, Logic Gates- AND, OR, NOT, NAND, NOR, XOR and XNOR, logic circuits, converting expression to logic circuit, The universal NAND gate, universal NOR gate. Exclusive OR and equivalence functions.

Module IV

Computer Software and Languages :define software, relationship between hardware and software, Types of software-system software -Application software, Logical system architecture, Software development steps. Machine language, Assembly language, High-level language. Define Program, purpose of program, algorithms, flowcharts, flowchart symbols, flowcharting rules, advantages and limitations of flowcharts.

Module V

Operating system: Definition, functions of an operating system, types of Operating system: (batch, multiprogramming, time sharing etc.), features of UNIX,LINUX,MS DOS,WINDOWS operating systems. Basic internet services- email, FTP, TELNET, WWW.

Book of Study:

1. Rohit Khoana-Introduction to Computer Science 2nd Edition, Pearson
2. P.K Sinha, Priti Sinha -Computer Fundamentals, Fourth edition , BPB Publication.

Reference:

1. V. Rajaraman and T. Radhakrishnan An introduction to Digital Computer design
2. Computer fundamentals by B. Ram
3. A First Course in Computers 2003, Saxena, VIKAS

BSc. BIOINFORMATICS - Semester V

CA5CMT02: WEB PROGRAMMING AND PERL

Module I
Introduction to internet, www, servers and browsers. Introduction to web programming languages-HTML, DHTML, XML,JAVASCRIPT etc..

Module II
Introduction to HTML-structures of HTML.Text formatting, Lists-ordered and unordered lists. Adding graphics to HTML documents, Tables, Linking documents, Frames, Forms.

Module III
Introduction to Javascript-Dta types, literals, operators and expressions, Placing text in browser

Module IV
Javascript programming constructs-conditional checking using if,switch,Loops-for, while, do while loops, Dialogue boxes, Functions in javascript.

Module V
PERL-Introduction , perl strings, scalar variables, arrays, hashes. Operators and decision making in PERL-if, while, until, for loop, foreach loop, string handling functions, regular expressions.

Book of Study:
1. HTML,DHTML,JAVASCRIPT<PERL CGI(REVISED EDITION) by IVAN BAYROOS
2. Perl-5 Hermann
3. Perl programming for Bio Informatics and Biologists. D. Curtis Jamison, Wiley India

BSc. BIOINFORMATICS - SEMESTER VI

CA6CMT03 : ALGORITHMS, DATASTRUCTURE AND COMPILER

Module I.
Different types of data structures, complexity of algorithms, big O notations. Arrays-bubble sort, linear search, binary search.

Module II.
Stacks and queues-organization and operation on stacks-conversion between infix, suffix and prefix representation, quick sort, heap sort, merge sort.

Module III:
Queues: Organization and operations on queues, lamination of simple queue – variations in a queue, circular queue double ended queue, Priority queue – Applications of queues.

Module IV:
Design and analysis technique-divide and conquer,dynamic programming,greedy algorithms,tree graph algorithms-breadth first search,depth first search, minimal spanning tree algorithms,shortest path.

Module V.
Concept of compiler and interpreter, different phases of compilation, lexical analyzer concept, finite state automata, regular expressions.

Reference:
1.Fundamental of Computer Algoritms By Horowitz Ellis, Sartaj Sahni, Computer Science press.
2.Introduction of Algorithms By Coremen,Charker E Leiserson.
3. Data Structures Through C (A Practical Approach), G.S Baluja, Danapat Rai & Co
4. Fundamentals of Data Structures By Horowitz Ellis And Sartaj Sajni.
5.Principles of Compiler Design By Aho & Ulman.
6.Computer Algorithms Introduction To Design & Analysis By Saara Baase,Allen Van Gelder.
7.Data Structures And Algorithms By Alfred V Aho,John E Hopcroft,Jeffrey D Ullman.

THE COCHIN COLLEGE

DEPARTMENT OF COMPUTER SCIENCE

TIME TABLE 2020-2021 ODD SEMESTER

SEMESTER V

	I	**II**	**III**	**IV**	**V**
MONDAY	CN	JAVA	OC	JAVA	CN
TUESDAY	JAVA	JAVA	OC	MINI PROJECT	
WEDNESDAY	CN	JAVA	OC	MINI PROJECT	
THURSDAY	ITE	JAVA	OC	MINI PROJECT	
FRIDAY	ITE	JAVA	CN	ITE	JAVA

SEMESTER III

	I	**II**	**III**	**IV**	**V**
MONDAY	MP	DS	DS	CG	OS
TUESDAY	CG	OS	DS	MP	Stat
WEDNESDAY	MP	CG	OS	DS	Stat
THURSDAY	DS	CG	DS	Stat	MP
FRIDAY	DS	Stat	MP	OS	DS

SEMESTER I

	I	**II**	**III**	**IV**	**V**
MONDAY	MATHS	C	ENG	ENG	C
TUESDAY	Stat	C	ENG	Stat	C
WEDNESDAY	C	MATHS	C	ENG	CFDP
THURSDAY	CFDP	CFDP	MATHS	ENG	Stat
FRIDAY	MATHS	CFDP	Stat	C	C

LAB

	I	**II**	**III**	**IV**	**V**
MONDAY	II BSc	I BSc	DS	JAVA	TALLY
TUESDAY	JAVA	TALLY	DS	PROJECT	PROJECT
WEDNESDAY	C	I BSc	C	PROJECT	PROJECT
THURSDAY	DS	IT	DS	PROJECT	PROJECT
FRIDAY	II BSc	IT	I BSc	C	JAVA



MAHATMA GANDHI UNIVERSITY

PRIYADARSINI HILLS
KOTTAYAM
KERALA



SYLLABUS FOR UNDER GRADUATE PROGRAMME IN

BOTANY

UNDER THE RESTRUCTURED CURRICULUM
IN
CHOICE BASED CREDIT SYSTEM (UGCBCS)

(EFFECTIVE FROM 2017 ADMISSIONS)

PREPARED BY:

BOARD OF STUDIES IN BOTANY (UG) AND FACULTY OF SCIENCE, MAHATMA GANDHI UNIVERSITY, KOTTAYAM

CONTENTS

Model I Botany: Programme structure, design, summary of courses and credits …… **2**

Model I: Combination of core and complementary courses and semester-wise distribution **4**

Semester I: core course **5**
Semester II: core course **7**
Semester III: core course …… **9**
Semester IV: core course ……..... **11**
Semester V: core courses ……..... **13**
Semester V: open courses …… **22**
Semester VI: core courses …… **27**
Semester VI: Elective courses ……... **36**

Model I complementary courses ……..... 42 - 48

Semester I: complementary course ….. **42**
Semester II: complementary course …. **43**
Semester III: complementary course ... **45**
Semester IV: complementary course ... **47**

Model II (Vocational) Botany: Programme structure, design, summary of courses and credits . **49**

Model II: combination of vocational courses and semester-wise distribution of courses …….. **51**

1. Environmental monitoring and management …… 52 - 60

Semester I: vocational courses…….. **52**
Semester II: vocational courses…… **54**
Semester III: vocational courses…….. **56**
Semester IV: vocational courses…….. **59**

2. Food microbiology ……. …….. 61 - 74

Semester I: vocational courses ……..... **61**
Semester II: vocational courses ……... **64**
Semester III: vocational courses …….. **68**
Semester IV: vocational courses …….. **71**

3. Horticulture and nursery management …….. 75 - 84

Semester I: vocational courses ……. **75**
Semester II: vocational courses …….. **77**
Semester III: vocational courses …….. **79**
Semester IV: vocational courses …….. **82**

4. Plant biotechnology …… ……. 85 - 93

Semester I: vocational courses **85**
Semester II: vocational courses …….. **87**
Semester III: vocational courses ……... **89**
Semester IV: vocational courses …….. **91**

Model II (Vocational) complementary courses: combination of courses, semester-wise distribution of courses and credits …….. **94**

Semester I: complementary course ….. **94**
Semester II: complementary course …. **96**
Semester III: complementary course ... **98**
Semester IV: complementary course ... **99**

Model III (Botany and Biotechnology dual core) Botany: Programme structure, design, summary of courses and credits …… **101**

Model III: combination of vocational courses and semester-wise distribution of courses …….. **103**

Semester I: core courses …….. **104**
Semester II: core courses ……. **108**
Semester III: core courses …… **111**
Semester IV: core courses …… **115**
Semester V: core courses …… **119**
Semester VI: core courses …… **121**

B Sc BOTANY PROGRAMME – MODEL I

PROGRAMME DESIGN

The UG programme in Botany (Model - I) must include (a) Common courses*, (b) Core courses (c) Complementary Courses (d) Open courses (e) Choice based courses and (f) Project work. No course shall carry more than 4 credits. The student shall select any one Open course in Semester V offered by different departments in the same institution. The number of courses for the restructured programme should contain 12 compulsory core courses, 1 open course, 1 choice based elective course from the frontier area of the core courses, 6 core practical courses, 1 project work, 8 complementary courses and 2 complementary practical courses. There should be 10 common courses, or otherwise specified, which includes the first and second language of study.

PROGRAMME STRUCTURE: SUMMARY OF COURSES AND CREDITS

Sl. No.	Course type	No. of courses	Total credits
1	Common course I - English	6	22
2	Common course II – Additional language	4	16
3	Core + Practical	12 + 6	46
4	Complementary I + Practical	4 + 2	14
5	Complementary II + Practical	4 + 2	14
6	Open course	1	3
7	Programme elective (Choice based core course)	1	3
8	Project work	1	2
Total		**43**	**120**
Total credits		120	
Programme duration		6 Semesters	
Minimum attendance required		75%	

***Course:** a segment of subject matter to be covered in a semester. Each course is designed variously under lectures/tutorials/laboratory or fieldwork/seminar/project/practical training/ assignments/evalution etc., to meet effective teaching and learning needs.

B Sc BOTANY PROGRAMME – MODEL I

SEMESTER-WISE DISTRIBUTION OF COURSES AND CREDITS

Course Title	Hrs/ week	Credits	Course Title	Hrs/ week	Credits
SEMESTER I			**SEMESTER II**		
Common course – English 1	5	4	Common course – English 3	5	4
Common course – English 2	4	3	Common course – English 4	4	3
Common course – Additional language course 1	4	4	Common course – Additional language course 2	4	4
Core course 1 + Practical	4	3	Core course 2 + Practical	4	3
1st Complementary course – Zoology course 1 + Practical	4	3	1st Complementary course – Zoology course 2 + Practical	4	3
2nd Complementary course – Chemistry/Biochemistry course 1 + Practical	4	3	2nd Complementary course - Chemistry/Biochemistry course 2 + Practical	4	3
Total	**25**	**20**	**Total**	**25**	**20**
SEMESTER III			**SEMESTER IV**		
Common course – English 5	5	4	Common course – English 6	5	4
Common course – Additional language course 3	5	4	Common course – Additional language course 4	5	4
Core course 3 + Practical	5	4	Core course 4 + Practical	5	4
1st Complementary course – Zoology course 3 + Practical	5	4	1st Complementary course – Zoology course 4 + Practical	5	4
2nd Complementary course – Chemistry/Biochemistry course 3 + Practical	5	4	2nd Complementary course – Chemistry/Biochemistry course 4 + Practical	5	4
Total	**25**	**20**	**Total**	**25**	**20**
SEMESTER V			**SEMESTER VI**		
Core course 5 + Practical	5	4	Core course 9 + Practical	5.5	4
Core course 6 + Practical	5.5	4	Core course 10 + Practical	5	4
Core course 7 + Practical	5.5	4	Core course 11 + Practical	6.5	4
Core course 8 + Practical.	5	4	Core course 12 + Practical	5	4
Open course	4	3	Programme elective - Choice based core course	3	3
Total	**25**	**19**	Project work	--	2
			Total	**25**	**21**

B Sc BOTANY PROGRAMME – MODEL I

COMBINATION OF CORE AND COMPLEMENTARY COURSES AND SEMESTER-WISE DISTRIBUTION

Sem.	Course category	Course code	Course title	Instr. hrs.*		Credits
				Th.	Pr.	
I	Core	BO1CRT01	Methodology of Science and an Introduction to Botany	36	36	2 +1
II	Core	BO2CRT02	Microbiology, Mycology and Plant Pathology	36	36	2 + 1
III	Core	BO3CRT03	Phycology and Bryology	54	36	3 + 1
IV	Core	BO4CRT04	Pteridology, Gymnosperms and Paleobotany	54	36	3 + 1
V	Core	BO5CRT05	Anatomy, Reproductive Botany, Microtechnique	54	36	3 + 1
	Core	BO5CRT06	Research methodology, Biophysics and Biostatistics	54	45	3 + 1
	Core	BO5CRT07	Plant Physiology and Biochemistry	54	45	3 + 1
	Core	BO5CRT08	Environmental sciences and Human Rights	54	36	3 + 1
	Open	BO5OPT01	1. Agri-based microenterprises	72	--	3
	Open	BO5OPT02	2. Horticulture and Nursery management	72	--	3
	Open	BO5OPT03	3. Ecotourism	72	--	3
VI	Core	BO6CRT09	Genetics, Plant Breeding and Horticulture	54	45	3 + 1
	Core	BO6CRT10	Cell and Molecular Biology	54	36	3 + 1
	Core	BO6CRT11	Angiosperm morphology, Taxonomy and Economic Botany	72	45	3 + 1
	Core	BO6CRT12	Biotechnology and Bioinformatics	54	36	3 + 1
	Elective	BO6PET01	1. Agribusiness	54	--	3
	Elective	BO6PET02	2. Plant Genetic Resources Management	54	--	3
	Elective	BO6PET03	3. Phytochemistry and Pharmacognosy	54	--	3
	Project	BO6PRT01	Investigatory project work done individually or in groups	--	--	2
I	Compl. 1	BO1CMT01	Cryptogams, Gymnosperms and Plant Pathology	36	36	2 + 1
II	Compl. 2	BO2CMT02	Plant Physiology	36	36	2 + 1
III	Compl. 3	BO3CMT03	Angiosperm Taxonomy and Economic Botany	54	36	3 + 1
IV	Compl. 4	BO4CMT04	Anatomy and Applied Botany	54	36	3 + 1

* 18 instructional hours is equal to one teaching hour per week

SEMESTER I

Core course 1 Code: BO1CRT01

METHODOLOGY OF SCIENCE AND AN INTRODUCTION TO BOTANY

(Theory 36 hrs; Practical 36 hrs; Credits 2 + 1)

Objectives:

- Understand the universal nature of science
- Demonstrate the use of scientific method
- To lay a strong foundation to the study in Botany
- Impart an insight into the different types of classifications in the living kingdom.
- Appreciate the world of organisms and its course of evolution and diversity.
- Develop basic skills to study Botany in detail.

Module 1: Introduction to science and the methodology of science (4 hrs)

Scientific method: steps involved - observation and thoughts, formulation of hypothesis; inductive reasoning - testing of hypothesis; deductive reasoning - experimentation - formulation of theories and laws.

Module 2: Experimentation in science (4 hrs)

Selection of a problem - searching the literature – designing of experiments - selection of variables, study area, and a suitable design. Need of control, treatments and replication. Mendel's experiments as an example of moving from observations to questions, then to hypothesis and finally to experimentation. Ethics in science.

Module 3: Origin and evolution of life (10 hrs)

Origin of life on earth from molecules to life - Oparin's hypothesis, Haldane's hypothesis, Miller-Urey experiment, Panspermia, origin of cells and the first organisms. Evolutionary history of Biological diversity – fossil record; geological time scale – major events in each era. Evidences of evolution; theories of evolution - Lamarck, Wallace, Charles Darwin, Hugo De Vries. Neo-Darwinism – major postulates - isolation, mutation, genetic drift, speciation.

Module 4: Diversity of life and its classification (12 hrs)

Diversity of life: two kingdom classification (Carolus Linnaeus, 1735); phylogenetic classification (August W Eichler, 1878); five kingdom classification (R H Whittaker, 1969). Three domains, six kingdom classification, (Carl Woese, 1990) – criteria for classification, general characters of each kingdom. The three domains of life: Archaea, Bacteria, Eucarya – general characters of each.

Diversity of plants: study the salient features of algae, fungi, bryophytes, pteridophytes, gymnosperms and angiosperms.

Module 5: Basic Botanical skills (6 hrs)

Light microscope: dissection and compound microscope – parts and uses. Preparation of specimens for light microscopy - collection and preservation of plant specimens; killing and fixing; killing agents - formalin, ethyl alcohol; fixing agents - Carnoys fluid, Farmer's fluid, FAA; herbarium (brief study only). Whole mounts and sections – hand sectioning – TS, TLS, RLS. Staining plant tissues: purpose; stains - safranine, acetocarmine, crystal violet. Temporary and permanent mounting, mountants.

PRACTICAL (36 hrs)

1. Design an experiment to verify a given hypothesis.
2. Conduct a survey-based inquiry on a given topic (To test the validity of a given hypothesis. E.g., all angiosperm parasites are Dicot plants).
3. Select an important classical experiment and find out the different elements of the methodology of science (e.g., Robert Koch experiment).
4. Conduct field surveys to identify and collect plant specimens to appreciate the diversity of plant kingdom. Submit five preserved specimens (in bottles and/or herbarium) belonging to diverse groups.
5. Identification of plants with vascular elements, plants which produce flowers, fruits, seeds, cone, sporophyll, embryos and study their salient features.
6. Prepare temporary, stained hand sections (TS, TLS, RLS) of plant specimens appropriate for light microscopic studies.

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SEMESTER II

Core course 2 Code: BO2CRT02

MICROBIOLOGY, MYCOLOGY AND PLANT PATHOLOGY

(Theory 36 hrs; Practical 36 hrs; Credits 2 + 1)

Objectives:

- Understand the world of microbes, fungi and lichens
- Appreciate the adaptive strategies of the microbes, fungi and lichens
- To study the economic and pathological importance of microorganisms

MICROBIOLOGY (Theory 9 hrs; Practical 9 hrs)

Module 1: Introduction (1 hr)

Introduction to microbiology, scope of microbiology.

Module 2: Bacteria (4 hrs)

Bacteria: general characters and classification based on staining, morphology and flagellation. Ultra structure of bacteria. Reproduction - binary fission. Genetic recombination in bacteria - conjugation, transformation and transduction. Economic importance of bacteria.

Module 3: Viruses (2 hrs)

General characters of viruses, viriods and prions. Structure of TMV and Bacteriophage (λ). Multiplication of λ phage – lytic and lysogenic cycle.

Module 4: Applied microbiology (2 hrs)

Isolation and culture of bacteria; media used – general purpose and selective media, applications of bacterial culture (brief study only). Role of microbes: in producing antibiotics, vine, vinegar, curd – role in N_2 fixation, as biofertilizers – role in food spoilage (Brief study only).

PRACTICAL (9 hrs)

1. Gram staining - curd, root nodules.
2. Isolation of microbes from soil through serial dilution and streak plate method.
3. Demonstrate the culture of bacteria.
4. Microbes and type of fermentation - vine, vinegar, curd.

MYCOLOGY (Theory 18 hrs; Practical 18 hrs)

Module 5: Introduction, classification and types of fungi (13 hrs)

General characters of fungi. Classification of fungi - Ainsworth (1973). Distinguishing characters of the different classes of fungi with special reference to reproductive structures and life history of the genera mentioned in each group:

Myxomycotina – *Physarum*; Mastigomycotina – *Albugo*; Zygomycotina - *Rhizopus*; Ascomycotina – Hemiascomycetes - *Saccharomyces*; Plectomycetes - *Penicillium*; Pyrenomycetes – *Xylaria*; Discomycetes - *Peziza*; Basidiomycotina – Teliomycetes – *Puccinia*; Hymenomycetes – *Agaricus*; Deuteromycotina – *Fusarium.*

Module 6: Economic importance of fungi (3 hrs)

Useful and harmful effects of fungi - medicinal, industrial, agricultural, food, genetic studies, spoilage, fungal toxins and diseases. Mycorrhiza: ecto- and endomycorrhiza, significance.

Module 7: Lichens (2 hrs)

General characters, types, general internal structure. Economic and ecological significance of lichens. Structure, reproduction and life cycle of *Parmelia.*

PRACTICAL (18 hrs)

1. Micropreparation and detailed microscopic study of *Rhizopus, Albugo, Saccharomyces, Penicillium, Xylaria, Peziza, Puccinia, Fusarium* and *Parmelia*.
2. Staining and microscopic observation of endomycorrhizal fungus.
3. Investigation of fungal succession on cow dung.

PLANT PATHOLOGY (Theory 9 hrs; Practical 9 hrs)

Module 8: Plant disease development (3 hrs)

History of plant pathology. Classification of plant diseases on the basis of causative organism and symptoms. Host parasite interaction - defence mechanisms in host, mechanism of infection, transmission and dissemination of diseases.

Module 9: Common plant diseases (4 hrs)

Study of following diseases with emphasis on symptoms, cause, disease cycle and control: Bunchy top of Banana, Bacterial blight of Paddy, Root wilt of Coconut, Abnormal leaf fall of Rubber, Root knot disease of Pepper, Leaf mosaic disease of Tapioca, Citrus canker.

Module 10: Control of diseases (2 hrs)

Prophylaxis - quarantine measures, seed certification; Therapeutic - physical therapy, chemotherapy; Biological control and its significance. Fungicides - Bordeaux mixture. Tobacco and Neem decoction (Brief study only).

PRACTICAL (9 hrs)

1. Identify the diseases mentioned in the syllabus with respect to causative organisms and symptoms
2. Submit herbarium preparations of any three of the diseases mentioned.
3. Learn the technique of preparing Bordeaux mixture, Tobacco and Neem decoction.

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SEMESTER III

Core course 3 Code: BO3CRT03
PHYCOLOGY AND BRYOLOGY
(Theory 54 hrs; Practical 36 hrs; Credits 3 + 1)

Objectives:

- To study the evolutionary importance of Algae as progenitors of land plants
- Understand the unique and general features Algae and Bryophytes and familiarize it
- To study the external morphology, internal structure and reproduction of different types of Algae and Bryophytes
- Realize the application of Phycology in different fields

PHYCOLOGY (Theory 36 hrs; Practical 27 hrs)

Module 1: Introduction to Phycology and classification of Algae (9 hrs)

Introduction: general characters, habitat diversity, range of thallus structure and pigments in algae; structure of algal flagella. Different types of life cycle and alternation of generations in algae. Classification: by Fritsch (1945); brief introduction to the modern classification by Lee (2009) [up to divisions].

Module 2: Type study (18 hrs)

Salient features, thallus structure and reproduction of algae in the following groups with special reference to the type(s) mentioned: Cyanophyceae - *Nostoc*; Chlorophyceae - *Volvox, Oedogonium, Cladophora, Chara;* Xanthophyceae – *Vaucheria;* Bacillariophyceae - *Pinnularia*; Phaeophyceae – *Ectocarpus, Sargassum*; Rhodophyceae - *Polysiphonia*.

Module 3: Artificial culture and economic importance of Algae (9 hrs)

Algal culture: isolation, cultivation and preservation of micro- and macro-algae. Economic importance of algae: algae as food, SCP, fodder, green manure, role in N_2 fixation, medicine and biofuels. Commercial products from Algae - carrageenin, agar-agar, alginates and diatomaceous earth. Role of algae in pollution studies: as indicators of pollution and as bioremediation agents. Eutrophication – algal bloom; harmful and toxic algal blooms – neurotoxins and parasitic algae.

PRACTICAL (27 hrs)

1. Conduct a field visit to any one of the ecosystems rich in Algae to experience algal diversity. Submit a report with photographs.
2. Make micropreparations of vegetative and reproductive structures of the types mentioned in the syllabus.
3. Algal Culture: isolation and cultivation of micro- and macro-algae in suitable growth media (Demonstration only).
4. Familiarizing the technique of algal collection preservation.

BRYOLOGY (Theory 18 hrs; Practical 9 hrs)

Module 4: General introduction and classification of bryophytes (4 hrs)

Introduction, general characters and classification of bryophytes by Rothmaler (1951); a very brief account of systems and classifications by Goffinet *et al* (2008).

Module 5: Type study (12 hrs)

Distribution, morphology, anatomy, reproduction and life cycle of the following types (developmental details are not required): Hepaticopsida - *Riccia, Marchantia*; Anthocerotopsida - *Anthoceros*; Bryopsida - *Funaria*. Evolution of gametophyte and sporophyte among Bryophytes.

Module 6: Economic importance (2 hrs)

Economic importance of Bryophytes – biological, ecological, medicinal and as potting material.

PRACTICAL (9 hrs)

1. Study the habit, anatomy of thallus and reproductive structures of *Riccia, Marchantia, Anthoceros,* and *Funaria*.

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SEMESTER IV

Core course 4 Code: BO4CRT04

PTERIDOLOGY, GYMNOSPERMS AND PALEOBOTANY

(Theory 54 hrs; Practical 36 hrs; Credits 3 + 1)

Objectives:

- Understand the diversity in habits, habitats and organization of various groups of plants.
- To impart an insight into the modern classifications in lower forms of plants.
- Understand the evolutionary trends in Pteridophytes and Gymnosperms.
- Study the anatomical variations in vascular plants.
- Understand the significance of Paleobotany and its applications.

PTERIDOLOGY (Theory 27 hrs; Practical 27 hrs)

Module 1: General introduction and classification of Pteridophytes (5 hrs)

Introduction, general characters and classification of Pteridophytes up to classes by Smith (1955) and a very brief account of the classification by Christenhusz *et a*l., 2011.

Module 2: Type study (18 hrs)

Study the distribution, morphology, anatomy, reproduction, life cycle and affinities of the following types (Developmental details are not required): Psilophyta - *Psilotum*; Lycophyta - *Lycopodium, Selaginella;* Sphenophyta - *Equisetum;* Pterophyta - *Pteris, Marsilea.* Stelar evolution in Pteridophytes; Heterospory and seed habit.

Module 3: Economic importance (4 hrs)

Importance of Pteridophytes: medicinal, ornamental, as biofertilizer.

PRACTICAL (27 hrs)

1. Habit, TS of stem, LS of strobilus and sections of special structures of the following types: *Psilotum, Lycopodium, Selaginella, Equisetum, Pteris, Marsilea.*

GYMNOSPERMS (Theory 18 hrs; Practical 9 hrs)

Module 4: General introduction and classification of Gymnosperms (5 hrs)

Introduction, General characters, classification of Gymnosperms by Sporne (1965) and a very brief account of the classification by Christenhusz *et al* (2011).

Module 5: Type study (11 hrs)

Distribution, morphology, anatomy, reproduction, life cycle and affinities of the following types (Developmental details are not required): Cycadopsida – *Cycas*; Coniferopsida – *Pinus*; Gnetopsidae – *Gnetum.* Affinities of Gymnosperms with Pteridophytes and Angiosperms.

Module 6: Economic importance of Gymnosperms (2 hrs)

Uses of Gymnosperms: as food, medicine, in industry and as ornamental plants.

PRACTICAL (9 hrs)

1. Study of the habit, TS of leaf and stem, morphology of reproductive structures of *Cycas*, *Pinus* and *Gnetum.*

PALEOBOTANY (Theory 9 hrs)

Module 6: Fossils (6 hrs)

Introduction to paleobotany and its significance. Fossil formation, types of fossils. Study of fossil Bryophyte - *Naiadita lanceolata;* fossil Pteridophytes – *Rhynia, Calamites;* fossil Gymnosperm – *Williamsonia.* Applied aspects of Paleobotany - exploration of fossil fuels.

Module 7: Paleobotany in India (3 hrs)

Brief study of the fossil deposits in India. Important Indian Paleobotanical Institutes, contributions of Indian Paleobotanists - Birbal Sahni.

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SEMESTER V

Core course 5 Code: BO5CRT05

ANATOMY, REPRODUCTIVE BOTANY AND MICROTECHNIQUE

(Theory 54 hrs; Practical 36 hrs; Credits 3 + 1)

Objectives:

- Imparting an insight into the internal structure and reproduction of the most evolved group of plants, the Angiosperm.
- Understand the individual cells and also tissues simultaneously
- Understand the structural adaptations in plants growing in different environment.
- Understand the morphology and development of reproductive parts.
- Get an insight in to the fruit and seed development.
- Understand the techniques used to preserve and study plant materials.

ANATOMY (Theory: 27 hrs. Practical: 18 hrs)

Module 1: Structure and composition of plant cells (8 hrs)

Cell wall: structure of cell wall; sub-microscopic structure - cellulose, micelle, micro fibril and macro fibril; structure and function of plasmodesmata, simple and bordered pits; different types of cell wall thickening in treachery elements; extra cell wall thickening materials. Growth of cell wall - apposition, intussusception. Non-living inclusions in plant cells: food products, secretory products, excretory (waste) products - nitrogenous and non nitrogenous.

Module 2: Organization of tissues (9 hrs)

Tissues: meristematic tissue – characteristic features, functions and classification. Theories on apical organization - apical cell theory, histogen theory, tunica-corpus theory. Permanent tissues - structure and function of simple and complex tissues. Secretory tissues: external secretory tissue - glands and nectaries; internal secretory tissues - laticifers.

Tissue systems: epidermal tissue system - epidermis, cuticle, trichome; stomata – structure, types; bulliform cells. Ground tissue system - cortex, endodermis, pericycle, pith and pith rays. Vascular tissue system - structure of xylem and phloem, different types of vascular bundles and their arrangement in root and stem. .

Module 3: Plant body structure (6 hrs)

Primary structure of stem, root and leaf (dicot and monocot). Normal secondary growth in dicot stem and root. Periderm: structure and development - phellum, phellogen, phelloderm, bark, and lenticels. Anomalous secondary thickening: *Bignonia* stem, *Boerhaavia* stem and *Dracaena* stem.

Module 4: Wood anatomy (4 hrs)

Basic structure of wood - heart wood, sap wood; hard wood, soft wood; growth rings and dendrochronology; porous and non-porous wood; ring porous and diffuse porous wood, tyloses. Reaction wood: tension wood and compression wood.

PRACTICAL (18 hrs)

1. Study of cell types and tissues.
2. Non-living inclusions - starch grains, cystolith, raphides, aleurone grains.
3. Primary structure of stem, root and leaf - Dicots and Monocots.
4. Dissect and identify the stomatal types - anomocytic, anisocytic, paracytic and diacytic.
5. Secondary structure of dicot stem and root.
6. Anomalous secondary structure of *Bignonia* stem, *Boerhaavia* stem, and *Dracaena* stem.

REPRODUCTIVE BOTANY (Theory 18 hrs; Practical 9 hrs)

Module 5: Introduction (2 hrs)

Introduction to embryology, floral morphology - parts of flower.

Module 6: Microsporangium and male gametophyte (4 hrs)

Microsporangium: structure and development of anther, microsporogenesis, dehiscence of anther, structure of pollen. Male gametophyte development.

Module 7: Megasporangium and female gametophyte (6 hrs)

Megasporangium: types of ovules – anatropous, orthotropous, amphitropous, campylotropous, circinotropous. Megasporogenesis – female gametophyte – structure of a typical embryosac, types of embryosacs - monosporic (*Polygonum* type), bisporic (*Allium* type) and tetrasporic (*Peperomia* type).

Module 8: Fertilization (2 hrs)

Mechanism of pollination, agents of pollination, germination of pollen grains; double fertilization.

Module 9: Endosperm and embryo (4 hrs)

Endosperm: types – cellular, nuclear and helobial. Embryogeny, structure of dicot and monocot embryo, seed formation. Polyembryony.

PRACTICAL (9 hrs)

1. Dissect and display parts of different types of flowers.
2. Identification of C.S. of anther, embryo sac and embryo.
3. Identification of various anther types - monothecous, dithecous.
4. Identify the different types of ovules.

MICROTECHNIQUE (Theory 9 hrs; Practical 9 hrs)

Module 6: Preservation of plant specimens, sectioning and mounting (9 hrs)

Introduction to microtechnique: killing and fixing - purpose. Dehydration - purpose, agents used - ethyl alcohol. Sectioning: hand sections, serial section; Microtome - rotary, sledge (application only). Staining technique: principle of staining; stains - hematoxylin, fast green, acetocarmine; vital stains - neutral red, Evans blue; mordants - purpose with examples. Types of staining - single staining, double staining. Mounting and mounting media – purpose, mounting media - glycerine, DPX, Canada balsam. Use of permanent whole mounts; permanent sections; maceration, smear and squash preparation.

PRACTICAL (9 hrs)

1. Familiarize preparation and use of stains, fixatives and mounting media.
2. Preparation of smears and squash.
3. Demonstration of microtome sectioning.
4. Maceration and identification of tracheary elements.
5. Preparation of single stained hand sections (Permanent – demonstration only).

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Core course 6 Code: BO5CRT06
RESEARCH METHODOLOGY, BIOPHYSICS AND BIOSTATISTICS
Theory: 54 hrs; Practical: 45 hrs; Credits: 3 + 1)

Objectives:

- To equip the students to conduct independent research and prepare research reports.
- To make the students acquaint with different tools and techniques used in research work.
- To equip the students with basic computer skills necessary for conducting research.
- To enable the students to have enough numerical skills necessary to carry out research.

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RESEARCH METHODOLOGY (Theory 18 hrs; Practical 18 hrs)

Module 1: Introduction (4 hrs) -

Objectives of research. Types of research - pure and applied. Identification of research problem. Review of literature: purpose, literature sources – names of reputed National and International journals in life science (2 international & 3 national); reprint acquisition - INSDOC, INFLIBNET.

Module 2: Process of research (7 hrs)

Conducting research: define the problem, identify the objective, design the study, collection of data, analysis and interpretation. Preparation of research report: preparation of dissertation - IMRAD system - preliminary pages, introduction and review of literature, materials and methods, results, discussion, conclusion and bibliography.

Module 3: Use of computer in research (7 hrs)

Introduction to MS - WINDOWS and LINUX, application of MS WORD - word Processing, editing tools (cut, copy, paste), formatting tools. MS EXCEL - creating worksheet, data entry, sorting data. Statistical tools (SUM, MEAN, MEDIAN and MODE). Preparation of graphs and diagrams (Bar diagram, pie chart, line chart, histogram). MS-POWERPOINT - presentation based on a biological topic; inserting tables, charts, pictures. Open source and free alternatives to MS Office: Libre Office, Open Office (brief study). Search engines: Google.com; meta search engine – dogpile.com; academic search - Google scholar. Educational sites related to biological science - Scitable, DNAi.

PRACTICAL (18 hrs)

1. Prepare outline of a dissertation (IMRAD system).
2. Prepare a list of references (not less than 10) on a topic in biological science.
3. Review the literature on a given topic.
4. Collect information on a topic related to biological science using the internet.

5. Make a report based on the collected information from the internet (using MS-WORD).
6. Prepare tables/charts/graphs using EXCEL.
7. Prepare a worksheet using a set of data collected and find out the SUM.
8. Prepare a PowerPoint presentation based on the report in Experiment 4.

BIOPHYSICS (Theory 18 hrs; Practical 9 hrs)

Module 4: Introduction (2 hrs)

Introduction to biophysics; branches of biophysics - molecular, cellular, membrane and biomedical instrumentation (scope only).

Module 5: Biophysical instrumentation (16 hrs)

Principle, working and applications of the following:

Microscopy: compound microscope, phase-contrast microscope and electron microscope – SEM. Colorimeter, spectrophotometer. Centrifuge: ultracentrifuge. Chromatography: paper, thin layer and column. Electrophoresis, PAGE. pH meter. Haemocytometer.

PRACTICAL (9 hrs)

1. Measurement of pH and adjusting pH using pH meter.
2. Separation of plant pigments using TLC.
3. Determination of the concentration of a sample solution using colorimeter.
4. Demonstration of column chromatography.
5. Count the number of cells/spores using Haemocytometer.

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BIOSTATISTICS (Theory 18 hrs; Practical 18 hrs)

Module 6: Introduction

Introduction, statistical terms and symbols (Brief study only). Sampling: concept of sample, sampling methods - random and non random sampling. Collection and representation of data: diagrammatic and graphic representation - line diagram, bar diagram, pie diagram, histogram, frequency curve. Measures of central tendency: mean, median, mode, (discrete and continuous series). Measures of dispersion: standard deviation. Distribution patterns: normal distribution, binomial distribution. Tests of significance: Chi-squire test - uses, procedure.

PRACTICAL (18 hours)

1. Collect numerical data, tabulate and represent in different types of graphs and diagrams mentioned in the syllabus.
2. Problems related to mean, median, mode, standard deviation and Chi-square test.

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Core course 7 Code: BO5CRT07
PLANT PHYSIOLOGY AND BIOCHEMISTRY
(Theory 54 hrs; Practical 45 hrs; Credits 3 + 1)

Objectives:

- Acquire basic knowledge needed for proper understanding of plant functioning.
- Familiarize with the basic skills and techniques related to plant physiology.
- Understand the role, structure and importance of the bio molecules associated with plant life.

PLANT PHYSIOLOGY (Theory 36 hrs; Practical 27 hrs)

Module 1: Water relations (6 hrs)

Plant water relations - diffusion, imbibition, osmosis, OP, DPD, TP; water potential - concepts and components (pressure potential, gravity potential, osmotic potential and matric potential). Absorption of water - active and passive, pathway of water movement - apoplastic and symplastic pathway. Ascent of sap - cohesion-tension theory. Transpiration - types, mechanism, theories (Starch-sugar, Proton-K+ ion exchange), significance; antitranspirants. Guttation.

Module 2: Mineral nutrition (3 hrs)

Role of major and minor elements in plant nutrition, deficiency symptoms of essential nutrients; mineral uptake - passive (ion exchange) and active (carrier concept).

Module 3: Photosynthesis (12 hrs)

Photosynthetic pigments, photo excitation - fluorescence, phosphorescence; red drop and Emerson enhancement effect. Photosystems - components and organization; cyclic and non-cyclic photophosphorylation; carbon assimilation pathways - C3, C4 plants - kranz anatomy, CAM. Photorespiration. Factors affecting photosynthesis - Blackmann's law of limiting factors.

Translocation of solutes: pathway of phloem transport, mechanism - pressure flow, mass flow hypothesis; phloem loading and unloading.

Module 4: Respiration (8 hrs)

Respiration: anaerobic and aerobic; glycolysis, Kreb's cycle, mitochondrial electron transport system - components, oxidative phosphorylation, ATPase, chemiosmotic hypothesis. RQ - significance. Factors affecting respiration.

Module 5: Plant growth and development (5 hrs)

Plant hormones: their physiological effect and practical applications - auxins, gibberellins, cytokinins, ABA, and ethylene. Plant movements: tropic movements - geotropism and phototropism; nastic movements - seismonastic and nyctinastic movements. Physiology of flowering - phytochrome, photoperiodism, vernalization.

Module 6: Stress physiology (2 hrs)

Concepts of plant responses to abiotic stresses (water, salt, temperature), biotic stress (pathogens). Allelopathy.

PRACTICAL (27 hrs)

Core Experiments (any four compulsory):

1. Determination of osmotic pressure of plant cell sap by plasmolytic/weighing method.
2. Compare the stomatal indices of hydrophytes, xerophytes and mesophytes (any two).
3. Separation of plant pigments by TLC/Paper chromatography.
4. Measurement of photosynthesis by Wilmott's bubbler/any suitable method.
5. Estimation of plant pigments by colorimeter.

Demonstration experiments:

1. Papaya petiole osmoscope.
2. Demonstration of tissue tension.
3. Relation between transpiration and absorption.
4. Necessity of chlorophyll, light and CO_2 in phytosynthesis.
5. Simple respiroscope.
6. Respirometer and measurement of RQ.
7. Fermentation.
8. Measurement of transpiration rate using Ganong's potometer/Farmer's potometer.

BIOCHEMISTRY (Theory 18 hrs; Practical 18 hrs)

Module 4: Water (3 hrs)

Physical and chemical properties of water, acids and bases; pH - definition, significance; measurement of pH – colorimetric, electrometric (brief study only). Buffers: buffer action, uses of buffers.

Module 5: Carbohydrates (3 hrs)

General structure and functions; classification - mono (glucose and fructose), di (maltose and sucrose) and polysaccharides (starch and cellulose).

Module 6: Proteins (4 hrs)

General structure and classification of amino acids - peptide bond; structural levels of proteins - primary, secondary, tertiary and quaternary; functions of proteins.

Module 7: Lipids (2 hrs)

General features and roles of lipids, types of lipids; fatty acids - saturated and unsaturated; fatty acid derivatives - fats and oils; compound lipids (brief study only).

Module 8: Enzymes (6 hrs)

Classification and nomenclature, mechanism of action. Enzyme kinetics, Michaelis-Menten constant (brief study only). Regulation of enzyme action. Factors affecting enzyme action.

PRACTICAL (18 hrs)

1. General test for carbohydrates - Molischs test, Benedicts's tests, Fehling's test.
2. Colour test for starch - Iodine test.
3. Colour tests for proteins in solution – Xanthoproteic test, Biuret test, Million's test, Ninhydrin test.

4. Action of various enzymes in plant tissues: peroxidase, dehydrogenase.
5. Quantitative estimation of protein using colorimeter.

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Core course 8 Code: BO5CRT08
ENVIRONMENTAL SCIENCE AND HUMAN RIGHTS
(Theory 54 hrs; Practical 36 hrs; Credits 3 + 1)

Objectives:

- Acquaint the student with the significance of Environmental Science.
- Make the students aware about the extent of the total biodiversity and the importance of their conservation.
- Help the student to design novel mechanisms for the sustainable utilization of natural resources.
- Enable the students to understand the structure and function of the ecosystems.
- Enable the students to understand various kinds of pollution in the environment, their impacts on the ecosystem and their control measures
- Make the students aware about various environmental laws in India and the role of various movements in the protection of nature and natural resources.

ENVIRONMENTAL SCIENCE (48 hrs)

Module 1: Introduction to ecology (8 hrs)

Ecology: introduction, definition, scope and relevance; sub-divisions of ecology - autecology, synecology and ecosystem ecology**.**

Population: population size, density, natality, mortality, age, rate of natural increase, growth form and carrying capacity, population interactions between species - competition, parasitism, predation, commensalism, protocooperation, mutualism, neutralism.

Community: community concept, biotic community, species diversity, species richness, dominance; growth forms and structure, trophic structure, ecotone, edge effect, habitat, ecological niche, micro-climate, ecological indicators, keystone species**.**

Module 2: Ecosystems (10 hrs)

Structure and function of ecosystems, ecosystem components: abiotic - atmosphere, climate, soil, water; biotic - producers, consumers, decomposers. Productivity - primary and secondary - gross and net productivity - homeostasis in the ecosystem. Concept of energy in ecosystems - energy flow, food chain, food web, trophic levels, trophic structure and ecological pyramids - pyramid of numbers, biomass, energy. Nutrient cycles - biogeochemical cycles of C and N_2.

Ecosystem development: ecological succession, process, climax community, hydrosere, xerosere. Adaptations of plants to environment - xerophytes, hydrophytes, epiphytes, halophytes, mangroves.

Module 3: Biodiversity and its conservation (10 hrs)

Biodiversity: definition, types, examples – endemism - hot spots; hot spots in India - Western Ghats as hot spot. Wetlands and their importance. Biodiversity loss - IUCN threat categories, Red data book; causes and rate of biodiversity loss - extinction, causes of extinction. Conservation: methods - *in-situ*, *ex-situ*. Joint Forest management - people's participation in biodiversity conservation: community reserve, eg. Kadalundi-vallikkunnu. Remote sensing and GIS: introduction, principle, application of remote sensing and GIS in environmental studies and biodiversity conservation (brief account). Ecotourism: ecotourism centers in Kerala - Thenmala and Thattekkad WLS.

Module 4: Environmental pollution (10 hrs)

Environmental studies - definition, relation to other sciences, relevance. Environmental pollution - introduction, definition; Air pollution - air pollutants, types, sources, effect of air pollution on plants and humans, control measures; Water pollution – common pollutants, sources, impact, control measures; water quality standards - DO and BOD; eutrophication. Soil Pollution - causes, sources, solid waste, biodegradable, non-biodegradable, management of solid waste, composting, e – waste. Environmental issues - global warming, greenhouse effect, climate change - causes and impact, ozone layer depletion. Carbon sequestration.

Module 5: Conservation of nature (10 hrs)

Global conservation efforts - Rio Earth summit - Agenda 21, Kyoto protocol, COP15 (15^{th} Conference of the parties under the UN framework convention on climate change) and Paris protocol - major contributions. Conservation strategies and efforts in India and Kerala.

Organizations, movements and contributors of environmental studies and conservation: organizations - WWF, Chipko, NEERI; contributors - Salim Ali, Sunder Lal Bahuguna, Madhav Gadgil, Anil Agarwal, Medha Patkar, Vandana Siva (brief account only).

Environmental Legislation and Laws: Environment (protection) Act 1986, Air (protection and control of pollution) act, 1981 Water (protection and control of pollution) Act, 1974, Wildlife (protection) Act, 1972, Forest (conservation) Act, 1980, Biological Diversity Act (2002) [brief account only].

Module 6: Human rights (6 hrs)

Introduction, meaning, concept and development. Three generations of human rights - civil and political rights, economic, social and cultural rights. Human Rights and United Nations: contributions; main human rights related organizations - UNESCO, UNICEF, WHO, ILO; Declarations for women and children, Universal declaration of human rights. Human rights in India: fundamental rights and Indian constitution, rights for children and women, scheduled castes, scheduled tribes, other backward castes and minorities.

Environment and human rights: right to clean environment and public safety; issues of industrial pollution; prevention, rehabilitation and safety aspect of new technologies such as chemical and nuclear technologies, issues of waste disposal, protection of environment. Conservation of natural resources and human rights: reports, case studies and policy formulation. Conservation issues of Western Ghats – Madhav Gadgil committee report, Kasturi Rangan report. Over-exploitation of ground water resources, marine fisheries, sand mining etc.

PRACTICAL (36 hrs)

1. Estimation of CO_2, Cl, and alkalinity of water samples (Titrimetry)
2. Determination of pH of soil and water.
3. Assessment of diversity, abundance, and frequency of plant species by quadrate method (Grasslands, forests).
4. Study of the most probable number (MPN) of Coliform bacteria in water samples.
5. EIA studies in degraded areas (Sampling, Line transect, Quadrate).
6. Ecological adaptations in xerophytes, hydrophytes, epiphytes, halophytes and mangroves.

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OPEN COURSES

Open course 1 Code: BO5OPT01
AGRI-BASED MICROENTERPRISES
(Theory 72 hrs; Credits 3)

Objectives:

- Provide basic information about the business opportunities in plant sciences.
- Inform the student about sustainable agriculture and organic farming.
- Inculcate an enthusiasm and awareness about ornamental gardening, nursery management and mushroom cultivation.

Module 1: Organic farming and composting techniques (9 hrs)

Advantages of organic manures and fertilizers. Composition of fertilizers – NPK content of various fertilizers. Common organic manures – bone meal, cow dung, poultry waste, oil cakes, organic mixtures and compost. Preparation of compost - aerobic and anaerobic - advantages of both; vermicompost - preparation, vermiwash. Biofertilizers: definition, types – *Trichoderma*, *Rhizobium*, PGPR. Biopesticides – Tobacco and Neem decoction. Biological control.

Module 2: Horticulture and Nursery management (18 hrs)

Soil components. Preparation of potting mixture. Common Garden tools and implements. Methods of plant propagation - by seeds - advantages and disadvantages. Vegetative propagation - advantages and disadvantages. Natural methods of vegetative propagation. Artificial methods - cutting, grafting,

budding and layering. Use of growth regulators for rooting. Gardening - types of garden - ornamental, indoor garden, kitchen garden, vegetable garden for marketing.

Module 3: Food spoilage and preservation techniques (9 hrs)

Causes of spoilage. Preservation techniques - asepsis, removal of microorganisms, anaerobic conditions and special methods – by drying, by heat treatment, by low temperature storage and by chemicals (Food Additives). Preparation of wine, vinegar and dairy products.

Module 4: Mushroom cultivation and Spawn production (9 hrs)

Types of mushrooms - button mushroom, oyster mushroom and milky mushroom, poisonous mushroom – methods of identification. Spawn – isolation and preparation. Cultivation milky mushrooms – using paddy straw and saw dust by polybag. Value added products from mushroom – pickles, candies, dried mushrooms.

Module 5: Plant tissue culture and micropropagation (9 hrs)

Concept of totipotency. Micropropagation: different methods – shoot tip, axillary bud and meristem culture; organogenesis, somatic embryogenesis. Infra structure of a tissue culture laboratory. Solid and liquid media - composition and preparation. Sterilization techniques. Explant - inoculation and incubation techniques. Stages of micropropagation – hardening and transplantation. Packaging and transportation of tissue culture regenerated plantlets.

ON HAND TRAINING (18 hrs)

1. Prepare a chart showing the NPK composition of minimum 6 manures and fertilizers.
2. Identification and familiarization of the following organic manures: cow dung (dry), Coconut cake, Vermicompost, neem cake, organic mixture, bone meal.
3. Preparation of potting mixture.
4. Make a vermicompost pit /pot in the campus/ house of the student.
5. Familiarization of common garden tools and implements.
6. Estimation of germination percentage of seeds
7. Demonstrate the effect of a rooting hormone on stem cutting.
8. Demonstration of T budding and air layering on live plants.
9. Familiarization of garden components from photographs.
10. Preparation of vinegar/dairy product (any two) in class or home.
11. Familiarization of different mushrooms and preparation of a polybag of *Pleurotus* using straw/sawdust.
12. Visit to a well established tissue culture lab, nursery and mushroom cultivation unit.

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Open course 2 Code: BO5OPT02
HORTICULTURE AND NURSERY MANAGEMENT
(Theory 72 hrs; Credits 3)

Objectives:

- Understand the importance of horticulture in human welfare.
- Understand the propagation and cultural practices of useful vegetable, fruit and garden plants.
- Understand the impact of modern technologies in biology on horticultural plants.
- Understand the basic concepts of landscaping and garden designing.
- Inculcate interest in landscaping, gardening and flower and fruit culture.

HORTICULTURE (48 hrs)

Module 1: Introduction (10 hrs)

Introduction to horticulture: definition, history; classification of horticultural plants, disciplines of horticulture. Soil: formation, composition, types, texture, pH and conductivity. Garden tools and implements.

Preparation of nursery bed; manures and fertilizers - farm yard manure, compost, vermicompost, biofertilizers; chemical fertilizers - NPK; time and application of manures and fertilizers, foliar spray.

Irrigation methods - surface, sub, drip and spray irrigations - advantages and disadvantages - periodicity of irrigation.

Module 2: Propagation of plants (10 hrs)

Propagation of horticultural plants - by seeds; seed development and viability, seed dormancy, seed health, seed testing and certification. Growing seedlings in indoor containers and field nurseries, seed bed preparation, seedling transplanting; advantages and disadvantages of seed propagation.

Vegetative propagation - organs used in propagation - natural and artificial vegetative propagation; methods - cutting, layering, grafting and budding; advantages and disadvantages of vegetative propagation; micropropagation.

Module 3: Gardening (10 hrs)

Gardening - ornamental gardens, indoor gardens, kitchen gardens- terrestrial and aquatic gardens - garden adornments; garden designing; garden components - lawns, shrubs and trees, borders, hedges, edges, drives, walks, topiary, trophy, rockery; famous gardens of India. Landscape architecture - home landscape design, urban planning, parks, landscaping and public buildings, industrial and

highway landscaping. Physical control of plant growth - training and pruning - selection of plant, bonsai containers and method of bonsai formation.

Module 4: Floriculture (6 hrs)

Introduction, commercial floriculture - jasmine, orchid, anthurium, rose, gladiolus; production of cut flowers, quality maintenance, packing, marketing. Flower arrangements - basic styles - upright and slanting - japanese ikebana, dry flower arrangement.

Module 5: Olericulture (4 hrs)

Olericulture - types of vegetable growing - home gardens and market gardens; cultivation practices of leafy vegetable (Amarathus), tuber (Potato), fruit (Tomato), flower (Cauliflower).

Module 6: Pomology (4 hrs)

Pomology - cultivation of fruit crops - mango, banana and pine apple - preparation of land, spacing, planting, irrigation, hormones, harvest and storage. Factors affecting duration of storage. Principles of preservation - temporary and permanent - agents for fruit preservation. Preparation of pickles, jams, jellies and squashes using locally available fruits.

Module 7: Gardening – additional features (4 hrs)

Garden friends - honey bees, ladybirds, frogs, spiders, earthworms, centipedes and millipedes. Garden foes - pests, pathogenic fungi, bacteria, virus. Control measures - pesticides and fungicides; neem tobacco decoction. Hazards of chemical pesticides; equipments used in controlling horticultural pests - sprayers, dusting equipments - sterilization, fumigation.

Weeds - annual, perennial; weed control - prevention, eradication - hand weeding, tillage, burning, mowing, biological control, use of herbicides - selective and non selective - mechanisms involved in herbicidal actions.

NURSERY MANAGEMENT (6 hrs)

Module 1: Nurseries (6 hrs)

Nursery: definition, types; management strategies - planning, layout, budgeting - production unit, sales unit. Plant growing structures - green houses, fernery, orchidarium, arbetorium.

ON HAND TRAINING (18 hrs)

1. Preparation of potting mixture of known combination and potting in earthern pots/poly bags.
2. Preparation of nursery beds.
3. Preparation of compost/vermicompost using different substrates.
4. Working knowledge and identification of garden tools and implements.
5. Practical knowledge in different plant propagation techniques listed in syllabus.
6. Cultivation of a vegetable/ornamental plant/fruit crop listed in the syllabus.
7. Practice of different pruning operations (top dressing, shaping and topiary) in the following plants: (1) Bougainvillea (2) Phyllanthus.
8. Visit a well established nursery and submit report.

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Open course 3 Code: BO5OPT03
ECOTOURISM
(Theory 72 hrs; Credits 3)

Objectives:

- Make the students to opt various ecotourism programs in the self employment stream
- Make the students aware of the usefulness of ecotourism in the conservation of natural resources.
- Help the students to assess various ecotourism programs

Module 1: Introduction (4 hrs)

Definition, concept, introduction, history, relevance and scope.

Module 2: Key principles and characteristics of ecotourism (4 hrs)

Nature area focus, interpretation, environmental sustainability practice, contribution to conservation, benefiting local communities, cultural respect, customer satisfaction, responsible marketing.

Module 3: Components of Ecotourism (12 hrs)

Travel, tourism industry, biodiversity, local people, cultural diversity, resources, environmental awareness, interpretation, stake holders, capacity building in ecotourism.

Module 4: Ecotourism terms (10 hrs)

Adventure tourism, certification, commercialization chain, cultural tourism, canopy walkway, conservation enterprises, ecosystem, ecotourism activities, ecotourism product, ecotourism resources, ecotourism services, endemism, ecolabelling, ecotourism "lite", geotourism, greenwashing, stakeholders, sustainable development, sustainable tourism, leakages

Module 5: Ecotourism resources in India and Kerala (14 hrs)

Major ecosystems vegetation types and tourism areas in Kerala. Festivals and events, entertainment, overview, culture, famous destinations, sightseeing, historical monuments, museums, temples, national parks & wildlife sanctuaries, hill stations, waterfalls, rivers, reaches, wildlife watching and bird watching sites, agricultural sites, tribal areas, tribal museums, tribal arts, rural handicrafts, tribal medicines, archeological sites, adventure sports, sacred groves, mountains, etc.

Module 6: Forms of Ecotourism in India and Kerala (8 hrs)

Eco regions, eco places, waterfalls in Kerala and India, eco travel, dos and don't on eco travel, eco trips. Potential of ecotourism in Kerala. Community based ecotourism, ecotourism and NGOs.

Module 7: Ecotourism Planning (16 hrs)

Background, objectives, strategy, design of activities, target groups, opportunities, capacity building, threats, expectations positive and negative impacts, strength and weakness, benefits and beneficiaries,

stakeholders, linkages, economics, ecotourism auditing. Problems with ecotourism. Carrying capacity of ecotourism. ecotourism facilities – Green report card. Ecotourism management – issues.

Module 8: Ecotourism and livelihood security (4 hrs)

Community, biodiversity conservation and development – Eco-development committees.

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SEMESTER VI

Core course 9 Code: BO6CRT09

GENETICS, PLANT BREEDING AND HORTICULTURE

(Theory 54 hrs; Practical 45 hrs; Credits 3 + 1)

Objectives:

- Imparting an insight into the principles of heredity
- Understand the patterns of inheritance in different organisms
- Understand the inheritance pattern of nuclear and extra nuclear genes
- Understand the methods of crop improvement
- Understand the importance of horticulture in human welfare
- Develop skill in gardening technique among students

GENETICS (Theory 27 hrs; Practical 27 hrs)

Module 1: Origin and development of Genetics (3 hrs)

Genetics as a science: origin - experiments of Mendel with *Pisum sativum*, general terminology used in genetics. Principles of inheritance, Mendelian laws - monohybrid and dihybrid cross, test cross and backcross.

Module 2: Exceptions to Mendelism (10 hrs)

Modification of Mendelian ratios: incomplete dominance - *Mirabilis*; Co-dominance - MN blood group in man; Lethal genes – pigmentation in Snapdragon..

Geneic interaction: epistasis, (a) Dominant - fruit colour in summer squashes (b) Recessive - coat colour in mice; Complementary genes - flower colour in sweet pea. Non-epistasis - comb pattern in Fowls. Multiple alleles – ABO blood groups in man; self sterility in *Nicotiana*.

Module 3: Linkage of genes (3 hrs)

Linkage and crossing over: chromosome theory of linkage; crossing over - types of crossing over, mechanism of crossing over. Linkage map - 2 point cross, interference and coincidence.

Module 4: Determination of sex (6 hrs)

Sex determination: sex chromosomes and autosomes; chromosomal basis of sex determination; XX-XY, XX-XO mechanism; sex determination in higher plants (*Melandrium album*). Sex linked

inheritance: X-linked - Morgan's experment e.g. eye colour in *Dorsophila*, Haemophilia in man; Y-linked inheritance; sex limited and sex influenced inheritance. Pedigree analysis.

Module 5: Quantitative inheritance (2 hrs)

Quantitative characters: polygenic inheritance, continuous variation - kernel color in wheat, ear size in maize.

Module 6: Extra-chromosomal inheritance (2 hrs)

Extra chromosomal inheritance: chloroplast mutation - variegation in 4O'clock plant; mitochondrial mutations in yeast. Maternal effects - shell coiling in snail; infective heredity - kappa particles in *Paramecium*.

Module 7: Population genetics (1 hr)

Concept of population, gene pool, Hardy-Weinberg principle (brief).

PRACTICAL (18 hrs)

1. Students are expected to work out at least two problems each from: monohybrid, dihybrid, back-cross and test cross; all types of modified Mendelian ratios mentioned in the syllabus.

PLANT BREEDING (Theory 13 hrs; Practical 9 hrs)

Module 1: Introduction to plant breeding (1 hr)

Introduction and objectives of plant breeding. Plant breeding centers in Kerala, their achievements – CPCRI, CTCRI, RRII.

Module 2: Plant introduction (2 hrs)

Plant introduction: domestication - centers of origin - procedure of plant introduction - quarantine regulations, acclimatization, agencies of plant introduction in India, major achievements.

Module 3: Selection (2 hrs)

Plant Selection: mass, pure-line, clonal.

Module 4: Hybridization (4 hrs)

Hybridization: types, procedure, important achievements. Heterosis in plant breeding, inbreeding depression, genetics of heterosis and inbreeding depression. Handling segregating generation - pedigree method, bulk method, back cross method. Disease resistance breeding.

Module 5: Mutation breeding and polyploidy breeding (2 hrs)

Mutation breeding: methods, applications and important achievements. Polyploidy breeding: methods and applications.

Module 6: Tissue culture as method in plant breeding (2 hrs)

Application of meristem culture, embryo culture and pollen culture in plant breeding. Role of tissue culture in the creation of transgenic plants.

PRACTICAL (9 hrs)

1. Emasculation and bagging.
2. Demonstration of hybridization in plants.
3. Estimation of pollen sterility/viability.

HORTICULTURE (Theory 14 hrs; Practical 18 hrs)

Module 1: Introduction (3 hrs)

Introduction to horticulture - definition, history. Classification of horticultural plants. Disciplines of horticulture - pomiculture, olericulture, floriculture, arboriculture.

Garden implements - budding knife, secateurs, hedge shear, hand cultivator, sprayers, lawn mower, garden rake, spade.

Irrigation methods: surface, sub, drip and spray irrigations; mist chambers - advantages and disadvantages.

Module 2: Plant propagation: (5 hrs)

Seed propagation: seed testing and certification, seed bed preparation, seedling transplanting, hardening of seedling; advantages and disadvantages of seed propagation. Vegetative propagation: natural and artificial; artificial methods - cutting, layering, grafting and budding, micro-propagation; advantages and disadvantages of vegetative propagation.

Module 3: Gardening (6 hrs)

Types of garden: brief study on ornamental garden, indoor garden, kitchen garden, aquatic garden, vertical garden, medicinal garden, terrace garden, terrarium.

Garden designing: garden components - lawns, shrubs and trees, borders, topiary, hedges, edges, walks, drives.

Physical control of plant growth: training and pruning. Bonsai - selection of plant - bonsai containers and method of bonsai formation.

Plant growing structures: green house, orchidarium, conservatory; Potting mixture – components.

PRACTICAL (18 hrs)

1. Approach grafting (demonstration only), budding (T, patch), air layering.
2. Identification of different garden tools and their uses.
3. List out the garden components in the photograph of the garden given.
4. Visit to established horticultural/agricultural/ornamental/kitchen gardens and observe the components there.

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Core course 10 Code: BO6CRT10

CELL AND MOLECULAR BIOLOGY

(Theory 54 hrs; Practical 36 hrs; Credits 3 + 1)

Objectives:

- Understand the ultra structure and functioning of cell in the sub-microscopic and molecular level.
- Get an idea of origin, concept of continuity and complexity of life activities.
- Familiarization of life processes.
- Understand the basic and scientific aspect of diversity.
- Understand the cytological aspects of growth and development.
- Understand DNA as the basis of heredity and variation.

CELL BIOLOGY (Theory 27 hrs; Practical 27 hrs)

Module1: Ultra structure of cell components (8 hrs)

Cell biology through ages: a brief history of cell biology. Cytosol - chemical composition. Composition, structure and function of plasma membrane - fluid mosaic model.

The ultra-structure of a plant cell with structure and function of the following organelles: Endoplasmic reticulum, chloroplasts, Mitochondria, Ribosomes, Dictyosomes, Microbodies - peroxisomes and glyoxisomes, lysosomes and vacuole. Cytoskeleton - microtubules and microfilaments.

Ultra structure of nucleus: nuclear envelope - detailed structure of pore complex, nucleoplasm - composition, nucleolus.

Module 2: Chromosomes (6 hrs)

Chromosomes: introduction, chromosome number, autosomes and allosomes, morphology - metacentric, submetacentric, acrocentric and telocentric. Structure - chromatid, chromonema, chromomere, centromere and kinetochore, telomere, secondary constriction and nucleolar organizer. Chromatin fibres: heterochromatin and euchromatin. Karyotype and ideogram.

Chemical composition of chromatin: histones and non-histones, arrangement of proteins and DNA in chromatin - the 10 nm fibre (nucleosome model), 30 nm fibre (solenoid model) and central axis with radial loops of 300 nm fibre.

Special type of chromosomes: giant chromosomes (salivary gland chromosomes, Lamp brush chromosomes), supernumerary chromosomes (B chromosome).

Module 3: Cell division (6 hrs)

Cell cycle - definition, different stages – interphase (G1, S and G2) and division phase. Mitosis: karyokinesis and cytokinesis, significance of mitosis. Meiosis: stages - first meiotic division (reduction division) and second meiotic (equational division), structure and function of synaptonemal complex, significance of meiosis; comparison of mitosis and meiosis.

Module 4: Chromosomal aberrations (4 hrs)

Numerical: heteroploidy; euploidy – haploidy; polyploidy – autopolyploidy, allopolyploidy (*Raphanobrassica*); aneuploidy - monosomy, trisomy (Fruit morphology in Datura), nullisomy (*Triticum*). Numerical chromosomal abnormalities in man: Down‘s syndrome, Klinefelter‘s syndrome, Turner‘s syndrome.

Structural: deletion (Cri-du-chat syndrome), duplication (Bar eye in Drosophila), inversions (paracentric and pericentric) and Translocations (Robertsonian translocation).

Module 5: Mutation (3 hrs)

Mutation: definition, importance. Types of mutations: somatic and germinal; spontaneous and

induced; chromosomal and gene or point mutations. Molecular basis of mutation: frame shift, transition, transversion and substitution. Mechanism of mutation induction: base replacement, base alteration, base damage, errors in DNA replication. Mutagens: physical - non-ionizing and ionizing radiations; chemical - base analogs, alkylating agents, deaminating agents.

PRACTICAL (27 hrs)

1. Make acetocarmine squash preparation of onion root tip to identify mitotic stages.
2. Study the mitotic index of onion root tip cells (Demonstration only).
3. Study of the different stages of meiosis and identification of different substages of prophase I using photomicrographs or pictures.
4. Identify and study the chromosomal anomalies, patterns and karyotype in man such as Down's syndrome, Turner's syndrome and Klinefelter's syndrome.

MOLECULAR BIOLOGY (Theory 27 hrs; Practical 9 hrs)

Module 6: The genetic material (8 hrs)

Molecular biology: a brief historical prelude. Identification of DNA as genetic material: direct evidences – transformation experiment by Avery *et al*.; Hershey and Chase Experiment. Evidences for RNA as genetic material in some viruses.

Nucleic acids: DNA and RNA, important features of Watson and Crick model of DNA; Chargaff's rule. Alternate forms of DNA - comparison of A, B and Z forms. Structure and function of different types of RNA - tRNA, mRNA, rRNA, snRNA, miRNA.

Module 7: Replication of DNA (4 hrs)

Semiconservative replication of DNA - Messlson and Stahl's experiment; process of semiconservative replication with reference to the enzymes involved in each step.

Module 8: Gene expression (8 hrs)

Gene expression: concept of gene, split genes, one gene one enzyme hypothesis, one gene one polypeptide hypothesis, the central dogma, reverse transcription. Details of transcription in prokaryotes and eukaryotes; hnRNA, splicing, release of mRNA. Translation - initiation, elongation and termination. Genetic code and its features, wobble hypothesis.

Module 9: Regulation of gene expression (5 hrs)

Regulation of gene expression in prokaryotes: operon concept, indicible and repressible systems, negative control and positive control. Lac operon, catabolic repression. Tryptophan operon, attenuation. Regulation in eucaryotes (brief account only).

Module 10: Genetics of cancer (2 hrs)

Genetic basis of cancer – brief description of proto-oncogenes and oncogenes, tumour suppressor genes; characteristics of cancer cells.

PRACTICAL (9 hrs)

6. Work out elementary problems based on DNA structure, replication, transcription and translation and genetic code.

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Core course 11 Code: BO6CRT11
ANGIOSPERM MORPHOLOGY, TAXONOMY AND ECONOMIC BOTANY
(Theory 72 hrs; Practical 45 hrs; Credits 3 + 1)

Objectives:

- Acquaint with the aims, objectives and significance of taxonomy.
- Identify the common species of plants growing in Kerala and their systematic position.
- Develop inductive and deductive reasoning ability.
- Acquaint with the basic technique in the preparation of herbarium.
- Familiarizing with the plants having immense economic importance.

ANGIOSPERM MORPHOLOGY

Module 1: Leaf, Inflorescence and Fruit morphology (13 hrs)

Leaf Morphology: types, venation, phyllotaxy. Morphology of flower: flower as modified shoot; detailed structure of flowers - floral parts - their arrangement, relative position - symmetry, aestivation and placentation types - cohesion and adhesion. Floral diagram and floral formula. Inflorescence: racemose types - simple raceme, corymb, umbel, spike, spadix, head and catkin; cymose types - simple cyme; monochasial - scorpoid and helicoid, dichasial and polychasial; special type - cyathium, hypanthodium, verticillaster, thyrsus and panicle. Fruits: simple - fleshy, dry - dehiscent, schizocarpic, indehiscent, aggregate, multiple (sorosis and syconus).

TAXONOMY

Module 2: Principles of Plant systematics (12 hrs)

Aim, scope, significance and components of taxonomy. Types of classification - artificial (brief account), natural – Bentham and Hooker (Detailed account) and Phylogenetic (Brief account). Angiosperm phylogeny group system (introduction only). Plant nomenclature - binomial, ICBN/ICN principles - rule of priority and author citation. Interdiciplinary approach in taxonomy -

Cytotaxonomy and Chemotaxonomy. Herbarium technique – importance of herbarium; preparation of herbarium and their preservation. Important herbaria in India, BSI.

Module 3: Detailed study of families (30 hrs)

Study the following families of Bentham and Hooker's System with special reference to their vegetative and floral characters; special attention should be given to common and economically important plants within the families: Annonaceae, Nymphaeaceae, Malvaceae, Rutaceae, Anacardiaceae, Leguminosae (Mimosaceae, Caesalpiniaceae and Fabaceae), Combretaceae, Myrtaceae, Cucurbitaceae, Umbelliferae (Apiaceae), Rubiaceae, Compositae (Asteraceae), Sapotaceae, Apocynaceae, Asclepiadaceae, Solanaceae, Convolvulaceae, Scrophulariaceae, Acanthaceae, Verbenaceae, Labiatae (Lamiaceae), Amaranthaceae, Euphorbiaceae, Orchidaceae, Palmae (Arecaceae), Graminae (Poaceae).

ECONOMIC BOTANY AND ETHNOBOTANY (Theory 9 hrs; Practical 9 hrs)

Module 4: Economic botany (12 hrs)

Study the following groups of plants with special reference to the botanical name, family and morphology of the useful part and uses: Cereals - Rice, Wheat; Millets Ragi; Pulses - Green gram, Bengal gram, Black gram; Sugar yielding plants – Sugarcane; Fruits - Apple, Pineapple, Orange, Mango and Banana; Vegetables - Bittergourd, Ladies finger, Carrot and Cabbage; Tuber crops - Tapioca; Beverages - Tea, Coffee; Oil yielding plants - Ground nut, Coconut, Gingelly; Spices – Cardamom, Pepper, Cloves, Ginger; Timber yielding plants - Teak wood and Rose wood; Fibre yielding plants - Coir, Jute, Cotton; Rubber yielding plants - Para rubber; Gums and Resins - White damer, Gum Arabic, Asafoetida; Insecticide yielding Plants - Tobacco and Neem.

Module 5: Ethnobotany (5 hrs)

Introduction, scope and significance of ethnobotany. Study of the following plants used in daily life by tribals and village folks for food, shelter and medicine: Food - *Artocarpus heterophylla*, *Corypha*; Shelter - *Bambusa*, *Ochlandra* and *Calamus*; Medicine – *Curcuma longa*, *Trichopus zeylanicus* and *Alpinia galanga.*

PRACTICAL (45 hrs)

1. Identify the following inflorescence and fruits with reference to their morphological specialities: (a) Inflorescence - simple raceme, spike, corymb, head, simple cyme, cyathium and hypanthodium. (b) Fruits - simple - (fleshy) - berry drupe, pepo, hespiridium. Dry indehiscent - nut. Dry dehiscent - legume, capsule (loculicidal). Aggregate.
2. Preparation of floral formula and floral diagram from floral description (of families studied).
3. Identify the families mentioned in the syllabus by noting their vegetative and floral characters.
4. Students must describe the floral parts, draw the L.S., floral diagram and write the floral formula of at least one flower from each family.
5. Prepare herbarium of 25 plants with field notes.
6. Conduct field work for a period of not less than 5 days under the guidance of a teacher and submit field report.
7. Study the finished products of plants mentioned in the syllabus of economic botany with special reference to the morphology of the useful part, botanical name and family.
8. Identify and describe the ethnobotanical uses of the items mentioned in the syllabus.

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Core course 12 Code: BO6CRT12
BIOTECHNOLOGY AND BIOINFORMATICS
(Theory 54 hrs; Practical 36 hrs; Credits 3 + 1)

Objectives:

- Understand the current developments in the field of Biotechnology and Bioinformatics.
- Equip the students to carry out plant tissue culture.
- Introduce the vast repositories of biological data knowledge.
- Equip to access and analyze the data available in the databases.

BIOTECHNOLOGY (36 hrs)

Module 1: Plant tissue culture (6 hrs)

Biotechnology - an overview; plant tissue culture - basic concepts, totipotency, differentiation, de-differentiation and re-differentiation. Tissue culture media: components, role of plant growth regulators in tissue culture. Preparation of MS medium; sterilization of equipments, glassware and culture medium, surface sterilization of explants.

Module 2: Applications of plant tissue culture (10 hrs)

Micropropagation, methods - axillary bud proliferation, adventitious regeneration – shoot organogenesis and somatic embryogenesis - direct and indirect; meristem culture. Stages of micropropagation, hardening and transplantation. Advantages and disadvantages of micropropagation - somaclonal variations. Embryo culture, callus and cell suspension culture, *in vitro* production of haploids - anther and pollen culture; uses of haploids. Protoplast culture: isolation of protoplast, culture methods, applications; protoplast fusion - cybrids. Artificial seeds, advantages and disadvantages. *In vitro* production of secondary metabolites; cell immobilization, bioreactors (brief study only).

Module 3: Recombinant DNA technology and its applications (10 hrs)

Steps in rDNA technology, cloning vectors and their desirable properties; plasmids, cosmids, phage vectors, Phasmids, YAC and BAC; structure and applications of pBR322, M13 and Ti plasmid. Cutting and joining of DNA molecules - Restriction endonucleases and ligases - ligation techniques. Transformation and selection of transformants - using antibiotic resistances markers and complementation.

Achievements of recombinant DNA technology: in medicine (Human insulin and gene therapy); in agriculture – Bt cotton; in environmental cleaning - super bugs.

Module 4: Techniques in rDNA technology (10 hrs)

DNA isolation, agarose gel electrophoresis, southern hybridization, autoradiography. DNA finger printing and its applications. PCR and its applications. DNA sequencing by Sanger's dideoxy method. Uses of refrigerated centrifuges, UV trans-illuminator, gel documentation system and Laminar Air Flow chamber (brief account only).

GENOMICS AND BIOINFORMATICS (18 hrs)

Module 4: Genomics (4 hrs)

A brief account on genomics and proteomics; major findings of the following genome projects – *E. coli*, Human, *Arabidopsis thaliana*.

Module 5: Basic bioinformatics (7 hrs)

An introduction to bioinformatics, objectives and applications of bioinformatics. Biological data bases: types - primary, secondary and composite databases; nucleotide sequence databases – NCBI (GenBank), EMBL, DDBJ; Protein Sequence databases - SWISS-PROT, PIR; Protein structure database – PDB; bibliographic database – PubMed.

Module 6: Sequence analysis and molecular phylogeny (7 hrs)

Sequence analysis tools - BLAST and FASTA, Molecular visualisation tool - RASMOL (basic commands), Sequence alignment - Scoring matrices, global and local alignment, Pairwise and multiple sequence alignment; common software used in alignment - CLUSTAL W & CLUSTAL X. Molecular phylogeny - homologs, orthologs and paralogs; phylogenetic tree - rooted and unrooted tree, advantages of phylogenetic tree, use of PHYLIP software.

PRACTICAL (36 hrs)

1. Preparation of nutrient medium – Murashige and Skoog medium (Demonstration only).
2. Sterilization and inoculation of plant tissue in culture media.
3. Establishing shoot tip, axillary bud cultures (Demonstration only).
4. Immobilization of whole cells or tissues in sodium alginate.
5. Isolation of DNA from plant tissue.
6. Agarose gel elecotrophoresis of the isolated DNA (Demonstration only).
7. Familiarise the instruments included in the syllabus such as Autoclave, laminar air flow chamber, UV- trans-illuminator, PCR machine, Electrophoresis apparatus, centrifuge etc. and prepare short notes with diagrammatic sketch or photographs.

8. Familiarizing GENBANK, DDBJ, ENA, SWISS-PROT and PDB databases (Demonstration only).
9. Analysis of structural features of proteins using RASMOL.
10. Local alignment of sequences using BLAST (Demonstration only).
11. Retrieving a few research papers related to genetic engineering from PubMed (Demonstration only).

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PROGRAMME ELECTIVE COURSES

Programme elective course 1 Code: BO6PET01

AGRIBUSINESS

(Theory 54 hours; Credit 3)

Objectives:

- Inculcate and impart an idea about the business opportunities in the field of plant sciences.
- Develop an entrepreneurial mindset and also to stick on to the core subject among the Botany students.
- Give an idea about the need of sustainable development and organic farming.
- Harness the opportunities and potentials in the field of ecotourism, processing technology and food sciences.

Module 1: Entrepreneurship (2 hrs)

Basic qualities of an Entrepreneur. Financial assistance from Banks, role of Institutions like MSME Training Institute, Khadi and village industries board, self help groups, Co-operative sector, Kudumbasree projects and microenterprises.

Module 2: Value added food products (8 hrs)

Preparation and preservation techniques, causes of spoilage of food. Principles of preservation - asepsis, removal of microorganisms, anaerobic situation and special methods - drying, thermal processing - pasteurization, sterilization and canning - low temperature, use of chemical preservatives

and food additives. Preparation of wine, vinegar, pickles, jam, jelly, syrups, sauce, dry fruits, dairy products - cheese, butter, yoghurt, paneer.

Module 3: Processing techniques (8 hrs)

Processing of latex: centrifuged latex products and galvanized rubber products. Processing, storage and marketing of Cocoa, Coconut (Copra ,Coir and Tender coconut), Rice (par boiled, raw rice and rice flour), Pepper, Cardamom, Ginger, Arrowroot, Tapioca, Cashew, Mango, Jack fruit, Guava, Grapes, Lemon, Papaya, Musa, Garcinia.

Module 4: Nursery management (6 hrs)

Preparation of potting mixtures, polybags. Plant growing structures - green houses, shaded houses, polyshed, mist chamber, sprinkling system, drip irrigation. Modern strategies in propagation by root initiation of cutting, layering technique, budding and grafting technique; micropropagation. Planting, transplanting and hardening of seedlings, after care of seedlings. Packing and transport of seedlings.

Module 5: Organic farming and composting techniques (6 hrs)

Organic manures and fertilizers, composition of fertilizers. NPK content of various fertilizers and preparation of fertilizer mixtures. Common organic manures - bone meal, cow dung, poultry waste, oil cakes, organic mixtures and compost. Preparation of compost - aerobic and anaerobic - advantages and limitations. Vermicompost - preparation; Vermiwash - preparation. Biofertilizers - definition and preparation of different types - Trichoderma, Rhizobium, PGPR, PSB, mycorrhiza. Application of biofertilizers. Biopesticides, Tobacco and Neem decoction. Biological control of disease and pests.

Module 6: Cultivation of vegetables, fruits and medicinal plants (6 hrs)

Types - home gardening, market gardening and truck gardening. Packing and transporting of vegetables. Organic farming of fruit crops - packing and transporting of fruits. Induction of flowering and weed control. Cultivation of medicinal and aromatic plants of common use and great demand.

Module 7: Floriculture and Apiculture (6 hrs)

Floriculture: problems and prospects of floriculture in Kerala. Scope of growing Anthurium, Orchids and Jasmine in Kerala. Common cut flowers - Rose, Gerbera, Gladiolus, Aster, *Chrysanthemum*, Anthurium and Orchids. Common leaves used in flower arrangement - *Cyprus, Podocarpus*, *Asparagus*, Palms, Cycads and Ferns.

Apiculture: scope and significance. Structure, installation and maintenance of an Apiarium. Extraction, processing, preservation and marketing of honey.

Module 8: Flower arrangement (4 hrs)

Types - Western, Eastern (Japanese/ Ikebana) and modern. Wases, flower holders and floral foam. Wase life of flowers and leaves. After care of flower arrangements – Bouquets. Packing and maintenance of flowers and leaves.

Module 9: Ornamental garden designing (4 hrs)

Garden components. Lawn preparation by seeds, seedling and turfing. Maintenance of garden by Irrigation, Pruning, Repotting. Disease and Pest control.

Module 10: Mushroom cultivation and farming (4 hrs)

Mushrooms: significance, nutritive value. Types of Mushrooms – Button – *Pleurotus, Volvorella*. Spawn production, storage and marketing. Growth of Mushrooms on paddy straw and saw dust by poly bag. Mushroom growing structures and maintenance of humidity. Pests and defects of mushrooms. Storage, transporting and marketing of mushrooms.

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Programme elective course 2 Code: BO6PET02

PLANT GENETIC RESOURCES MANAGEMENT

(Theory 54 hours; Credit 3)

Objectives:

- Acquaint the student with the history and evolution of crop plants, and their diversity.
- Familiarize the student with the available plant genetic wealth and the measures adopted for the conservation of these resources.
- Help the student to identify the crop plants and their wild relatives.
- Help the student to explore the potentialities of various underutilized plants to project as the future food prospects.
- Understand the significance of modern technology to locate the distribution of endangered species.

Module 1: Introduction (5 hrs)

Introduction - historical developments in crop botany, Centers of origin - Vavilovian concept - primary and secondary centers. Exploration and collection of genetic resources - importance of wild relatives of crop plants and their genetic diversity in crop improvement.

Module 2: Plant genetic resources (10 hrs)

Major threats to the genetic resources: human interference and deforestation, alien invasive plants, over exploitation of resources. Endemism and biodiversity hot spots. Conservation of genetic resources: in situ - biosphere reserves, national parks and wildlife sanctuaries; ex situ - in vivo - botanic gardens, field gene banks; in vitro - seed banks - short term, medium term and long term storage of seeds, tissue culture storage and cryopreservation.

Module 3: Study of biodiversity (5 hrs)

Remote sensing: principle, concept of remote sensing and components of remote sensing, application of remote sensing in conservation of endangered plants and habitat studies; IUCN - role and activities. Documentation of endangered and threatened plants - red data book.

Module 4: Ethnobotany and conservation (4 hrs)

Ethnobotany in relation to conservation of genetic resources: mythology and conservation of ecosystems, sacred groves and their role in the conservation of gene pool; taboos for conservation of selected plant species.

Module 5: Regulations and rules (4 hrs)

Role of Governmental and non-governmental organizations in plant genetic resource management; Governmental organizations - regional – TBGRI and KFRI; national - BSI and NBPGR; International – IPGRI (IBPGR) and ICRISAT; Non-Governmental Organizations - WWF and MNHS.

Module 6: Crop plants of Kerala (18 hrs)

Important Crop plants of Kerala - taxonomy and uses and cultivation of, food crops - Rice, Tapioca; Vegetables - Elephant foot yam, Cow pea, Bitter gourd; Spices. Ginger, Black pepper, Nutmeg, Cardamom; Medicinal plants - Vasaka, Aloe; Plantation crops – Rubber, Coffee; cashew, Coconut and Tea; Fruits - Banana, Pineapple and Mango.

Module 7: Unexploited and underutilized plants (9 hrs)

Underutilized plants and its importance for future food requirements. Botany and uses of the following under exploited edible plants - Vegetables - *Averrhoa bilimbi* (Bilimbi, Chemmeenpuli, Irumbampuli), *Averrhoa carambola* (Carambola apple, Chathurappuli), *Dioscorea esculenta* (Cherukizhangu, Nanakizhangu), *Canavalia gladiate* (Sword bean, Valpayar), *Psophocarpus tetragonolobus* (Winged bean, Chathurapayar), (Sessile joyweed), *Sauropus androgynus* (Velicheera, Chikurmanis, Sauropus), *Ipomoea turbinate* (Nithya Vazhuthana); Fruits; *Artocarpus heterophyllus* (Jack, Plavu, chakka), *Artocarpus hirsutus* (Anjili, Ayani, Wild jack), *Aporosa cardiosperma* (Vetti), *Spondias pinnata* (Ambazham, Hog plum), *Syzygium cumini* (Njara, Njaval, Black plum), *Flacourtia montana* (Kattuloovika). Millets - *Echinochloa crus-galli* (Barnyard grass, Indian Barnyard Millet)

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Programme elective course 3 Code: BO6PET03
PHYTOCHEMISTRY AND PHARMACOGNOSY
(Theory: 54 hours; Credit 3)

Objectives:

- Understand the structure and function of basic secondary metabolites in medicinal and aromatic plants.
- Familiarize with the common separation and characterization techniques used in phytochemistry
- Understand the basic officinal part present in the common medical plants and their use in ayurvedic formulations

PHYTOCHEMISTRY

Module 1: Introduction (2 hrs)

Introduction to phytochemical approaches: morphological, organoleptic, microscopic - to study drug and aromatic plants.

Module 2: Extraction of phytochemicals (4 hrs)

Extraction and chacterisation techniques: cold extraction, hot extraction - soxhlet-clevenger apparatus; Solvents - petroleum ether, chloroform, ethanol, water. Separation techniques - TLC, Column, HPLC. Characterization techniques - GC/MS, HPTLC, UV Spectra, IR Spectra.

Module 3: Effect of phytochemicals (10 hrs)

Study of the drug plants and their active principles. Alkaloids - introduction, properties, occurrence, structure, classification, functions, and pharmacological uses.
Triterpenoids. Introduction, properties, occurrence, classification, functions and pharmacological uses.
Phenolics. Quinines - benzoquinones, napthoquinones, anthraquinone, and coumarins.

Module 4: Plants of importance (20 hrs)

Study of the following plants with special reference to habit, habitat and systematic position and morphology of the useful part; organoleptic, anatomical and chemical evaluation of the officinal part; phytochemistry and major pharmacological action of plant drugs and ayurvedic formulations made using the plant: *Tinospora cordifolia, Papaver somniferum, Aegle marmelos, Punica granatum, Adhatoda vasica, Withania somnifera, Achyranthes aspera, Asparagus racemosus, Sida acuta, Carica papaya, Azadirachta indica, Phyllanthus neruri, Datura stramonium, Aloe veera, Tylophora indica,, Acorus calamus.*

Module 5: Aromatic plants and their uses (10 hrs)

Study of the following aromatic plants - volatile oils and methods of extraction *Vetiveria zizanoides, Cinnamomum zeylanica, Sysygium aromaticum, Santalum album, Eucalyptus, Ocimum bacilicum, Rosa, Mentha piperita, Cympopogon, Cananga, Pelargonium.*

PHARMACOGNOSY

Module 6: Pharmocognosy (4 hrs)

Introduction, tools for identifying adulteration; methods in pharmocognosy - microscopy, phytochemical methods - study of starch grains of maize, wheat, rice, potato, curcuma.

Module 7: Ethnomedicine (4 hrs)

Traditonal plant medicines as a source of new drugs – The process of modern drug discovery using ethnopharmacology – Taxol, Artemisinin, Galathamine and Flavopyridole as examples of drug discovery based on ethanopharmacological approach. Jeevani-Pushpangadan model of benefit sharing.

Suggested additional topics:

1. Basic principles in spectroscopy - UV, NMR, IR etc.
2. Use of secondary metabolites for protection against pathogens, herbivores.

REFERENCES

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COMPLEMENTARY COURSES FOR MODEL I B Sc ZOOLOGY

SEMESTER I

Complementary course 1 Code: BO1CMT01
CRYPTOGAMS, GYMNOSPERMS AND PLANT PATHOLOGY
(Theory 36 hrs; Practical 36 hrs; Credits 2 + 1)

Objectives:

- Acquire fundamental knowledge in plant science and to make the student to understand that Botany is an integral part of the human life and developments.
- Foster and encourage an attitude of curiosity, appreciation and enquiry of various life forms of plants.
- Understand the identifying characters of the different types included in the syllabus.
- Understand the diversity of plants with respect to Algae, Fungi, Lichens, Bryophytes, Pteridophytes and Gymnosperms.

CRYPTOGAMS (27 hrs)

Module 1: Algae (13 hrs)

General characters of algae and their classification up to classes (F E Fritsch); range of thallus variation in Algae. Reproduction and life history of the following groups with reference to the types mentioned: Cyanophyceae - *Nostoc*; Chlorophyceae - *Oedogonium* (*Volvox*, *Spirogyra*, *Cladophora* - vegetative features only); Phaeophyceae – *Sargassum;* Rhodophyceae – *Polysiphonia.*

Economic importance of Algae: food, industry, medicine, biofertilizers; algal bloom.

Module 2: Fungi and lichens (9 hrs)

General characters and outline on the classification of fungi by Ainsworth. General characters, thallus structure, reproduction and life history of the following groups with reference to the types mentioned: Zygomycotina – Rhizopus; Ascomycetes – *Xylaria;* Basidiomycetes – *Puccinia.*

Economic importance of Fungi: as food, industry, decomposition of organic matter. Fungal toxins and human health.

Lichens: Classification based on thallus morphology. Usnea - morphology and anatomy of vegetative and reproductive structure. Economic importance of lichen: food, industry, medicine.

Module 3: Bryophytes (2 hrs)

General characters of Bryophytes. Morphology, anatomy, reproduction and life cycle of *Riccia*.

Module 4: Pteridophytes (3 hrs)

General characters of Pteridophytes. Morphology, anatomy (stem), reproduction and life cycle of *Selaginella*.

Module 5: GYMNOSPERMS (4 hrs)

General characters of Gymnosperms. Morphology, anatomy (leaf let), reproduction and life cycle of *Cycas*.

PLANT PATHOLOGY (5 hrs)

Module 6: Plant diseases (5 hrs)

Classification of plant diseases on the basis causative organism and symptoms. Study the following diseases with special emphasis on causative organism, symptoms and control measures:

(i) Nut fall of Arecanut (ii) Bacterial blight of Paddy (iii) Leaf mosaic of Tapioca.

PRACTICAL (36 hrs)

1. Micropreparation and identification preparation of the following:

(i) Algae: vegetative structure of *Nostoc*, *Volvox*, *Spirogyra*, *Oedogonium*, *Cladophora*, *Polysiphonia*. Vegetative and reproductive structure of *Sargassum*.

(ii) Fungi: vegetative and reproductive structure of *Rhizopus*, *Xylaria*, *Puccinia*.

(iii) Lichen: morphology of Usnea thallus and Apothecium.

(iv) Bryophytes: *Riccia* thallus anatomy.

(v) Pteridophytes: *Selaginella* - anatomy of stem and morphology of strobilus.

(vi) Gymnosperms: *Cycas* - Anatomy of leaflet, morphological features of megasporophyll, microsporophyll and ovule.

2. Identify plant diseases mentioned in the syllabus.

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SEMESTER II

Complementary course 2 Code: BO2CMT02

PLANT PHYSIOLOGY

(Theory 36 hrs; Practical 36 hrs; Credits 2 + 1)

Objectives:

- Make the students realize the importance of all physiological processes which take place in plants.
- Understand the mechanism of various physiological processes related to plant life.

Module 1: Water relations (11 hrs)

Plant water relations: Physical aspects of water absorption - Diffusion, DP, DPD. Imbibition. Osmosis - OP, Exosmosis, Endosmosis, Plasmolysis. Water potential and its components. Mechanism of water

absorption by root - active and passive absorption. Movement of water towards xylem by apoplast and symplast pathway. Ascent of sap – theories - transpiration pull theory, root pressure theory; guttation.

Transpiration: types, mechanism of transpiration and stomatal movement (K^+ - ABA theory), significance and factors affecting transpiration, antitranspirants.

Module 2: Mineral nutrition (4 hrs)

General account on Micro and macro nutrients. Absorbable form, function and deficiency symptoms of the following mineral nutrients: N, P, K, Mg, B, Fe, Zn.

Module 3: Photosynthesis and translocation of photosynthate (15 hrs)

Basic requirements of Photosynthesis: Light - PAR; organs and site of photosynthesis; chloroplast. Photosynthetic pigments, photosynthetic unit; red drop and Emerson's enhancement effect; two pigment systems.

Mechanism of photosynthesis: light dependent reaction - cyclic and non cyclic photo phosphorylation. Light independent reaction (dark reactions) C3 cycle, brief account on C4 and CAM Cycles. Factors affecting photosynthesis. Photorespiration (brief study only).

Translocation of photosynthate and organic solutes: path of translocation, mechanism of translocation (Pressure Flow Hypothesis).

Module 4: Growth and Development (6 hrs)

Seed dormancy - causes of seed dormancy - methods of breaking dormancy. Germination of seeds - physiological changes. Growth: Phases of growth, plant growth regulators - auxins, gibberellins, cytokinins, abscissic acid and ethylene and their physiological role (brief study only). Photoperiodism - definition, short day plants, long day plants, day neutral plants. Vernalization.

PRACTICAL (36 hrs)

Core Experiments:

1. Demeonstration of osmosis using potato tuber osmoscope/Papaya petiole osmoscope.
2. Separation of leaf pigments by paper chromatography.
3. Compare the stomatal indices of hydrophytes and xerophytes.

Demonstration experiments:

1. Measure the rate of transpiration by Ganong's potometer.
2. Relationship between transpiration and absorption.
3. Measurement of growth using Arc Auxanometer.
4. Demonstration of geographic curvature using Clinostat.
5. Evolution of oxygen during photosynthesis.
6. Mohl's half leaf experiment.
7. Light screen experiment.

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SEMESTER III

Complementary course 3 Code: BO3CMT03
ANGIOSPERM TAXONOMY AND ECONOMIC BOTANY
(Theory 54 hrs; Practical 36 hrs; Credits 3 + 1)

Objectives:

- Acquaint the student with the objectives and components of Taxonomy.
- Help the student to understand the systems of classification of angiosperms.
- Help the student to identify the common angiosperm species of Kerala.
- Familiarize the student with plants of immense economic importance.

ANGIOSPERM TAXONOMY (36 hrs)

Module 1: Morphology (10 hrs)

Leaf - simple, compound; venation and phyllotaxy. Flower as a modified shoot, structure of flower - floral parts, their arrangement, relative position; cohesion and adhesion of floral parts, symmetry of flowers; types of aestivation and placentation; floral diagram and floral formula. Inflorescence: racemose - simple, spike, spadix, catkin, corymb, umbel and head; cymose - simple, monochasial-helicoid and scorpoid; special types – cyathium, verticillaster. Fruits: outline on the classification; Simple: Fleshy - drupe, berry, hesperidium; Dry - Dehiscent - legume, capsule; Indehiscent - Caryopsis, Cypsella, Schizocarpic - lomentum, carcerulus, regma, cremocarp with examples. Aggregte. Multiple: sorosis, syconus. (Examples should be from families prescribed in the syllabus).

Module 2: Plant classification and Herbarium techniques (8 hrs)

Importance of plant classification, types of classification - artificial, natural and phylogenetic (brief account only); binomial nomenclature; ICBN (Brief account only). Bentham and Hooker‘s system of classification (up to series) and its merits and demerits. Cytotaxonomy and chemotaxonomy (brief account only). Herbarium techniques; importance of herbarium.

Module 3: Angiosperm families (18 hrs)

Study of the following families of Bentham and Hookers system of classification with special reference to major identifying characters and economic importance: Annonaceae, Malvaceae, Rutaceae, Leguminosae (Mimosaceae, Caesalpiniaceae and Fabaceae), Apiaceae (Umbelliferae), Rubiaceae, Asteraceae (Compositae), Apocynaceae, Lamiaceae (Labiatae), Euphorbiaceae, Arecaceae (Palmae), Poaceae (Gramineae).

ECONOMIC BOTANY (18 hrs)

Module 4: Classes of economically important plants (10 hrs)

Classification of economically important plants based on their uses. Study of the following groups of plants with special reference to their botanical name, family, morphology of useful part, economic products and uses: Cereals - Paddy, Wheat; Pulses - Green gram, Bengal gram; Tuber crops -

Tapioca; Spices - Pepper, Cardamom; Beverages - Tea, Coffee; Oil yielding plants - Coconut, Groundnut; Fibre yielding plants - Cotton, Coir; Timber yielding plants - Teak, Rose wood; Latex yielding plants - Para rubber; Bio pesticides - Neem, Tobacco; Ornamental plants - Rose, Orchids, Anthurium.

Module 5: Medicinal plants (8 hrs)

Study of the following medicinal plants with special reference to their binomial, family, morphology of useful parts and uses: *Adhatoda, Aloe*, *Bacopa*, *Catharanthus*, *Eclipta*, Neem, *Ocimum*, *Phyllanthus amarus*, *Rauvolfia*, *Sida.*

PRACTICAL (36 hrs)

1. Students should be trained to identify the different types of inflorescence and fruits of typical plants belonging to the families prescribed in the syllabus.
2. Students should be trained to identify typical local plants belonging to the families prescribed in the syllabus.
3. Students should be trained to describe the floral parts in technical terms and draw the L.S. of flower, construct the floral diagrams and write the floral formula of at least one flower from each family.
4. Study of the groups of plants mentioned in the economic botany syllabus with special reference to their botanical name, family, morphology of useful part, economic products and uses.
5. Students should study the botanical name, family, morphology of the useful part and the uses of the medicinal plants listed in the syllabus.

REFERENCES

1. Eames A J, 1969. *Morphology of Angiosperms*. McGraw Hill, New York.
2. Hill A F, 1952. *Economic Botany: A Text book of Useful Plants and Plant Products*. Tata McGraw-Hill Publishing Company Limited, New Delhi.
3. Jain S K, 1987. A Manual of Ethnobotany. Scientific Publishers, Jodhpur.
4. Kochhar S L, 1981. *Economic Botany in the Tropics.* Macmillion India Limited, Delhi.
5. Lawrence G H M, 1951. *Taxonomy of Vascular Plants*. Oxford & IBH, New Delhi.
6. Naik V N, 1984. *Taxonomy of Angiosperms*. Tata McGraw Hill Publishing Co, New Delhi.
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9. Simpson B S, M Conner – Ogorzaly, 1986. *Economic Botany: Plants in Our World.* McGraw Hill Book Company, New York.
10. Singh G, 1999. *Plant Systematics – Theory and Practice.* Oxford & IBH, New Delhi.

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SEMESTER IV

Complementary course 4 Code: BO4CMT04
ANATOMY AND APPLIED BOTANY
(Theory 54 hrs; Practical 36 hrs; Credits 3 + 1)

Objectives:

- Understand different types of plant tissues.
- Understand the internal structure of different plant organs with reference to their functions.
- Understand the process of normal and anomalous secondary thickening in plants.
- Know the morphological and anatomical adaptations of plants growing in different habitats.
- Understand how botanical knowledge could be applied for crop improvement.

PLANT ANATOMY (27 hrs)

Module 1: Cells and tissues (9 hrs)

Gross structure of primary and secondary cell walls; structure and function of plasmodesmata; non-living inclusions - cystolith, raphides; Tissues – meristematic and permanent, types of meristems; simple and complex tissues, secretory tissues (nectaries, hydathodes, mucilage ducts and lactiferous tissue).

Module 2: Anatomy of plant organs (12 hrs)

Primary structure of stem and root in dicots and monocots; anatomy of monocot and dicot leaf. Secondary thickening in dicot stem and dicot root, heart wood and sap wood; tyloses; hard wood and soft wood; growth rings, dendrochronology. Anomalous secondary thickening in *Bignonia*.

Module 3: Ecological anatomy (6 hrs)

Study of the morphological and anatomical adaptations of the following groups: Hydrophytes – *Nymphaea*, Hydrilla; Xerophytes – *Nerium;* Epiphytes - *Vanda*.

APPLIED BOTANY: Plant breeding, Horticulture and Micropropagation (27 hrs)

Module 4: Plant breeding (12 hrs)

Objectives of plant breeding, methods of plant improvement - plant introduction, acclimatization, plant quarantine; selection - mass selection, pureline selection and clonal selection; hybridization - intervarietal, interspecific and intergeneric; procedure of hybridization.

Module 5: Artificial vegetative propagation methods (5 hrs)

Propagation of plants through cutting, layering - air layering; budding T and patch budding; grafting - tongue and splice grafting. Role of cambium in budding and grafting.

Module 6: Plant tissue culture (10 hrs)

Principles of tissue culture, micropropagation - different steps - selection of explants, culture media – general composition and preparation; sterilization of media and explants; callus. Regeneration of plants: organogenesis, somatic embryogenesis; artificial seeds. Applications of plant tissue culture.

PRACTICAL (36 hrs)

1. Primary structure of stem and root of dicots and monocots; Dicot stem - Centella; Monocot stem – Bamboo, grass, asparagus; Dicot root - Tinospora; Monocot root - Colocasia, Musa.
2. Structure of dicot stem and dicot root after secondary thickening; Stem - Vernonia, Eupatorium; Root - Tinospora, Papaya.

3. Anomalous secondary thickening in *Bignonia.*
4. Anatomical adaptations of Hydrophytes - *Nymphaea* petiole, *Hydrilla* stem; Xerophytes - *Nerium* Leaf; Epiphytes - Velamen root of *Vanda*.
5. Emasculation of pea or *Caesalpinia* flower.
6. Demonstrate T and patch budding.
7. Demonstration of tissue culture techniques: culture media, surface sterilization and inoculation of explants.
8. Identification of non living inclusions - cystolith, raphides.

REFERENCES

1. Christopher E P, 1958. *Introductory Horticulture*. McGraw – Hill, New York.
2. Esau K, 1965. Plant Anatomy. Wiley, New York.
3. Fahn A, 1985. *Plant Anatomy*. Pergamon Press, Oxford.
4. Hartman H T, D E Kester, 1991. *Plant Propagation: Principles and Practices*. Prentice Hall of India, New Delhi.
5. Kumar N, 1994. *Introduction to Horticulture*. Rajalakshmi Publications, Nagercoil.
6. Pandey B P, 1984. *Plant Anatomy*. S Chand and Company, New Delhi.
7. Vasishta V C, 1978. *Plant Anatomy*. S Nagin and Company, Jalandhar.

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B Sc BOTANY PROGRAMME - MODEL II (VOCATIONAL)

PROGRAMME DESIGN

The UG Programme in Botany (Model II Vocational) must include (a) Common courses, (b) Core courses, (c) Complementary courses, (d) Vocational courses, (e) Open course, (f) Choice based core course (Elective course), (g) Project work and (h) Hands-on training (HOT). No paper shall carry more than 4 credits. The student shall select choice based core course offered by the department that enables the students to familiarize the advanced area of core course. Students can opt for any one of the Open course offered by different departments of the college in V semester.

PROGRAMME STRUCTURE: SUMMARY OF COURSES AND CREDITS

Sl. No.	Course type	No. of courses	Total credits
1	Common course I - English	4	16
2	Common course II – Additional language	2	8
3	Core + Practical	12 + 6	46
4	Vocational + Practical	8 + 3	26
5	Complementary + Practical	4 + 2	14
6	Open course	1	3
7	Programme elective (Choice based core course)	1	3
8	Project work	1	2
9	HOT	1	2
Total		**45**	**120**
Total credits		120	
Programme Duration		6 Semesters	
Minimum attendance required		75%	

B Sc BOTANY PROGRAMME - MODEL II (VOCATIONAL)

SEMESTERWISE DISTRIBUTION OF COURSES

Course Title	Hrs/ week	Credits	Course Title	Hrs/ week	Credits
SEMESTER I			**SEMESTER II**		
Common course - English 1	5	4	Common course - English 2	5	4
Common course – Additional language course 1	5	4	Common course – Additional language course 2	5	4
Core course 1 + Practical	4	3	Core course 2 + Practical	4	3
Complementary course 1 + Practical	5	3	Complementary course 2 + Practical	5	3
Vocational course 1	2	2	Vocational course 3	2	2
Vocational course 2 + Practical	4	3	Vocational course 4 + Practical	4	3
Total	**25**	**19**	**Total**	**25**	**19**
SEMESTER III			**SEMESTER IV**		
Common course – English 3	5	4	Common course – English 4	5	4
Core course 3 + Practical	5	4	Core course 4 + Practical	5	4
Complementary course 3 + Practical	5	4	Complementary course 4 + Practical	5	4
Vocational course 5 + Practical	5	4	Vocational course 7 + Practical	5	4
Vocational course 6 + Practical	5	4	Vocational course 8 + Practical	5	4
Total	**25**	**20**	**Total**	**25**	**20**
SEMESTER V			**SEMESTER VI**		
Core course 5 + Practical	5	4	Core course 9 + Practical	5.5	4
Core course 6 + Practical	5.5	4	Core course 10 + Practical	5	4
Core course 7 + Practical	5.5	4	Core course 11 + Practical	6.5	4
Core course 8 + Practical.	5	4	Core course 12 + Practical	5	4
Open course	4	3	Programme elective - Choice based core course	3	3
Total	**25**	**19**	Project work	--	2
			Hands-on training	--	2
			Total	**25**	**23**

B Sc BOTANY PROGRAMME - MODEL II (VOCATIONAL)
COMBINATION AND SEMESTER-WISE DISTRIBUTION OF VOCATIONAL COURSES

Sem.	Course category	Course code	Course title	Instr. hrs.* Th.	Instr. hrs.* Pr.	Credits
1. Environmental monitoring and Management						
I	Vocational	BO1VO1T01	Environmental Biology Part-I	36	--	2
	Vocational	BO1VO1T02	Environmental Biology Part-II	36	36	2 + 1
II	Vocational	BO2VO1T03	Environmental Microbiology	36	--	2
	Vocational	BO2VO1T04	Environmental hygiene and Human health	36	36	2 + 1
III	Vocational	BO3VO1T05	Environmental Monitoring Part-I	54	36	3 + 1
	Vocational	BO3VO1T06	Environmental Conservation and Management Part-I	54	36	3 + 1
IV	Vocational	BO4VO1T07	Environmental Monitoring Part-II	54	36	3 + 1
	Vocational	BO4VO1T08	Environmental Conservation and Management Part-II	54	36	3 + 1
2. Food Microbiology						
I	Vocational	BO1VO2T01	Microbial world Part-I	36	--	2
	Vocational	BO1VO2T02	Microbial world Part-II	36	36	2 + 1
II	Vocational	BO2VO2T03	Applied Microbiology Part-I	36	--	2
	Vocational	BO2VO2T04	Applied Microbiology Part-II	36	36	2 + 1
III	Vocational	BO3VO2T05	Principles of Food Microbiology	54	36	3 + 1
	Vocational	BO3VO2T06	Contamination, spoilage and Preservation of Food Part-I	54	36	3 + 1
IV	Vocational	BO4VO2T07	Contamination, spoilage and Preservation of Food Part-II	54	36	3 + 1
	Vocational	BO4VO2T08	Food fermentations, Food infection and Food borne diseases	54	36	3 + 1
3. Horticulture and Nursery management						
I	Vocational	BO1VO3T01	Fundamentals of Horticulture	36	--	2
	Vocational	BO1VO3T02	Plant Propagation	36	36	2 + 1
II	Vocational	BO2VO3T03	Ornamental Horticulture and Landscaping	36	--	2
	Vocational	BO2VO3T04	Plant protection and Nursery management	36	36	2 + 1
III	Vocational	BO3VO3T05	Floriculture	54	36	3 + 1
	Vocational	BO3VO3T06	Olericulture	54	36	3 + 1
IV	Vocational	BO4VO3T07	Pomology, Food technology and Post-harvest management of Horticultural crops	54	36	3 + 1
		BO4VO3T08	Cultivation of Medicinal and aromatic plants, spices and Plantation crops	54	36	3 + 1
4. Plant Biotechnology						
I	Vocational	BO1VO4T01	Introduction to Biotechnology	36	--	2
	Vocational	BO1VO4T02	Microbiology	36	36	2 + 1
II	Vocational	BO2VO4T03	Molecular Biology	36	--	2
	Vocational	BO2VO4T04	Fundamentals of Enzymology and Radiobiology	36	36	2 + 1
III	Vocational	BO3VO4T05	Biotechniques and Instrumentation	54	36	3 + 1
	Vocational	BO3VO4T06	Basics of Molecular cloning techniques	54	36	3 + 1
IV	Vocational	BO4VO4T07	Genetic Engineering	54	36	3 + 1
	Vocational	BO4VO4T08	Plant Tissue culture	54	36	3 + 1

* 18 instructional hours is equal to one teaching hour per week

ENVIRONMENTAL MONITORING AND MANAGEMENT

SEMESTER I

Vocational course 1 Code: BO1VO1T01
ENVIRONMENTAL BIOLOGY PART - I
(Theory 36 hrs; Credits 2)

Objectives:
To enable students to;

- Create awareness on aspects of the ecosystem and interactions within the system.
- Have an idea on diverse group of plants, their survival and their interactions in different environments.
- Understand the flow of energy and route of elements through the ecosystem.

Module 1: Environment and Ecology (4 hrs)
Definition, principles and scope of environmental science, history of ecology, subdivisions of ecology - autoecology and synecology. Fundamental ecological variables - matter, light, time, space and diversity.

Module 2: Ecosystems (14 hrs)
Definition, components, structure, function and size of ecosystems. Types of ecosystems - freshwater ecosystems, marine ecosystem, terrestrial ecosystems. Structure, function and characteristics of: forest ecosystem - temperate and tropical forests, arctic and alpine forests, tundra's. Deserts ecosystem - arid and semi-arid. Grassland ecosystems - savannas. Coastal and marine ecosystem - coral reefs. wetlands - lakes, rivers, estuaries. Mangroves.

Module 3: Ecosystem processes (8 hrs)
Nutrient cycles, energy flow, homeostasis in the ecosystem. Biogeochemical cycles (gaseous - C, N, O; sedimentary cycles – S, P). Trophic relations, food chain, food-web and ecological pyramids, concept and measurement of productivity.

Module 4: Biodiversity (10 hrs)
Introduction, definition, types of biodiversity - species, genetic and ecosystem diversity. Composition and levels of biodiversity, ecological foot prints, endemic species, endangered species - flora and fauna. Red data book, key stone species, flag ship species, values and distribution pattern of biodiversity - biodiversity hotspots, biodiversity depletion-causes and consequences. Plant and animal interactions.

REFERENCES

1. Abbasi S A, 1998. Environmental pollution and its control. Cogent International, Pondicherry.
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3. Abbasi S A, Ramasami E, 1999. Biotechnological methods of pollution control. Universities Press, Hyderabad.
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7. Baird C, 1999. Environmental chemistry. W H Freeman & Co., New York.

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10. Brady N C, 1996. Nature and Properties of Soil. Prentice Hall of India Pvt. Ltd. New Delhi.

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Vocational course 2 Code: BO1VO1T02
ENVIRONMENTAL BIOLOGY PART–II
(Theory 36 hrs; Practical 36 hrs; Credits 2 + 1)

Objectives:
To enable students to;

- Assess the inter-relationship between organisms at population and community level
- Create awareness on importance of biological resources
- Study types and process of succession

Module 1: Population Ecology (6 hrs)
Definition, structure and measurements - density, growth, natality, mortality. population dispersal and distribution, population growth. Factors affecting population, carrying capacity, population regulation.
Module 2: Community Ecology (12 hrs)
Concepts of community, structure, community gradients - ecotone, edge effect, continuum concept, ecological niche, ecological equivalents, ecotypes. Characters of community: qualitative characters - floristic composition, stratification and periodicity. Quantitative characters - density, abundance and species diversity. Analysis - quadrate and transect method.
Module 3: Ecological Succession (12 hrs)
Definition, classification, processes - nudation, invasion or migration, competition, climax - concept of climax, theories and significance, Kinds of succession - hydrsere and xerosere. Interactions between species: competition, predation, mutualism commensalism, parasitism and allelopathy.
Module 4: Biological resources (6 hrs)
Plant and animal resources, mangrove and wet land resources, agricultural resources, forest products and biomass, microbial resources and their ecological significance.

PRACTICAL (36 hours)
1. Vegetation analysis - association, diversity, frequency, density, productivity (primary) indirect estimation of standing crop.
2. Aquatic ecosystems - survey, mapping, preservation, identification and abundance estimation of macrophytes, biomass and primary productivity; dissolved oxygen and pH.
3. Visits to mangrove and inland water ecosystems.
4. Demonstration of ecosystems and succession patterns: familiarization of forest products, plants and animal resources.

REFERENCES
1. Chakrabartti N K, 1994. Environmental Protection and Law. Abilash Publishing House, New Delhi.
2. Chapman J L, Reiss M J, 1992. Ecology: Principles and Applications. Cambrdige University Press.
3. Claus W G, 1989. Understanding Microbes: A laboratory text book for Microbiology. W H Freeman and Co., New York.

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6. Emiliani C, 1997. Planet Earth: Cosmology, Geology.
7. Freedman B (Ed), 1995. Environmental Ecology: The ecological aspects of pollution, disturbance and other stresses. Academic Press.
8. Gabriel Bitton, 1994. Water and Waste water Microbiology. John Wiley & sons, N. York.
9. Goel P K, Sharma K P, 1996. Environmental Guidelines and Standards in India. Techno Science Publications, Jaipur.

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SEMESTER II

Vocational course 3 Code: BO2VO1T03
ENVIRONMENTAL MICROBIOLOGY
(Theory 36 hrs; Credits 2)

Objectives:
To enable students to;

- Understand the world of microbes & evaluate their role in the environmental segments.
- Evaluate the application of microbiology in different fields.
- Study the aspects of food spoilage and importance of preservation of food.

Module 1: Microorganisms in the Environment (12 hrs)
Introduction to Microbiology. Bacteria: Morphology and ultra structure of bacteria, classification, nutrition - autotrophy and heterotrophy, reproduction. Fungi: morphology and structure of fungal hyphae and mycelium, classification, reproduction and life cycle. Protozoa: structure, symbiotic and parasitic protozoans, reproduction and life cycle. Viruses: structure, types, multiplication and life cycle. Bacteriophages - lytic and lysogenic cycle.

Module 2: Microorganisms and the Environment (12 hrs)
Role of microbes in the environment, microbes in biogeochemical cycles, microbial transformation of metals, biological nitrogen fixation and microbial antibiotics, microorganisms in extreme environments. Distribution of microorganisms in soil, water and air. Soil Microbiology - soil microorganisms association with plants - the rhizosphere, mycorrhizae, actinorrhizae, tripartite association, fungal and bacterial endophytes of plants, Agrobacterium, soil microorganisms interactions with the atmosphere.

Module 3: Food microbiology (4 hrs)
General properties of food spoilage, chemical changes caused by microorganisms, microbial toxins, fermentation products, preservation of food.

Module 4: Diseases connected with food and water (8 hrs)
Food poisoning, food allergy. Microorganisms and water pollution: significance of bio-indicators - faecal bacteria and pathogenic microorganisms, microbial interaction with other organisms - competition, parasitism and mutualism. Microbial analysis of water quality.

REFERENCES

1. Hans F Linskens, John F Jackson, Peter J S Bain, 1999. Analysis of plant waste material. Springer, Berlin.

2. Holmes A, 1965. Principles of Physical Geology, ELBS.
3. Jackson M L, 1973. Soil Chemical Analysis. Prentice Hall Pvt. Ltd, New Delhi.
4. Khan A, 2002. Sustainable Development Watershed Management for Sustainable Development. Agro botanical Publishers, Bikaner.
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6. Schlegel H G, 1973. General microbiology, Cambridge University Press.
7. Scragg A, 1999. Environmental Biotechnology. Addison Wesley Longmann, Singapore.
8. Sharma P D, 2005. Environmental Microbiology. Narosa Publishing House, New Delhi.

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Vocational course 4 Code: BO2VO1T04
ENVIRONMENTAL HYGEINE AND HUMAN HEALTH
(Theory 36 hrs; Practical 36 hrs; Credits 2 + 1)

Objectives:
To enable students to;

- Understand the environmental factors that relate to human health and diseases.
- Study the importance of sanitation and hygiene in preserving the environment and maintaining good health.
- Make awareness on industrial hazards.

Module 1: Environmental factors in health (7 hrs)
Health and Diseases: physical, chemical and biological factors that affect health. Common water borne diseases and their control, home environment, Sanitation and hygiene, basic needs and relationships of sanitation to health. Epidemiological diseases due to pollution problems with special reference to Kerala. Role of sex education; sexually transmitted diseases – AIDS.

Module 2: Occupational hazards and safety (10 hrs)
Environmental and occupational safety - definitions, concept and scope. Occupational hazards and diseases - physical hazards - noise, radiation. Chemical hazards - dust of silica, cement, paper, cotton, jute, pesticides, particulate matter. Biological hazards - psychological and physiological fatigue. Control of toxic materials and safety measures.

Module 3: Toxicology (9 hrs)
Definition, poison, toxin, dose, exposure, xenobiotics and hazards. Physical toxicity - particulates, gaseous, solvent and vapour. Chemical toxicity - halogens, hydrocarbons, pesticides and heavy metals. Physiological toxicants - irritants, anaesthetics, narcotics, asphyxiants and systemic poisons.

Module 4: Mode of action of toxicants (10 hrs)
Transport processes of toxicants, biotransformations, bioaccumulation and bioconcentration. Factors affecting toxicity, dose effect and dose response relationship, dose effect and dose response curves. Toxic effect due to combination of chemicals - additive, potentiation, antagonism and synergism.

PRACTICAL (36 hours)
1. Microbial techniques: sterilization – flame sterilization, hot-air oven, boiling water bath, autoclaving, chemical sterilization, plating, isolation, streaking and identification.
2. Mounting and staining: (a) gram stain, (b) acid fast: aerobic and anaerobic microbes, identification: milk, food and soil microbes. Identification of pathogenic microbes in water.
3. Toxicity studies - application of LC_{50} in fishes, spot test for plant.

4. Pollution indicators: phytoplankton and zooplankton counts, biotic index, palmer's algal pollution index.
5. Field visits (regions of environmental problems).

REFERENCES

1. Kumar U, 2002. Air Pollution: Effects, Causes, Control and Analysis. Agro botanical Publishers, Bikaner
2. Kumar A, Lalan H S, 2000. Advanced Ecology. Daya Books.
3. Levy B S, Wagman D H (Ed), 1995. Occupational health: recognizing and preventing work related disease. Little Brown & Co.
4. Majumdar, Singh, 2002. Analysis of Soil Physical Properties. Agro botanical Publishers, Bikaner.
5. Marquita K Hill, 1997. Understanding Environmental Pollution. Cambridge University Press.

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SEMESTER III

Vocational course 5 Code: BO3VO1T05
ENVIRONMENTAL MONITORING – PART I
(Theory 54 hrs; Practical 36 hrs; Credits 3 + 1)

Objectives:

- Study about pollutants that adversely affect air environment
- Familiarize techniques involved in monitoring and controlling of air pollutants
- To study the causes & effects of soil pollution
- To highlight the adverse effects of quarrying, deforestation & unscientific farming practices
- To create awareness on different land use practices, involved in preserving our soil resource
- Study the methods involved in analysis of the soil pollutants

Module 1: Air pollution (15 hrs)

Structure and constituents; sources , nature and types of pollutants, particulate matter, aerosols, fly ash, sulphur, halogen, carbon and nitrogen compounds, primary and secondary air pollutants, Photochemical smog, Ozone depletion, Acid rain, Green house effect, Inversions, Biopollutants: effect of air pollution on health, plants, climate and materials. Radioactive pollutants: origin of radionuclides - natural and artificial- their path and effects on the ecosystem.

Module 2: Air pollution monitoring and control (14 hrs)

Pollution control by particulate removal, setting chamber, air scrubbers, water spraying, filters and electro static preceptors. Removal of gaseous pollutants and treatment of air pollutants - in chemical industries, refineries, thermal power plants, cement industries, automobile exhausts. Air quality standards and principles of air monitoring devices.

Module 3: Environmental chemistry of soil (7 hrs)

Introduction, weathering and pedogenesis; factors of soil formation, development of soil profile, structure of soil, organic and inorganic components of soil, physico-chemical characteristics of soil, ion-exchange and adsorption processes in the soil. Classification of soil types of soil (Reference to India and Kerala).

Module 4: Soil pollution (4 hrs)

Sources, nature and types of soil pollutants - fertilizer residues, solid wastes, radio active substances, hospital wastes, pesticide pollution, field run off and sewage effluents.

Module 5: Adverse effects of soil pollution (14 hrs)

Various aspects of soil erosion, soil degradation, water logging, sand and clay mining, desertification, quarrying, land conversion for agriculture, deforestation and farming, urban housing, road development and over grazing. Soil plant interactions, adverse effects of land use practices in Kerala. Soil pollution monitoring and control; methods and principles of analysis for the soil pollutants.

PRACTICAL (36 hrs)

1. Sampling techniques of soil.
2. Physical parameters: Soil type, soil profile and texture.
3. Preparation of soil extract.
4. Determination of pH, acidity, total organic content, potassium and calcium.
5. Familiarize the equipments used in soil analysis.
6. Determination of soil texture - triangular diagram.

REFERENCES

1. Brady N C, 1996. Nature and Properties of Soil. Prentice Hall of India Pvt. Ltd. New Delhi.
2. Mido Y, S A Iqbal, 1995. Chemistry of air and air pollution. Discovery publishing house, New Delhi.
3. Marquita K Hill, 1997. Understanding Environmental Pollution. Cambridge University Press.
4. Kumar U, 2002. Air Pollution: Effects, Causes, Control and Analysis. Agrobotanical Publishers, Bikaner.
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6. Jackson M L, 1973. Soil Chemical Analysis. Prentice Hall Pvt. Ltd, New Delhi.
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9. Pandey S N, Mishra S P, 2011. Environment and Ecology. Ane Books Pvt Ltd. New Delhi.

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Vocational course 6 Code: BO3VO1T06
ENVIRONMENTAL CONSERVATION AND MANAGEMENT – PART I
(Theory 54 hrs; Practical 36 hrs; Credits 3 + 1)

Objectives:

- Familiarize different aspects of habitat management
- Highlight strategies and planning involved in land use management for sustainable development
- Create awareness on importance of solid waste and water resource management
- Study various aspects of ecotourism
- Evaluate the importance of environmental education in preserving our resources

Module 1: Habitat management (15 hrs)

Conservation of forests, wild life, air, water, soil and environments. Threats/depletion of biodiversity, conservation of biodiversity - ex-situ and in-situ; national parks, wildlife sanctuaries, biosphere reserves, sacred groves. International conservation strategies - CBD, CITES, global biodiversity strategy, GEF Initiatives, national biodiversity action plans, biodiversity registries, biodiversity with

special reference to Kerala, cause of extinction of species, endangered species, management of mangrove vegetation.

Module 2: Land use management for sustainable development (10 hrs)

Strategies and planning for soil pollution control, changes in agricultural practices, solid waste management, vermicomposting, bacterial composting. Precautions in the use of radioactive substances. Occupational health hazards with relation to solid waste disposal.

Module 3: Water resources management (6 hrs)

Socio-economic factors involved in managing water resources. Conventional and non-conventional sources of water supply management, rain water harvesting.

Module 4: Ecotourism (15 hrs)

From an environmental management perceptive rather than tourism as an industry. Ecotourism and responsible tourism. Identification of nature based ecotourism opportunities in Kerala - dam sites, HEP, waterfalls, mangroves, bird sanctuaries, pilgrim tourism, forest area, parks, sacred groves, beaches, wildlife sanctuaries, national parks. Strategies to maintain these areas in an ecological sustainable way. Coastal management activities in India and Kerala.

Module 5: Environmental education (8 hrs)

Education to inculcate environmental consciousness among learners. Non-formal and formal education (business, union, community and other organizations): methodologies (posters, banners, audio-visual aids, street plays, padayatras, corner meetings).

PRACTICAL (36 hrs)

1. Analysis of chemical parameters - acidity, alkalinity and hardness of water sample.
2. Analysis of biological parameters: Identification, counting of zooplanktons and phytoplanktons, estimation of productivity using algae.
3. Study different agricultural practices and its significance.
4. Familiarize the equipments and the steps involved in estimating soil water content.
5. Identification of endangered animal and plant species of Kerala from photographs.

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SEMESTER IV

Vocational course 7 Code: BO4VO1T07
ENVIRONMENTAL MONITORING - PART II
(Theory 54 hrs; Practical 36 hrs; Credits 3 + 1)

Objectives:

- Create awareness on importance of water as a resource
- Know about pollutants that adversely affect aquatic environment
- Familiarize techniques involved to analysis of water pollutants
- Study the causes & effects of water pollution.
- Highlight the adverse effects various industries that contribute to aquatic pollution
- Study methods involved in water pollution monitoring and control
- Perform analysis to assess soil & water quality

Module 1: Hydrosphere (15 hrs)

Nature and composition of natural waters, hydrological cycle, trace level substances in water, redox equilibria in natural waters. Physical and chemical properties of water in relation to living organisms. Biological importance of water, hydrological cycle, ground water, types of water, origin, movement, storage and factors affecting ground water. Ground water – replenishment, potable water qualities. Quality and productivity of fresh water, estuarine and marine water.

Module 2: Water analysis (10 hrs)

Sampling techniques - sample preservation and their importance. Water quality monitoring devices - principles. Physical and chemical tests of water related to water pollution. Principles and methods of water analysis.

Module 3: Water pollution (10 hrs)

Sources, types and nature of pollutants. Nature and effects of water pollutants - acids, alkalis, thermal, radioactive, heavy metals, pesticides, waxes, soaps, fertilizers, farm wastes, sewage and industrial effluents, synthetic detergents. Effects of water pollutants on human beings, plants and animals. Quality of water - eutrophication, bloom formation, COD, BOD, turbidity, salinity and colour.

Module 4: Water pollution monitoring and control (12 hrs)

Water and waste water treatment. Preliminary, primary, secondary and tertiary treatments. Treatment of industrial waste water - chemical, fertilizer, paper pulp, tannery, sugar distillery and oil refineries; recycling of industrial and domestic waste waters. Water quality criteria and standards (Indian and International).

Module 5: Biomonitoring (7 hrs)

Bioassesment - bioassays, 5 R's of biomonitoring – eutrophicaction monitoring. Biotic index. Bioindicators - uses of biomonitoring.

PRACTICAL (36 hrs)

1. Analysis of physical parameters - temperature, colour, pH, turbidity, conductivity, and total solids, total dissolved solids and total suspended solids of water sample.
2. Analysis of chemical parameters – CO_2, salinity, dissolved oxygen, COD, productivity and BOD of water sample.
3. Analysis of biological parameters: Identification counting of zooplanktons and phytoplanktons, estimation of productivity using algae.
4. Familiarize instruments and chemicals used in water quality analysis.

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2. Mido Y, S A Iqbal, 1995. Chemistry of Air and air pollution. Discovery Publishing House, New Delhi.
3. Mishra P C, 1995. Advances in Ecology and Environmental Sciences. APH Publishing.
4. Munn R E (Ed), 1979. Environmental Impact Assessment: Principles and procedures. John Wiley & sons, New York.

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Vocational course 8 Code: BO4VO1T08
ENVIRONMENTAL CONSERVATION AND MANAGEMENT – PART II
(Theory 54 hrs; Practical 36 hrs; Credits 3 + 1)

Objectives:

- Create awareness on the present laws associated with environmental protection
- Know about role of various international & national organizations that help in preserving our environment & resources
- Study the principles and tools evolved for development on sustainable basis
- Attain the acquired ability to impart knowledge to local public as a means to preserve environment and resources at grass root level
- Get an idea on aspects of disaster management and its effect on development

Module 1: Environmental legislation (10 hrs)

Fundamental principles of environmental laws, General structure of environmental laws in India and constitutional responsibilities, The Water (Prevention and Control of Pollution) Act 1974, The Air (Prevention and Control of Pollution) Act 1981, The environment (Protection) act 1986, wild life protection act 1972, Forest Conservation Act 1980. Laws for the waste disposal – solid waste and hazardous waste, biomedical waste.

Module 2: Environmental conventions and summits (6 hrs)

Stockholm Convention 1972, Montreal Protocol 1987, Ramsar Convention, Rio declaration 1992 and Agenda 21, Earth Summit, Kyoto Protocol.

Module 3: National and international organizations on environment (9 hrs)

UNEP, UNDP, WWF, IUCN, Earth watch, Green Peace; Information networks - ENVIS centres, National bureau for plant genetic resources (NBPGR), conservation of gene reserve, global environmental management, non-conventional energy use.

Module 4: Tools in sustainable development (10 hrs)

Principles and tools in sustainable development; careful identification of the causes and consequences (short term and long term) of a broad range of problems in developing and industrial countries. Environmental impact assessment, environmental auditing, remote sensing, geographic information systems, biofarming, environmental planning.

Module 5: Environmental policy (7 hrs)

Role of social movements - peoples Participation and various movements for environmental protection, formal organizations, national organizations, institutions (Parliament and Cabinet), mass media, the educational systems and scientists, role of NGOs in the implementation of environmental policies.

Module 6: Disaster management and Development (12 hrs)

Characterization of natural disasters and its management - earthquake, draught, flood and landslide. Link between disasters and development.

PRACTICAL (36 hours)

1. Analysis of chemical parameters - acidity, alkalinity of water sample.
2. Illustrate the steps involved in management of organic waste / control of soil pollution.
3. Study of different types of disasters and enumerate its environmental effects.

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FOOD MICROBIOLOGY

SEMESTER I

Vocational Course 1 Code: BO1VO2T01

MICROBIAL WORLD - PART I

(Theory 36 hrs; Credits 2)

Module 1: History and scope of microbiology (6 hrs)

History and scope of Microbiology; theory of spontaneous generation, theory of biogenesis. Contributions of early microbiologists - Anton van Leeuwenhoek, Robert Koch, Edward Jenner, Louis Pasteur, Paul Ehrlich, Alexander Fleming.

Module 2: Cell structure of prokaryotes and eukaryotes (10 hrs)

Prokaryotic cell - structure and function; size, shape and arrangement; cell organisation, membrane system, nucleoid; wall structure - peptidoglycan, gram positive and gram negative cell walls; components external to cell wall - capsule, slime layers, pili and fimbriae, flagella, endospore, cysts. General characters of Archaebacteria – classification.

Eukaryotic cell - structure and function, nucleus, cell inclusions - living and non living, external cell coverings, cilia and flagella.

Module 3: General characters of other microorganisms (10 hrs)

Viruses - Structure of viruses, virion size, nucleic acids, capsids, cultivation of viruses - structure of TMV and HIV. Bacteriophages - discovery, structure of bacteriophages, methods of replication - lytic and lysogenic cycle. Viroids and prions. General characters of fungi, yeast, protozoa.

Module 4: Microscopy (10 hrs)

Introduction to microscopy - resolution - limit of resolution - magnification - optics, principle and working of bright field microscopy, dark field microscopy, fluorescence microscopy, phase contrast microscopy - electron microscopy - TEM and SEM.

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Vocational Course 2 Code: BO1VO2T02
MICROBIAL WORLD - PART II
(Theory 36 hrs; Practical 36 hrs; Credits 2 + 1)

Module 1: Systematic Bacteriology (6 hrs)
Bergey's manual of systematic bacteriology: history, classification into 4 volumes – study of major groups - Spirochaetes, Enterobacteriaceae, Nitrogen Fixers, Rickettsiae, Chlamydiae, Mycoplasma, Endospore forming bacteria.
Module 2: Bacterial Growth (8 hrs)
Bacterial multiplication – bacterial growth curve - generation time - batch culture - continuous culture - synchronous culture - quantitative measurement of growth.
Module 3: Bacterial Physiology (12 hrs)
Nutritional requirements of microorganisms - nutritional types of Bacteria - physical conditions required for growth - Bacterial metabolism - respiration, fermentation, photosynthesis.
Module 4: Bacterial Genetics (10 hrs)
Mutation - types of mutation - bacterial recombination - transformation, conjugation, transduction. Genetic mapping in Bacteria. Plasmids – general features, use in recombinant DNA Technology.

PRACTICAL (36 hrs)
1. Laboratory techniques in Microbiology: Microscopy - use of bright field microscope, study of parts and functions; Use of equipment and glass wares - inoculating loop, needle, petri dishes, flasks, culture tubes, pipettes, pasteur pipettes, hot air oven, autoclave, incubator, water bath, colony counter, filters, UV lamp, pH meter, centrifuge, colorimeter, laminar air flow system.
2. Micrometry: measurement of size of fungal spores/yeast cells/ bacteria.
3. Bacterial motility - Hanging drop technique.
4. Cleaning glass wares, drying, plugging tubes and flasks, wrapping Petri dishes.

REFERENCES
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25. N Kannan. Laboratory manual in general microbiology. Panima Publishing Corporation, New Delhi.
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SEMESTER II

Vocational Course 3 Code: BO2VO2T03
APPLIED MICROBIOLOGY- PART I
(Theory 36 hrs; Credits 2)

Module 1: Sterilization Techniques (10 hrs)

Principles of sterilization - Control of microorganism by physical agents: dry heat, moist heat, filtration, radiation - Control of microorganism by chemical agents: phenolic compounds, alcohol, halogens, aldehydes and gaseous agents

Module 2: Staining Techniques (8 hrs)

Stains - wet mount and hanging drop techniques - smear preparation – heat fixation. Staining methods - simple staining - differential staining: gram staining, acid fast staining; special staining: spore staining, capsular staining.

Module 3: Cultivation of Microorganisms (6 hrs)

Media and media components: peptone, beef extract, yeast extract, agar agar, blood/serum – Sterilization of media - Types of media: crude and synthetic media, selective and differential media - composition and preparation of nutrient broth, nutrient agar, PDA, Czapex-dox agar.

Isolation of microbes - serial dilution, pure culture techniques: pour plate, spread plate and streak plate methods

Module 4: Antimicrobial Chemotherapy (12 hrs)

Chemotherapeutic agents - antibiotics and their classification based on mode of action- antifungal agents - antiviral agents - Determination of antimicrobial activity - Tube dilution and disk diffusion techniques - MIC and MBC.

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Vocational Course 4 Code: BO2VO2T04

APPLIED MICROBIOLOGY – PART II

(Theory 36 hrs; Practical 36 hrs; Credits 2 + 1)

Module 1: Environmental Microbiology (10 hrs)

Role of microbes in bio-geochemical cycling : Carbon, Sulphur and Nitrogen cycles - biological nitrogen fixation – Biofertilizers – Biocompost – Biodeterioration of leather, textile, jute, paper, rubber, paints - Role of microbes in organic decomposition of cellulose, hemicelluloses, lignin, pectin, starch, proteins

Module 2: Microbiology of Water (6 hrs)

Microorganisms and water pollution - Significance of bio-indicators - Faecal bacteria and pathogenic microorganisms - Detection of coliforms by MPN - Waste water treatment

Module 3: Clinical microbiology (12 hrs)

Fundamentals of Immunology - Immunity : innate and acquired immunity - Antigens Epitopes - Haptens - Factors influencing immunogenicity - Immunoglobulins - basic and fine structure, 5 classes of immunoglobulins – B cells and T cells - MHC restriction - Immune response : antibody mediated and cell mediated immune responses – vaccines – toxins and toxoids - interferons

Module 4: Microbial Diseases (8 hrs)

Bacterial diseases - diphtheria, tuberculosis, whooping cough, leprosy, syphilis, tetanus and cholera

Viral diseases - chicken pox and shingles, measles, mumps, rabies, serum hepatitis, AIDS

PRACTICAL (36 hrs)

1. Study of bacteria: Preparation and fixation of bacteria for staining; Simple staining- methylene blue/ crystal violet/ carbol fuchsin / safranin; Differential staining- Gram staining, acid fast staining, spore staining.

2. Preparation of culture media: Sterilisation - media, glass wares; moist heating - Autoclaving, Tyndallization, Boiling in water, Steaming; Dry heating - Heating in hot air oven and flaming. Preparation of media - Nutrient agar, Nutrient broth, PDA, Czapex-Dox agar; Preparation of agar slant, agar plate, broth tube and flasks.

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SEMESTER III

Vocational Course 5 Code: BO3VO2T05

PRINCIPLES OF FOOD MICROBIOLOGY

(Theory 54 hrs; Practical 36 hrs; Credits 3 + 1)

Module 1: Industrial importance of microorganisms (10 hrs)

Fungi - *Penicillium, Mucor, Cladosporium, Aspergillus, Fusarium, Thamnidium, Neurospora, Geotrichum, Trichothecium*;

Yeasts - *Saccharomyces, Schizosaccharomyces, Zygosaccharomyces, Pichia, Candida, Rhodotorula*;

Bacteria - *Acetobacter, Bacillus, Clostridium Desulfotomaculum, Escherichia, Erwinia, Flavobacterium, Halobacterium, Lactobacillus, Leuconostoc, Micrococcus, Propionibacterium, Pseudomonas, Samonella, Staphylococcus, Streptococcus, Streptomyces, Yersinia, Vibrio*

Module 2: Food as a Substrate for Microorganisms (8 hrs)

Factors affecting growth of microorganisms in food - intrinsic factors: pH, moisture, concept of water activity, oxidation-reduction potential, nutrient content, inhibitors and biological structure - extrinsic factors : temperature, relative humidity, concentration of gases

Module 3: Principles of Food Preservation (18 hrs)

General principles of food preservation - Methods and principles of : Asepsis – Removal of microorganisms - Maintenance of anaerobic conditions - Preservation using high temperature : heat resistance, heat penetration, thermal processes canning - Preservation using low temperature : cellar storage, chilling, freezing - Preservation by drying – Use of chemical preservatives : additives, added inorganic and organic preservatives, developed preservatives - Preservation by radiation : UV rays, ionizing radiations

Module 4: Microorganism as Food (18 hrs)

Single Cell Proteins - Vitamins: vitamin B_{12}, vitamin B_2 - Enzymes: amylase, invertase, pectolytic enzymes, proteolytic enzymes, glucose oxidase - Acids: citric acid, lactic acid - Gums: dextran, xanthan - Fats - Probiotics: basic concepts, advantages of taking probiotics - Probiotic preparations: yogurt, kefir.

PRACTICAL (36 hrs)

1. Identification of important fungi associated with post harvest rot of cereals and vegetables - *Mucor, Rhizopus, Fusarium, Aspergillus, Penicillium.*
2. Isolation of fungi: From infected cereals and pulses; from spoiled fruits and vegetables; From foodstuffs including pickle, jam, dried fruits etc.
3. Culturing of fungi for morphological studies: Agar plate method, Slide culture method
4. Glass slide technique for observing fungal spore germination

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Vocational Course 6 Code: BO3VO2T06
CONTAMINATION, SPOILAGE AND PRESERVATION OF FOOD - PART I
(Theory 54 hrs; Practical 36 hrs; Credits 3 + 1)

Module 1: Sources of food contamination (12 hrs)

Contamination of food from natural sources - pre-harvest and post harvest contamination: sources of pre-harvest contamination – green plants and fruits, animals, sewage, soil, water, and air; sources of post-harvest contamination: during transport, handling and processing - processing equipments or machineries – workers.

Module 2: Principles of food spoilage (12 hrs)

Criteria for fitness of food - causes of spoilage - general principles underlying spoilage - classification of food based on spoilage - chemical changes due to microbial spoilage: nitrogenous organic compound and non-nitrogenous organic compounds

Module 3: Cereals and sugars (20 hrs)

Cereals and cereal products: Contamination, preservation and spoilage of grains, flours, bread and cake. Sugar and sugar products: contamination, preservation and spoilage of cane sugar, jaggery, molasses and syrups, honey, candy.

Module 4: Vegetables and fruits (10 hrs)

Contamination, preservation and spoilage of raw vegetables and fruits, spoilage of fruit and vegetable juices.

PRACTICAL (36 hrs)

1. Serial dilution method for dilution of concentrated samples.
2. Isolation of bacteria by streak plate method: Continuous streak, Quadrant streak, Radial streak.
3. Bacteriological examination of water by multiple tube fermentation test or multiple tube test: Presumptive test, Confirmed test, Completed test.

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SEMESTER IV

Vocational Course 7 Code: BO4VO2T07
CONTAMINATION, SPOILAGE AND PRESERVATION OF FOOD - PART II
(Theory 54 hrs; Practical 36 hrs; Credits 3 + 1)

Module 1: Meat and sea foods (18 hrs)

Meat and meat products - contamination - preservation: heat, cold, drying, preservatives - spoilage: general principles, types of spoilage

Fish and other sea foods – contamination - preservation: heat, cold, drying - spoilage: factors influencing spoilage, causative organisms - spoilage of special kind of fish and seafood.

Module 2: Poultry and eggs (12 hrs)

Poultry: contamination - preservation: removal, heat, cold, drying, preservatives – spoilage. Eggs – Contamination - preservation: removal, heat, cold, drying, preservatives - spoilage: defects and changes, bacterial rots, fungal rots.

Module 3: Milk and milk products (12 hrs)

Milk and milk products – contamination - preservation: asepsis, removal, heat, cold, drying, preservatives – spoilage of milk and cream, condensed and dry milk, frozen desserts, butter.

Module 4: Heated canned foods (12 hrs)

Heated canned foods: cause of spoilage - grouping on pH - types of spoilage - spoilage of canned meat and fish.

PRACTICAL (36 hrs)

1. Quantitative estimation of microorganism: (i) Viable count: soil/milk/fish/meat/vegetables/cereals - Spread plate method; Pour plate method; Drop technique (ii) Total count- Haemocytometer method.
2. Bacteriological analysis of milk by MBRT

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Vocational Course 8 Code: BO4VO2T08

FOOD FERMENTATIONS, FOOD INFECTION AND FOOD BORNE DISEASES

(Theory 54 hrs; Practical 36 hrs; Credits 3 + 1)

Module 1: Microbes in fermented foods (20 hrs)

Production of cultures for food fermentation - Culture maintenance and preparation - Bacterial, fungal and yeast cultures for food fermentation - Leavening agents: chemical leavening, biological leavening - Preparation of fermented foods: Bread - Malt beverages, wine and distilled liquors – Vinegar - Sauerkraut - Oriental fermented foods: tempeh, soya sauce, idli, appam, processing of tea, coffee, cocoa and vanilla.

Module 2: Food poisoning (12 hrs)

Foodborne illness or food poisoning - food infections and food intoxications - Bacterial food infection: *Clostridium prefringens* poisoning, Salmonellosis - Bacterial food intoxication: aflatoxicosis, *Staphylococcus* poisoning, botulisum - Mycotoxins and mycotoxicosis - Aflatoxicosis

Module 3: Food and water borne diseases (12 hrs)

Viral: gastroenteritis, infectious hepatitis, poliomyelitis - Pacterial: cholera, typhoid fever, *Campylobacter* gastroenteritis - Protozoan: Amoebiasis (special reference of field investigation, laboratory testing and preventive measures)

Module 4: Food sanitation (10 hrs)

Cleaning and sanitation: Detergents and wetting agents - CIP and COP – Physical agents as sanitizers: Hot water, flowing steam or steam under pressure - Chemical sanitizers: Halogens such as chlorine and iodine based compounds - quaternary ammonium compounds - Acid-anionic sanitizers, Peroxides - HACCP principles; ISO 22000, FSSAI, AGMARK (in brief).

PRACTICAL (36 hrs)

1. Demonstration of enzyme action using a yeast fermentation system.
2. Demonstration of the effect of temperature on yeast fermentation.
3. Effect of environment on microbial growth: effect of temperature, effect of osmotic pressure, effect of oxygen, ionic effect.
4. Biochemical activities of microorganisms: IMViC tests, Catalase test.

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HORTICULTURE AND NURSERY MANAGEMENT

SEMESTER I

Vocational course 1 Code: BO1VO3T01

FUNDAMENTALS OF HORTICULTURE

(Theory 36 hrs; Credits 2)

Module 1: Introduction (2 hrs)

Introduction, definition, history, importance, development and division of horticulture.

Module 2: Soil (16 hrs)

Soil: origin, properties and types - formation of soil, weathering (physical, chemical and biological pedogenesis). Components of soil - soil air, soil water, soil microbes, field capacity, permanent wilting percentage, pH, organic and inorganic components of soil (types and its importance). Classification of soil - basis of classification - soil profile- soil types - red soil, black soil, alluvial soil, laterite soil, coastal soil, sandy soil, serpentine soil, sodic soil, problematic soil, acidic and alkaline - properties and reclamation. Soil preparation - soil treatment, selection of site for crops, role of microorganisms and humus.

Module 3: Irrigation and manuring (9 hrs)

Principles and methods of irrigation - dry and wet land water management – methods of irrigation- surface irrigation, subsoil irrigation and overhead irrigation system - micro irrigation for mist chambers, .Fertilizers and Manures- organic manure –farmyard manure, leaf mould, bone meal, oil cakes compost making - green manuring; methods of manuring- broadcast, seed treatment, foliar application.

Module 4: Garden and related structures (9 hrs)

Garden Tools and Implements, Plant growth regulators in horticulture, uses of growth regulators - natural and synthetic regulators, growth regulators used for inducing rooting, flowering, breaking seed and bud dormancy, induction of parthenocarpy, preparation and methods of application, Plant propagating structures –green house, glass house, hot bed, lath house, net house, and mist chamber.

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Vocational course 2 Code: BO1VO3T02

PLANT PROPAGATION

(Theory 36 hrs; Practical 36 hrs; Credits 2 + 1)

Module 1: Introduction (2hrs)

Introduction to plant propagation, definition, different methods of propagation, needs of plant propagation, Different methods (introduction)

Module 2: Plant propagation - natural (7 hrs)

Natural methods of plant propagation. Sexual method of propagation: characteristics of good seeds, types of pure seeds, seed treatment, seed dormancy, methods of breaking seed dormancy, care of seedlings. Advantages and disadvantages of seed propagation. Vegetative Propagation: natural - suckers, offsets, rhizome, stolon etc.

Module 3: Plant propagation – artificial (18 hrs)

Artificial methods of plant propagation. Cuttings: stem, root and leaf cuttings, factors affecting rooting of cuttings, advantages and disadvantages. Layering - advantages and disadvantages, types of layering ground layering, air layering, different types. Grafting: advantages and disadvantages, stock-scion relationships, incompatibility, different types. Budding: shield (T & I) and patch budding, green budding, chip budding - advantages and disadvantages.

Module 4: Plant tissue culture (9 hrs)

Basic principles of tissue culture. Regeneration of plants, micropropagation of horticulture plants - methods, advantages and disadvantages.

PRACTICAL (36 hrs)

1. Collection and identification of different types of soil from the locality.
2. Estimation of soil pH using pH meter.
3. Determination of water content of different types of soils.
4. Identification and uses of various garden tools and implements .Work experience based on these tools.
5. Preparation of potting mixtures of known combinations.
6. Practice different types of grafting(approach, whip or tongue, saddle, cleft and crown grafting)
7. Practice different type of budding - shield (T&I) and patch.
8. Collect and identify some natural vegetative propagules.
9. Familiarize common plant growing structures.
10. Familiarize common plant growth regulators.
11. Document the nutrient contents of different chemical fertilizers.

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SEMESTER II

Vocational course 3 Code: BO2VO3T03

ORNAMENTAL HORTICULTURE AND LANDSCAPING

(Theory 36 hrs; Credits 2)

ORNAMENTAL HORTICULTURE (32 hrs)

Module 1: (18 hrs)

Commercial flower production; Scope and importance; Global Scenario in cut flower production and trade, Special characteristics and requirements; cut flower, loose flowers, dry flowers and floral oil trade. Major ornamental crops research stations in India- IIHR, IARI, NBRI. Types of gardens-characteristics and components of English, Mughal, Japanese, Persian, French and Italian gardens-designing a garden: budgeting and layout garden components (brief account only). Gardening: layout of the garden: for small, medium, and large gardens. Different types: indoor garden, water garden, rockery; garden components - lawns, shrubs and shrubberies, flower beds, carpet beds, borders, hedges, roads, walks and paths in the garden - Garden ornaments. Hydroponics, Bonsai.

Cultivation of plants in pots; different type of pots and containers-Earthen and plastic pots, par affined paper or styloform cups, polythene bags, basket container-plants suitable for pot culture, soil mixtures, their constituents of different type of pot plants-Annuals, Bulbs and tubers, Roses, Crotons, Palms, Ferns, Begionas, Anthurium, Succulents , cacti, and fruit plants. Orchard planning, lay out, preparation of nursery beds.

Training and pruning: principle, purpose and methods - right season for training and pruning-precautions in pruning operations-top dressing, staking, disbudding, defruiting, shaping and topiary - pruning fruit trees, root pruning - ringing or girdling - wintering.

Module 2: (9 hrs)

Brief study including taxonomy and methods of cultivation of the following groups of ornamental plants with suitable examples:

1. Shrubs: flowering shrubs, ornamental foliage shrubs
2. Climbers and creepers
3. Annuals, Biennials and herbaceous perennials
4. Bulbs, tubers and corms
5. Ferns and Selaginellas
6. Succulents and cacti
7. Ornamental grasses/bamboos
8. Palm, cycads and conifers.

Module 3: (5 hrs)

Indoor gardening: designing - selection of garden ornaments. Identification and selection of indoor plants-care and maintenance of indoor plants-care of water garden - fountain and suitable. Adornments. Conservatory: green house and fern house (fernery) – components - care and management.

LANDSCAPE ARCHITECTURE (4 hrs)

Module 4: (4 hrs)

Commercial landscape gardening- History, Plant identification and ecology, Landscape gardening and Arboriculture: Importance and value of trees selection, planting, maintenance and care of trees-role of trees in landscaping Importance of landscaping, types of Landscaping - Contemporary landscaping,

Environmental landscaping, Industrial and institutional landscaping, Public and private garden making, playground landscaping.

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Vocational course 4 Code: BO2VO3T04
PLANT PROTECTION AND NURSERY MANAGEMENT
(Theory 36 hrs; Practical 36 hrs; Credits 2 + 1)

PLANT PROTECTION (18 hrs)

Module 1: Plant protection (18 hrs)

Weeds definition and their control; Pests: insect and non-insect pests. Pest control: physical, chemical and biological Control; Diseases: common diseases of horticultural crops- symptoms, casual organisms, mode of spreading and control measures; Commonly used agricultural chemicals: Insecticides: eg. BHC, Carbary (sevin), Carbofuran (Furadon) Malathion, Phorate (thimet), Quanalphos (Ekalux) Fungicides: Captan, Bavistin, antibiotics, Dithane M 45, organo-mercurial compounds, sulphur dust, Zineb (Dithane Z- 78, Hexathane) Rodenticides - Anticoagulants (Ratafin), zinc phosphide (Retox) Herbicides - 2,4-D Sodium salt, 2,4-D amine salt (Weeder 96).

NURSERY MANAGEMENT (18 hrs)

Module 2: Nursery management (18 hrs)

Importance of nursery, types of nurseries-small scale and large scale, planning, budgeting and lay out-irrigation and plant protection devices in nurseries.

Maintenance and management of nurseries: personals involved, technicians and casual laborers-customer relations-assessment of customer needs-export potential of horticultural products-loans and subsidies from banks and other agencies. Planting and transplanting: seasons for planting and transplanting, transplanting failures- Transplanting trees and shrubs, annuals, corms, bulbs and tubers.

PRACTICAL (36 hrs)

1. Prepare potting mixtures for different type of pot plants, viz, roses, begonia, Palms, Ferns, Anthurium and cacti etc.
2. Collect and identify common diseases of horticultural crops. Identify and comment on plant protection chemicals.
3. Visit a garden and identify the components, plants, and prepare a report. Collect, familiarize and identify ornamental plant group.

REFERENCES

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3. Methods of Control, 4th edition, rootrot Press 22 Lynch Street, Hughes, Canberra, ACT, Australia (e-book available)
4. Selected Ornamentals, Fruit and Vegetables, 4th edition, rootrot Press 22 Lynch Street, Hughes, Canberra, ACT, Australia (e-book available)
5. How to Diagnose Plant Problems 4th edition, root rot Press 22 Lynch Street, Hughes, Canberra, ACT, Australia (e-book available).

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SEMESTER III

Vocational course 5 Code: BO3VO3T05

FLORICULTURE

(Theory 54 hrs; Practical 36 hrs; Credits 3 + 1)

Module 1: (18 hrs)

Floriculture: importance, scope and significance, components of floriculture: ornamental gardening, commercial floriculture, landscape gardening, arboriculture; Commercial floriculture: importance, scope and significance - perfume industry, flower pigments - flower trading - cut flowers post-harvest treatment and packaging of cut flowers.

Module 2: (27 hrs)

Detailed study of the cultivation (species, propagation, planting and after care, pruning, nutrition, plant protection, harvesting) and marketing of flowers of the following flowering plants:

Long stem cut flowers: perennials - Rose, Gladiolus, Carnation, Gerbera, Chrysanthemums, Jasmine, Orchids, Anthuriums, Tuberose, Dahlia, Heliconia. Annuals - Aster, marigold, Celosia, (Cockscomb) Gomphrena. Cut greens - Asparagus, Cycad, Thuja, Palms, Dracaena.

Module 3: (9 hrs)

Landscape gardening and Arboriculture. Importance and value of trees selection, planting, maintenance and care of trees-role of trees in landscaping.

Bonsai: basic styles - identification of plants suitable for Bonsai - Bonsai containers - Operation required: pruning, nipping and wiring.

Module 4: (18 hrs)

Flower arrangement: principles, different styles: Fresh, dry and artificial: practical hints for flower arrangement-flower carpet-preparation of bouquets, wreaths and garlands. Techniques to prolong the vase life of flowers - practical application of flower arrangement - vegetable carving and decorations.

Floriculture promotion and extension: Role of agri-horticultural societies, Krishi bhavans, flower shows and exhibition.

PRACTICAL (36 hrs)

1. Identification of basic styles of bonsai and list out the plants suitable for bonsai.
2. Identification of the garden plants mentioned in the syllabus - their botanical name and family
3. Post-harvest treatment and packaging of cut flowers
4. Different styles of flower arrangement, bouquet, wreath and garland
5. Identification and collection of locally available plant materials for dry/artificial flower arrangement
6. Each student should familiarize with cultivation of ornamental plants in the syllabus
7. Visit and prepare a report on flower shows organized by agri-horticulture societies/any other agencies

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14. Rajeevan, P.K., Valsalakumari, P.K. and Geetha, C.K. 1999. Pookrishi:, Sastravum Prayogavum. (Malayalam) Kerala Agricultural University, Mannuthy, Trichur
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Vocational course 6 Code: BO3VO3T06

OLERICULTURE

(Theory 54 hrs; Practical 36 hrs; Credits 3 + 1)

Module 1: (9 hrs)

Vegetables: Introduction, classification-botanical, cultural, thermo classification, food value of common vegetables grown in Kerala, role of vegetable growing in Indian economy.

Types of vegetable farming - kitchen, garden, terrace garden, market garden, truck garden, vegetable garden for processing, vegetable forcing, garden for seed production, organic farming and its significance.

Module 2: (18 hrs)

Cultivation-planting season, preparation of soil, seed selection, seeding, transplanting- thinning, mulching. Irrigation, manuaring, plant protection methods-special care (if any). Harvesting and post harvesting operations of the following corps.

Warm season vegetables: brinjal, chilli, cucumber, bitter guard, pumpkin, snake guard, yam, tapioca, colocasia, ginger, lady‘s finger, cow pea, cephalandra, ash guard, amaranth, coleus, musa.

Module 3: (18 hrs)

Cool season vegetables: cabbage, carrot, beet, onion, peas and beans. Pre and post-harvest changes in vegetables: role of growth regulators and stimulants in vegetable production: changes during cooking and processing-spoilage of vegetables-factors influencing spoilage-microbial spoilage-problems and prospects of vegetable cultivation in Kerala

Module 4: (9 hrs)

Mushroom as a vegetable: cultivation of edible mushrooms; button, paddy straw and oyster mushroom. Spawn production, utilization of paddy straw and other agro wastes in cultivation, farm design, pest and disease control.

PRACTICAL (36 hrs)

1. Familiarization of different vegetable crops-through field visits and slide show, familiarization of seeds of vegetable corps, preparation of nursery bed, sawing and after care
2. Cultivate any five vegetable corps either in the pot or in the field. Equal representation should be given to plants like climbers, trailers, root tubers, underground stem crops etc.
3. Fertilizer application by different methods
4. Sterilization o paddy straw, inoculation, cultivation and harvesting of oyster/pleurotus sp. Using poly bag method
5. Field study: visit a market garden/truck garden to study the various cultivation practice

REFERENCES

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SEMESTER IV

Vocational course 7 Code: BO4VO3T07

POMOLOGY, FOOD TECHNOLOGY AND POST-HARVEST MANAGEMENT OF HORTICULTURAL CROPS

(Theory 54 hrs; Practical 36 hrs; Credits 3 + 1)

POMOLOGY (36 hrs)

Module 1: (18 hrs)

Importance of fruits: classification-fruit cultivation in India-role of fruits in Indian economy. Cultivation of fruit trees/plants with special reference to Musa, Pineapple, Papaya, Mango, Sapota, Guava.

Selection of suitable sites-seasons for planting-preparation of land –selection of fruit plants and their varieties-planning, aftercare and pruning-disease and pest control

Module 2: (18 hrs)

Reasons for failure to fruit development; internal and external factors; causes and remedies; role of plant growth regulators in fruit yielding plants.

Harvesting, marketing and storage of fruits: Basic principles in harvesting and marketing; storage of fruits; physiological changes during storage, factors influencing storage and methods of storage

FOOD TECHNOLOGY AND POST-HARVEST MANAGEMENT OF HORTICULTURAL CROPS (18 hrs)

Module 3: (9 hrs)

Importance of post-harvest management of fruits and vegetables. Post-harvest losses of fruits, vegetables, physiology of maturity, ripening and senescence, storage of fruits and vegetables, ambient low temperature and controlled atmosphere storage systems.

Packaging of fresh and processed products: general principles and methods of preservation. Principles of preservation by dehydration, thermal processing, chemical preservatives, fermentation, ionizing, radiation, Preparation of jams, jellies, squashes, pickles, salads, syrups and beverages.

Module 4: (9 hrs)

Government policies, regulations and specifications for fresh and processed products, export promotion agencies and their role on export of fresh and processed products. General guidelines for establishment of a home scale processing unit,

PRACTICAL (36 hrs)

1. Identification of plant diseases of fruit trees
2. Preparation of Bordeaux mixture
3. Cultivate any one of the crops listed in syllabus
4. Identification and conservation of wild local varieties of Mangoes, Jack fruits, Musa etc.
5. Preparation of any one of the fruit products mentioned in the syllabus

REFERENCES

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4. Davies, F. S and Albrigo,L.G. 1994. Citrus. CAB International, UK.
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16. Singh, R.1960. Fruits. National Book Trust, India.
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21. Panastico, B.M 1975. Postharvest Physiology, Handling and Utilization of Tropical and Sub-Tropical Fruits and Vegetables. The AVI Publishing Company,
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Vocational course 8 Code: BO4VO3T08

CULTIVATION OF MEDICINAL AND AROMATIC PLANTS, SPICES, AND PLANTATION CORPS

(Theory 54 hrs; Practical 36 hrs; Credits 3 + 1)

Module 1: (18 hrs)

Significance of medicinal and aromatic plans Indian system of medicine, Indigenous Traditional Knowledge. Taxonomy and uses of important medicinal and aromatic plants available in Kerala

Cultivation of Sida, Adathoda, Ocimum, Rauvolfa, Vinca, Mentha, Pumbago, Kaempiferia, Lemon grass, Vetiver, Turmeric.

Module 2: (18 hrs)

Introduction, importance of spice crops-historical account, present status, future prospects, botany and taxonomy, climatic and soil requirements, site selection, planting times and methods, treatment, nutritional and irrigation requirements, weed control, mulching, harvesting, post-harvest management and plant protection measures of following spices; Black pepper, Cardamom ,Clove, Cinnamon, Nutmeg, Allspice Turmeric, Ginger, Coriander, Fenugreek, Cumin, Fennel, Tamarind, Garcinia and Vanilla

Module 3: (18 hrs)

Plantation crops-scope and importance of plantation crops, Role of plantation crops in national economy, export potential, Types of plantation crops. Cultivation of Coffee, Tea, Cashew, Cocoa, Rubber, Oil palm, Coconut and Arecanut

PRACTICAL (36 hours)

1. Collection and identification of important medicinal and aromatic plants
2. Extraction of the active principles of local medicinal, aromatic and spices (Any five types)
3. Collect and identify the natural propagules of common spices FIELD WORK
4. Visit any spice/plantation crop estate to familiarize with the cultivation and processing practices. Besides, a project work based on horticultural aspects is an essential requirement

REFERENCES

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PLANT BIOTECHNOLOGY

SEMESTER I

Vocational course 1 Code: BO1VO4T01

INTRODUCTION TO BIOTECHNOLOGY

(Theory: 36 hrs; Credits: 2)

Module 1: Introduction to Biotechnology (4 hrs)

Introduction: concept of Biotechnology, Definition, landmarks in biotechnology; traditional and modern biotechnology; scope and relevance of Biotechnology.

Module 2: Application of Biotechnology in industry (10 hrs)

Basic principle of fermentation, Production of fermented food products - bread, wine, and fermented milk products – butter, cheese and yogurt. High value food products - single cell proteins and mycoproteins. Production of organic acids (citric acid and acetic acid) alcohol (ethanol) and enzymes (cellulase and amylase).

Module 3: Application of Biotechnology in agriculture (10 hrs)

Brief introduction to GM crops, transgenic plants and its applications. Biofertilizers and biopesticides. Tissue culture - scope and importance in crop improvement.

Module 4: Application of Biotechnology in environment (6 hrs)

Principle and applications of bioremediation. Bioenergy from waste - biogas, fuel alcohol from biomass and lignocellulose residues, biodiesel, advantages of biofuels.

Module 5: Application of Biotechnology in medicine (6 hrs)

Biotechnology in disease diagnosis and treatment - antenatal diagnosis, recombinant therapeutics, gene therapy. Production of monoclonal antibodies. Stem cell and organ culture and its importance.

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5. Julius M Cruse, Robert Elwin. Atlas of Immunology (III Edn). CRC press.
6. M K Sateesh. Introduction to Biotechnology. New age International publishers.
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Vocational course 2 Code: BO1VO4T02
MICROBIOLOGY
(Theory: 36 hrs; Practical: 36 hrs; Credits 2 + 1)

Module 1: Introduction to Microbiology (4 hrs)

Definition of microbiology. History of microbiology - important contributions of Louis Pasteur, Robert Koch, Joseph Lister, Alexander Fleming, Edward Jenner, John Tyndall. Scope and applications of microbiology.

Module 2: Structure and reproduction of Viruses (4 hrs)

Viruses: General characteristics-structure and properties. Structure of bacteriophage. Replication of bacteriophage - Lytic and lysogenic cycle.

Module 3: Structure and reproduction of Bacteria (10 hrs)

Bacterial cells: Morphology, size, shape and arrangement. General principles of bacterial classification: - classification on the basis of carbon and energy source. Ultra structure of bacteria: structures and functions of capsule, flagella, pili, cell wall, plasma membrane, cytoplasm, ribosome, mesosomes, reserve food material, nuclear materials-nucleotides, plasmids. Reproduction of bacteria: - binary fission, budding, fragmentation, bacterial endospores. Recombination in bacteria - conjugation, transformation, transduction.

Module 4: Instruments used in microbiology labs (4 hrs)

Principle, working and applications of inoculation loops, haemocytometer, laminar air flow, hot air oven, autoclave, colony counter, incubator.

Module 5: Methods of microbial control (4 hrs)

Definition of sterilization, Antiseptics, disinfectants, antimicrobial agents and antibiotics. Dry and moist heat, pasteurization, tyndalization, radiation, filtration. Chemical methods of sterilization, Fumigation.

Module 6: Microbial growth and culture techniques (6 hrs)

Microbial growth: Definition, Phases of growth, Measurement of growth, growth curve. Factors affecting microbial growth: nutrients, pH, temperature, oxygen, osmotic pressure, light and moisture. Bacteriological media - Natural, synthetic, semi-synthetic, enriched, differential & selective. Media components. Pure culture techniques: serial dilution, pour plate, streak plate, spread plate.

Module 7: Staining and staining techniques (4 hrs)

Classification of stains-acidic, basic and neutral stains. Theories and procedure of different bacterial staining - simple staining, negative staining, capsule staining, endospore staining, gram staining, acid fast staining.

PRACTICAL (36 hrs)

1. Preparation of agar slants and broths
2. Streak plate technique for purification of bacteria.
3. Culture bacteria in artificial medium.
3. Grams staining
4. Negative staining
5. Viable count – enumeration of bacteria – pour plate technique
6. Isolation of Microorganisms from drinking water/ soil through serial dilution technique
7. Test for catalase
8. Test for amylase
9. Hanging drop experiment – demonstration
10. Demonstration - principle, working and application of Laminar air flow, Autoclave, Colony counter, Hot air oven, Incubator, Haemocytometer.

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2. H.G. Schlegel (1995) General Microbiology, Cambridge.
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SEMESTER II

Vocational course 3 Code: BO2VO4T03

MOLECULAR BIOLOGY

(Theory 36 hrs; Practical 2 hrs; Credits 2)

Module 1: DNA – Basic features, mutation and polymorphism (10 hrs)

DNA – types and Structure. DNA replication. Mutation - types. Physical and chemical mutagens. Role of mutation in creating genetic variability. Polymorphism in DNA - SNPs. Methods to analyse polymorphism – RAPD, RFLP, DNA fingerprinting.

Module 2: Basic concepts of gene, chromosome and genome (10 hrs)

Definition of gene, cistron. Structure of eukaryotic gene. Chromosome as physical carriers of gene. Organization of DNA into chromosomes: chromatin, nucleosome, 30nm fiber, 300nm fiber, coiled coil structure. Structural features of chromosome - centromere, telomere. Euchromatin and

heterochromatin. Chromosome as a linkage group. Genome: Definition, satellite DNA, minisatellites and microsatellites. Coding and non coding sequences.

Module 3: Gene expression (10 hrs)

Central dogma of molecular biology. Steps involved in gene expression. Steps of transcription and translation. Genetic code. Structure and role of mRNA, tRNA and rRNA. Regulation of gene expression - Operon concept with Lac operon and Trp operon as examples. Reverse transcription.

Module 4: Cancer (6 hrs)

Introduction, characteristic features of cancer cell. Molecular biology of cancer - Oncogenes, proto oncogenes and tumour suppressor genes. Heredity and cancer.

REFERENCES

1. Lewin's Gene X. Jocelyn E.Krebs, Elliot S. Goldstein, Stephen T. Kilpatrick
2. Daniel Hartl. Essential genetics: A genomic perspective (VI Edn).
3. Molecular Biotechnology-Principles and applications of rDNA. Bernard R.Glick, Jack J.Pasternak, Cheryl L.Patten
4. An introduction to Molecular Biotechnology-Concepts and Experiments. Gerald Karp
5. Human Genetics- Cconcepts and applications.Ricki Lewis
6. Molecular cell biology. Lodhish et.al
7. Principles of Genetics. Snustard, Simmons.

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Vocational course 4 Code: BO2VO4T04
FUNDAMENTALS OF ENZYMOLOGY AND RADIOBIOLOGY
(Theory 36 hrs; Practical 36 hrs; Credits 2 + 1)

Module 1: Water, Solutions and pH (8 hrs)

Water as solvent in biological system: polarity, cohesiveness, physical properties, H-bonding. Solutions - Molarity, Molality and Normality. Acids and bases. pH and pH scale, measurement of pH - pH paper, pH meter: glass electrode and calomel electrode. Buffers - properties, buffer action, significance in biological systems and preparations.

Module 2: Chemical nature and general properties of enzymes (10 hrs).

Properties of Enzymes, Classes of enzymes- oxidoreductases (eg.alcoholdehydrogenase), transferases (Hexokinase), hydrolases (chymotrypsin), lyases (pyruvate decarboxylase), isomerases (alanine racemase) Structure of enzyme - Apoenzyme, coenzyme, cofactor, holoenzyme. Active site of an enzyme. Mechanism of enzyme action – lock & key hypothesis, induced fit hypothesis. Enzyme regulation - feedback, allosteric; enzyme inhibition. Factors affecting enzyme action.

Module 3: Enzyme kinetics (8 hrs)

Michaelis-Menten equation, Km value and its significance. Velocity of a reaction. Chemical equilibrium of enzymatic reaction, Reversible reaction. Isoenzymes. Significance of isoenzymes (eg: LDH)

Module 4: Radioisotopes and their applications in biology (10 hrs)

Half life period, tracer techniques; measurement of radioactivity – GM counter, solid scintillation counter, liquid scintillation counter, and autoradiography. Applications of C14, P32, S35 isotopes in biology.

PRACTICAL (36 hrs)

1. Preparation of buffers of various pH.
2. Preparation of molar solutions
3. Estimation of pH using pH paper and pH meter
4. Estimation of proteins by biuret method
5. Estimation of proteins by Lowry's method
6. Estimation of rate of enzyme catalyzed reaction
7. Effect Temperature on enzymatic reaction
8. Role of substrate concentration on enzyme catalyzed reaction

REFERENCES

1. Donald Voet, Judith G Voet. Biochemistry.
2. Lehninger. Principles of Biochemistry.
3. Lubert Stryer. Biochemistry.
4. David Wemmer, John Kurian, Boyana Konforti. The molecules of life: Physical and chemical principles.
5. Thomas M Devlin. Text book of Biochemistry with clinical correlations.
6. Nicholas C Price, Lewis Stevens. Fundamentals of Enzymology.
7. Trevor Palmer. Understanding Enzymes.

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SEMESTER III

Vocational course 5 Code: BO3VO4T05

BIOTECHNIQUES & INSTRUMENTATION

(Theory 54 hrs; Practical 36 hrs; Credits 3 + 1)

Module 1: Microscopy (10 hrs)

Compound Microscope – parts of compound microscope, bright field microscopy, dark field microscopy. Phase contrast microscopy, fluorescent microscopy, Electron microscopy- TEM, SEM

Module 2: Centrifugation (10 hrs)

Principles and Applications, Types of centrifuges, parts of centrifuges. Velocity gradient centrifugation, Isopycnic centrifugation, Differential centrifugation.

Module 3: Electrophoresis (12 hrs)

Principles and Applications. Separation of macromolecules by Agarose gel Electrophoresis, Poly Acrylamide Gel Electrophoresis. SDS-PAGE, Pulse Field gel Electrophoresis, Isoelectric focusing, Two dimensional gel electrophoresis.

Module 4: Chromatography (12 hrs)

Principle, Mobile and stationary phases, Rf value. Types of chromatography- Paper chromatography, TLC, Ion-Exchange chromatography, Affinity chromatography, Gel filtration chromatography, HPLC, GLC. Applications of chromatography techniques

Module 5: Photometric analysis (10 hrs)

Electromagnetic spectrum. Beer-Lamberts Law. Colorimetry and Photometry. Colorimeter and spectrophotometer. UV spectroscopy, Infrared spectroscopy.

PRACTICAL (36 hrs)

1. Estimation of proteins by Lowry's method
2. Estimation of DNA by Diphenylamine method
3. Estimation of RNA
4. Thin layer chromatography
5. Paper chromatography
6. Demonstration – Principle and experimental set up of column chromatography, Poly acrylamide gel electrophoresis (PAGE), density gradient centrifugation, UV spectroscopy.

REFERENCES

1. Debajyoti Das. Biophysics and Biophysical Chemistry (III Edn). Academic Press, Calcutta.
2. Sharma B K, 2002. Spectroscopy. Goel Publishing House, Meerut.
3. T C Ford, Graham J M, 1991. An Introduction to Centrifugation. Bios.
4. Vasantha Pattabhi, N Gautham, 2004. Biophysics. Nirosa Publishing House.

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Vocational course 6 Code: BO3VO4T06
BASICS OF MOLECULAR CLONING TECHNIQUES
(Theory 54 hrs; Practical 36 hrs; Credits 3 + 1)

Module 1: Enzymes used in genetic Engineering (10 hrs)

Restriction Endonucleases, Ligases, DNA polymerases, Reverse Transcriptase, Polynucleotide Kinase, Terminal Transferase, Alkaline Phosphatase.

Module 2: Cloning vectors (12 hrs)

Vectors from plasmids - Essential features common plasmid vectors - PBR322, PUC18, Vectors from Bacteriophages - construction of λ based vectors, M13, cosmids, Phagemids. Eukaryotic vectors YAC, BAC, and Shuttle Vectors. Expression vector

Module 3: Molecular probes (6 hrs)

Preparation of probes, nick translation, methods of labeling probes - radioactive and non radioactive labelling, GFP; applications of probes.

Module 4: Nucleic acid hybridization (8 hrs)

Principles and applications; Southern Blotting, Northern Blotting, Western Blotting, Dot - Blotting, colony hybridisation, Plaque hybridisation, *In-situ* hybridization.

Module 5: DNA amplification using PCR (6 hrs)

Polymerase Chain Reaction - methods, types and application.

Module 6: Sequencing of DNA (12 hrs)

Maxam and Gilbert chemical degradation method, Sanger and Coulson Enzymatic method, Direct DNA sequencing using PCR, Automated DNA sequencing methods.

PRACTICAL (36 hrs)

1. Isolation of plasmids
2. Preparation of competant cells for transformation
4. Demonstration – Principle and experimental set up of restriction digestion, transformation of competent cells, Southern blotting, PCR, Vector mediated gene transfer using pBR322, pUC18, YAC.

REFERENCES

1. B.D. Singh (1998.) Biotechnology (First Edition), Kalyani Publishers.

2. J Sambrook, E F Fritsch, Maniatis, 1989. Molecular Cloning: A Laboratory Manual, Cold Spring Harbour Laboratory Press.
3. M.S. Clark (1997. Plant Molecular Biology,A Laboratory Manual, Springer Verlag.
4. S S Pubohit, 2005. Biotechnology: Fundamentals and Applications (IV Edn). Agrobios (India).
5. T.A. Brown (1996). Gene Cloning – An introduction (Third Edition), Chapman and Hill.

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SEMESTER IV

Vocational course 7 Code: BO4VO4T07

GENETIC ENGINEERING

(Theory 54 hrs; Practical 36 hrs; Credits 3 + 1)

Module 1: Gene cloning strategies (10 hrs)

Methods of isolation of foreign gene, Transformation and transfection. Screening of transformants- Marker genes and Reporter genes. Direct and Indirect selection of transformants.

Module 2: Genetic Transformation of plants (10 hrs)

Direct and Indirect gene transfer - vectors based on Ti plasmid, Ri plasmid of Agrobacterium, Agroinfection. Plant viral vectors - Caulimo virus vectors, Gemini virus vectors

Module 3: Genetically modified crops (10 hrs)

Application of transgenic plants in agriculture – herbicide resistance, modification of seed protein quality – golden rice, Flavr savr tomato. Molecular farming – production of edible vaccines, antibodies, biodegradable plastics.

Module 4: Gene Libraries (10 hrs)

Genomic libraries Vs cDNA libraries - construction, screening and applications. Mapping of DNA :Restriction mapping, Chromosme walking, Chromosome jumping, DNA foot printing, Transposon tagging.

Module 5: Basic Principles & applications of the following technologies (6 hrs)

DNA chip Technology and Micro arrays- Types of DNA chips and their production. Applications of micro arrays on DNA chips. Nanobiotechnology.

Module 6: Genomics (4 hrs)

Human genome Project – history, significance, major findings.

Module 7: Drawbacks of Recombinant DNA Technology (4 hrs)

Ethical, Legal, Social, Environmental and Practical problems of Recombinant DNA Technology- Biosafety, Biowar, Patenting and IPR issues.

PRACTICAL (36 hrs)

1. 1. Isolation of plant cell DNA.
2. Agarose gel electrophoresis - fractionation and staining of DNA.
3. Demonstration – Principle and experimental set up of Southern blotting, methods of direct Gene transfer - Microinjection, Biolistic Transfer, Liposome mediated gene transfer, Electroporation, Chemical mediated gene transfer, Agrobacterium mediated gene transfer - Agroinfection, Production of genetically engineered plants.

REFERENCES

1. S.N. Jogdand (1997). Gene Biotechnology (First Edition). Himalaya Publishing House.

2. Sandhya Mitra (1996). Genetic Engineering, MacMillan India Ltd.
3. R W Old, S B Primrose, 1994. Principles of Gene Manipulation: An Introduction to Genetic Engineering (V Edn). Black well Scientific Publishers.
4. P K Gupta, 2004. Biotechnology and Genomics. Rastogi Publishers, Shnagi Road, Meerut.
5. H. K. Das (2005). Text Book of Biotechnology, Wiley Dream tech, India Pvt Ltd.
6. R. C. Dubey (2002). Text book of Biotechnology. S. Chand and Company Ltd., New Delhi.

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Vocational course 8 Code: BO4VO4T08
PLANT TISSUE CULTURE
(Theory 54 hrs; Practical 36 hrs; Credits 3 + 1)

Module 1: Introduction and history of plant tissue culture (2 hrs)
Definition, principle of tissue culture-cellular totipotency, de differentiation and redifferentiation. Brief history of plant tissue culture
Module 2: General facilities for plant tissue culture (4 hrs)
Equipments, laboratory organization and green house
Module 3: Methods of sterilization (4 hrs)
Dry heat, Wet heat, Filter sterilization, Sterilization by chemicals and antibiotics of plant material. Isolation of different types of explants: shoot tips, nodal segments, leaves, and anther.
Module 4: Plant tissue culture medium (4 hrs)
General components and their role. Plant growth regulators: Cytokinins, Auxins, Gibberellins, Abscissic acid, Ethylene. Method of preparation of stock solutions: MS medium.
Module 5: Method and importance of the following (2 hrs)
Inoculation, incubation, subculturing and hardening
Module 6: Importance, methodology and significance of the culture techniques (6 hrs)
Callus and suspension culture. Meristem culture, anther culture, pollen culture, ovary culture and embryo culture
Module 7: Organogenesis and Somatic Embryogenesis (8 hrs)
Organogenesis and factors affecting organogenesis. Cytodifferentiation and factors affecting cytodifferentiation. Somatic embryogenesis: Induction of somatic embryos – direct and indirect. Factors affecting somatic embryogenesis. Importance of somatic embryogenesis. Synthetic (artificial) seeds. Method of preparation and importance of artificial seeds.
Module 8: Protoplast culture and Somatic Hybridization (6 hrs)
Protoplast isolation (mechanical and enzymatic methods), culture and regeneration. Protoplast fusion - Somatic hybridization. Methods and applications of somatic hybridization. Cybrids-applications.
Module 9: Single cell culture and its importance (4 hrs)
Paper raft nurse technique, The petridish plating technique, The microchamber technique, Growth of single cell induced by nurse callus and microdroplet technique.
Module 10: Somaclonal variation (4 hrs)
Genetic basis and applications of somaclonal variations.
Module 11: Production of secondary metabolites (6 hrs)
Bioreactors – design. Types- batch, continuous, multistage bioreactors. Cell immobilization and immobilized cell bioreactors. Process scale up, biotransformation, elicitors and downstream processing. Hairy root culture.
Module 12: (4 hrs)
Applications of plant tissue culture.

PRACTICAL (36 hrs)

1. Preparation of stock solutions of MS medium
2. Preparation of MS medium
3. Surface sterilization and inoculation of explants (node, anther, leaf, cambium)
4. Subculturing of callus.
5. Production of synthetic seeds.
6. Set up an experiment for paper raft nurse technique.
7. Demonstration – Principle and experimental set up of suspension culture.

REFERENCES

1. S.N. Jogdand (1997). Gene Biotechnology (First Edition) Himalaya Publishing House
2. Sandhya Mitra (1996). Genetic Engineering, Macmillan India Ltd. R.W. Old and S.B. Primrose (1994)
3. Principles of Gene Manipulation -An Introduction to Genetic Engineering (Fifth Edition) Black well Scientific Publishers.
4. P. K. Gupta (2004). Biotechnology & Genomics (First Edition) Rastogi Publishers, Shnagi Road, Meerut.
5. H. K. Das (2005). Text Book of Biotechnology, Wiley Dream tech, India Pvt Ltd.
6. R. C. Dubey (2002). Text book of Biotechnology. S. Chand and Company Ltd., New Delhi.

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COMPLEMENTARY COURSES FOR MODEL-II (VOCATIONAL) B Sc ZOOLOGY - AQUACULTURE

COMBINATION OF COURSES AND SEMESTER-WISE DISTRIBUTION

Sem.	Course category	Course code	Course title	Instr. hrs.*		Credits
				Th.	Pr.	
I	Compl.1	BO1CMVOT01	Plant Diversity and Plant Pathology	54	36	2 + 1
II	Compl.2	BO2CMVOT02	Plant Physiology	54	36	2 + 1
III	Compl.3	BO3CMVOT03	Angiosperm Taxonomy and Economic Botany	54	36	3 + 1
IV	Compl.4	BO4CMVOT04	Anatomy and Applied Botany	54	36	3 + 1

SEMESTER I

Complementary course 1 Code: BO1CMVOT01
PLANT DIVERSITY AND PLANT PATHOLOGY
For B. Sc. Zoology Model II - Vocational
(Theory 54 hrs; Practical 36 hrs; Credits 2 + 1)

O**bjectives:**

- Acquire fundamental knowledge in plant science and to make the student to understand that Botany is an integral part of the human life and developments.
- Foster and encourage an attitude of curiosity, appreciation and enquiry of various life forms of plants.
- Understand the diversity of plants with respect to Algae, Fungi, Lichens, Bryophytes, Pteridophytes and Gymnosperms.

PLANT DIVERSITY (45 hrs)

Module 1: Diversity of plants (5 hrs)

Introduction to the origin of plant diversity in the existing forms of plants, evolutionary trends among plants; general classification of plants – Eichler's system.

Module 2: Algae (16 hrs)

General characters and classification of Algae up to classes (F E Fritsch); range of thallus variation. Reproduction and life history of the following groups with reference to the types quoted:
Cyanophyceae – *Nostoc;* Chlorophyceae - Oedogonium (*Volvox*, *Spirogyra*, *Cladophora* –Vegetative features only); Phaeophyceae - *Ectocarpus (Vegetative only), Sargassum* (vegetative and reproductive features); Rhodophyceae – *Polysiphonia.* Economic importance of Algae: food, industry, medicine, biofertilizers; algal bloom. Role of algae in Aquaculture.

Module 3: Fungi (16 hrs)

General characters and outline on the classification of fungi by Ainsworth. General characters, thallus structure, reproduction and life history of the following groups with reference to the types quoted:
Zygomycotina – *Rhizopus;* Ascomycetes – *Xylaria;* Basidiomycetes – *Puccinia;* Deuteromycetes - General characters only. Economic importance of Fungi: as food, in industry, decomposition of

organic matter; fungal toxins and human health. Fungal diseases of fishes: Causative organism, symptoms and control measures of following diseases:
(a) Saprolegniasis (b) Branchiomycosis.
Lichens: Classification based on thallus morphology. *Usnea* - morphology and anatomy of vegetative and reproductive structure. Economic importance of lichen: food, industry, medicine.

Module 4: Bryophytes (2 hrs)

General account; *Riccia* - morphology, anatomy, reproduction and life cycle.

Module 5: Pteridophytes (3 hrs)

General account; *Selaginella* - morphology, anatomy (stem), reproduction and life cycle.

Module 6: Gymnosperms (3 hrs)

General account; *Cycas* - morphology, anatomy (leaf let), reproduction and life cycle.

PLANT PATHOLOGY (9 hrs)

Module 7: Plant diseases and their control (9 hrs)

Classification of plant diseases based on causative organism and symptoms; different types of defence mechanisms in plants - morphological, anatomical and physiological; use of fungicides, pesticides and antibiotics for disease control. Study the following diseases with special emphasis on causative organism, symptoms and control measures:
Nut fall of Arecanut, Bacterial blight of Paddy, Leaf mosaic disease of Tapioca, Abnormal leaf fall of Rubber.

PRACTICAL (36 hrs)

1. Identification and micro preparation of the following:

Algae: Vegetative structure of Nostoc, Volvox, Spirogyra, Oedogonium, Cladophora, Polysiphonia. Vegetative and reproductive structure of Sargassum.
Fungi: Vegetative and reproductive structure of Rhizopus, Xylaria, Puccinia.
Lichen: Morphology of Usnea thallus and Apothecium.
Bryophytes: Riccia thallus anatomy.
Pteridophyte: Selaginella – Anatomy of Stem and Morphology of Strobilus.
Gymnosperms: Cycas – Anatomy of leaflet, morphological features of megasporophyll, microsporophyll and ovule.

2. Identify plant diseases mentioned in the syllabus.

REFERENCES

1. Ahamdijan, Vernon, Mason H E, 1973. The Lichens. Academic press, New York.
2. Alexopoulose C J, Mims C W, 1983. Introductory Micology. Wiley Eastern, New York.
3. Bhatia K N, 1975. A treatise on Algae. S. Chand and co.
4. Bilgramie K S, Dube H C, 1976. Text Book of Modern Plant pathology. Vikas Publishing House Pvt. Ltd. New Delhi.
5. Chaube H S, Ramji S, 2001. Introductory Plant Pathology. International Book Distributing Co. Lucknow.
6. Chopra R N, Kumra P K, 1988. Biology of Bryophytes. Wiley Eastern Ltd. New Delhi.
7. Fritsch F E, 1945. Structure and Reproduction of Algae Vol. I & II. Cambridge University Press.
8. Gangulee H C, Kar A K, 1993. College Botany Vol. II. New Central Book Agency, Calcutta.
9. Kanika Sharma, 2009. Manual of Microbiology. Ane Books Pvt. Ltd.
10. Mamatha Rao, 2009. Microbes and Non-flowering plants: Impact and applications. Ane Books Pvt. Ltd.
11. Pandey S N, Trivedi P S, 1994. A Text book of College Botany Vol. I.

12. Pandey S N, Trivedi P S, 1998. A Text book of College Botany Vol. II.
13. Pandey B P, 2007. College Botany Vol. I. S.Chand and Company.
14. Pandey B P, 2007. College Botany Vol. II. S Chand and Company.
15. Sharma P D, 2003. Microbiology, Plant Pathology and Biotechnology. Rasthogy Publications.
16. Vasishta B R. Bryophyta. S Chand and Co. New Delhi.

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SEMESTER II

Complementary course 2 Code: BO2CMVOT02
PLANT PHYSIOLOGY
For B. Sc. Zoology Model II - Vocational
(Theory 54 hrs; Practical 36 hrs; Credits 2 + 1)

Objectives:

- Make the students realize the importance of all physiological processes which take place in plants.
- Understand the mechanism of various physiological processes related to plant life.

Module 1: Water relations (15 hrs)

Introduction and unifying principles of plant physiology *(Reference 14). Plant water relations: physical aspects of water absorption - Diffusion, DP, DPD. Imbibition. Osmosis - OP, Exosmosis, Endosmosis, Plasmolysis. Water potential and its components.

Movement of water in soil towards root by bulk flow; mechanism of water absorption by root - active and passive absorption. Movement of water towards xylem by apoplast and symplast pathway. Ascent of sap – theories - transpiration pull theory, root pressure theory, guttation.

Transpiration: types, mechanism of transpiration and stomatal movement (K^+ - ABA theory), significance and factors affecting transpiration; antitranspirants.

Stress physiology: Water stress

Module 2: Mineral nutrition (8 hrs)

Major and minor elements - criteria for essentiality of mineral elements, hydroponics; Absorbable form, function and deficiency symptom of the following mineral nutrients – N, P, K, Mg, B, Fe, Zn.

Nitrogen metabolism: sources of nitrogen, biological nitrogen fixation, mechanism of nitrogen fixation in root nodule of legume; synthesis of aminoacids - reductive and transamination reactions.

Module 3: Photosynthesis (13 hrs)

Basic requirements of Photosynthesis: Light - PAR; organs and site of photosynthesis, chloroplast, Photosynthetic pigments, action spectrum, absorption spectrum; Photosynthetic unit; Red drop and Emerson's enhancement effect, two pigment systems,

Mechanism of photosynthesis: light dependent reaction - cyclic and non cyclic photo phosphorylation. Chemi osmotic theory of ATP formation. Light independent reaction (dark reactions) - C3 cycle; brief account on C4 and CAM Cycles. Factors affecting photosynthesis. Photorespiration (brief study only). Blackman's law of limiting factors.

Module 4: Translocation of organic solutes (6 hrs)

Substances translocated, path of translocation, direction of translocation; source-sink concept, mechanism of translocation (pressure flow hypothesis).

Module 5: Growth and Development (12 hrs)

Seed structure, seed dormancy, causes of seed dormancy, and methods of breaking dormancy. Germination of seeds: physiological changes; growth, growth regions, growth rate, phases of growth, sigmoid growth curve. Plant growth regulators: auxins, gibberellins, cytokinins, abscissic acid and ethylene and their physiological role (brief study only). Abscission, senescence. Photoperiodism: definition - short day plants, long day plants, day neutral plants. Vernalization. Role of phytochrome in photoperiodism.

PRACTICAL (36 hrs)

Core experiments

1. Demeonstration of osmosis using potato tuber osmoscope/ papaya petiole osmoscope.
2. Separation of leaf pigments by paper chromatography.
3. Compare the stomatal indices of hydrophytes and xerophytes

Demonstration experiments

1. Measure the rate of transpiration by Ganong's potometer.
2. Relationship between transpiration and absorption.
3. Measurement of growth using Arc Auxanometer.
4. Demonstration of geographic curvature using Clinostat.
5. Evolution of oxygen during photosynthesis.
6. Mohl's half leaf experiment.
7. Light screen experiment.

REFERENCES

1. Hopkins W G, Norman P A, Huner, 2008. Introduction to Plant Physiology. John Wiley & Sons, New York.
2. Jain V K, 2008. Fundamentals of Plant Physiology. S Chand and Co.
3. Kochhar P L, Krishnamoorthy H N. Plant Physiology. Atmaram and sons, Delhi.
4. Kumar and Purohit. Plant Physiology: Fundementals and Applications. Agrobotanical Publishers.
5. Malik C P, 2002. Plant Physiology. Kalyani publishers.
6. Mukherjii S, Ghosh A K, 2005. Plant Physiology. New Central Book Agency, Culcutta.
7. Noggle G R, Fritz G J, Introductory Plant Physiology. Prentice Hall of India.
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13. Verma S K, Mohit Verma, 2006. A text book of Plant physiology, Biochemistry and Biotechnology. S Chand and Co.

*14. Lincoln Taiz, Eduardo Zeiger, 2015. Plant physiology and Development VI Edn). Sinauer Associates Inc.

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SEMESTER III

Complementary course 3 Code: BO3CMVOT03

ANGIOSPERM TAXONOMY AND ECONOMIC BOTANY

For B. Sc. Zoology Model II - Vocational

(Theory 54 hrs; Practical 36 hrs; Credits 3 + 1)

Objectives:

- Acquaint the student with the objectives and components of Taxonomy.
- Help the student to understand the systems of classification of angiosperms.
- Help the student to identify the common angiosperm species of Kerala.
- Familiarize the student with plants of immense economic importance.

ANGIOSPERM TAXONOMY (38 hrs)

Module 1: Morphology (10 hrs)

Leaf - simple, compound; venation and phyllotaxy. Flower as a modified shoot, structure of flower - floral parts, their arrangement, relative position; cohesion and adhesion of floral parts, symmetry of flowers; types of aestivation and placentation; floral diagram and floral formula. Inflorescence: racemose - simple, spike, spadix, catkin, corymb, umbel and head; cymose - simple, monochasial-helicoid and scorpoid; special types – cyathium, verticillaster. Fruits: outline on the classification; Simple: Fleshy - drupe, berry, hesperidium; Dry - Dehiscent - legume, capsule; Indehiscent - Caryopsis, Cypsella, Schizocarpic - lomentum, carcerulus, regma, cremocarp with examples. Aggregte. Multiple: sorosis, syconus. (Examples should be from families prescribed in the syllabus).

Module 2: Plant classification and Herbarium techniques (8 hrs)

Importance of plant classification, types of classification - artificial, natural and phylogenetic (brief account only); binomial nomenclature; ICBN (Brief account only). Bentham and Hooker‘s system of classification (up to series), its merits and demerits. Cytotaxonomy and chemotaxonomy (brief account only). Herbarium techniques; importance of herbarium.

Module 3: Angiosperm families (20 hrs)

Study of the following families of Bentham and Hookers system of classification with special reference to major identifying characters and economic importance: Annonaceae, Malvaceae, Rutaceae, Leguminosae (Mimosaceae, Caesalpiniaceae and Fabaceae), Apiaceae (Umbelliferae), Rubiaceae, Asteraceae (Compositae), Apocynaceae, Lamiaceae (Labiatae), Euphorbiaceae, Arecaceae (Palmae), Poaceae (Gramineae).

ECONOMIC BOTANY (16 hrs)

Module 4: Classification (10 hrs)

Classification of economically important plants based on their uses. Study of the following groups of plants with special reference to their botanical name, family, morphology of useful part, economically important products and uses: Cereals - Paddy, Wheat; Pulses - Green gram, Bengal gram; Tuber crops - Tapioca; Spices - Pepper, Cardamom; Beverages - Tea, Coffee; Oil yielding plants - Coconut, Groundnut; Fibre yielding plants - Cotton, Coir; Timber yielding plants - Teak, Rose wood; Latex yielding plants - Para rubber; Bio pesticides - Neem, Tobacco; Ornamental plants - Rose, Orchids, Anthurium.

Module 5: Medicinal plants (6 hrs)

Study of the following medicinal plants with special reference to their binomial, family, morphology of useful parts and uses: *Adhatoda, Aloe*, *Bacopa*, *Catharanthus*, *Eclipta*, Neem, *Ocimum*, *Phyllanthus amarus, Rauvolfia*, *Sida.*

PRACTICAL (36 hrs)

1. Identify the different types of inflorescences and fruits of typical plants belonging to the families prescribed in the syllabus.
2. Identify typical local plants belonging to the families prescribed in the syllabus.
3. Describe the floral parts in technical terms and draw the L.S. of flower, construct the floral diagrams and write the floral formula of at least one flower from each family.
4. Study the botanical name, family, morphology of the useful part and the uses of the medicinal plants listed in the syllabus. .
5. Study of the groups of plants mentioned in the economic botany syllabus with special reference to their botanical name, family, morphology of useful part, economic products and uses

REFERENCES

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2. Hill A F, 1952. *Economic Botany: A Text book of Useful Plants and Plant Products*. Tata McGraw-Hill Publishing Company Limited, New Delhi.
3. Jain S K, 1987. A Manual of Ethnobotany. Scientific Publishers, Jodhpur.
4. Kochhar S L, 1981. *Economic Botany in the Tropics.* Macmillon India Limited, Delhi.
5. Lawrence G H M, 1951. *Taxonomy of Vascular Plants*. Oxford & IBH, New Delhi.
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8. Sharma O P, 1993. *Plant Taxonomy*. Tata McGraw Hill Publishing Co. Ltd., New Delhi.
9. Simpson B S, M Conner – Ogorzaly, 1986. *Economic Botany: Plants in Our World.* McGraw Hill Book Company, New York.
10. Singh G, 1999. *Plant Systematics – Theory and Practice.* Oxford & IBH, New Delhi.

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SEMESTER IV

Complementary course 4 Code: BO4CMVOT04
For B. Sc. Zoology Model II - Vocational
ANATOMY AND APPLIED BOTANY
(Theory 54 hrs; Practical 36 hrs; Credits 3 + 1)

Objectives:

- Understand different types of plant tissues.
- Understand the internal structure of different plant organs with reference to their functions.
- Understand the process of normal and anomalous secondary thickening in plants.
- Know the morphological and anatomical adaptations of plants growing in different habitats.
- Understand the applications of botanical knowledge in the field of crop improvement for human prosperity.

PLANT ANATOMY (34 hrs)

Module 1: Cells and tissues (9 hrs)

Gross structure of primary and secondary cell walls; structure and function of plasmodesmata; non-living inclusions - cystolith, raphides; Tissues - meristematic and permanent, types of meristems;

simple and complex tissues, secretory tissues (nectaries, hydathodes, mucilage ducts and lactiferous tissue).

Module 2: Anatomy of plant organs (16 hrs)

Primary structure of stem and root in dicots and monocots; anatomy of monocot and dicot leaf. Secondary thickening in dicot stem and dicot root; growth rings, dendrochronology, heart wood and sap wood; tyloses; hard wood and soft wood. Anomalous secondary thickening in *Bignonia*.

Module 3: Ecological anatomy (9 hrs)

Study of the morphological and anatomical adaptations of the following groups: Hydrophytes – *Nymphaea, Hydrilla*; Xerophytes – *Nerium;* Epiphytes - *Vanda*.

APPLIED BOTANY (20 hrs)

Module 4: Plant breeding (10 hrs)

Objectives of plant breeding, methods of plant improvement - plant introduction, acclimatization, plant quarantine; selection - mass selection, pureline selection and clonal selection; hybridization - intervarietal, interspecific and intergeneric; procedure of hybridization.

Module 5: Artificial vegetative propagation methods (4 hrs)

Propagation of plants through cutting, layering - air layering; budding T and patch budding; grafting - tongue and splice grafting. Role of cambium in budding and grafting.

Module 6: Plant tissue culture (6 hrs)

Principles of tissue culture, micropropagation - different steps - selection of explants, culture media, sterilization (explants and culture media), callus. Regeneration of plants: organogenesis, somatic embryogenesis; artificial seeds; applications of plant tissue culture.

PRACTICAL (36 hrs)

1. Primary structure of stem and root of dicots and monocots; Dicot stem - Centella; Monocot stem – Bamboo, grass, asparagus; Dicot root - Tinospora; Monocot root - Colocasia, Musa.
2. Structure of dicot stem and dicot root after secondary thickening; Stem - Vernonia, Eupatorium; Root - Tinospora, Papaya.
3. Anomalous secondary thickening in *Bignonia.*
4. Anatomical adaptations of Hydrophytes - *Nymphaea* petiole, Hydrilla stem; Xerophytes - *Nerium* Leaf; Epiphytes - Velamen root of *Vanda*.
5. Emasculation of pea or *Caesalpinia* flower.
6. Demonstrate T and patch budding.
7. Demonstration of tissue culture techniques: culture media, surface sterilization and inoculation of explants.
8. Identification of non living inclusions - cystolith, raphides.

REFERENCES

1. Christopher E P, 1958. *Introductory Horticulture*. McGraw Hill, New York.
2. Esau K, 1965. Plant Anatomy. Wiley, New York.
3. Fahn A, 1985. *Plant Anatomy*. Pergamon Press, Oxford.
4. Hartman H T, D E Kester, 1991. *Plant Propagation: Principles and Practices*. Prentice Hall of India, New Delhi.
5. Kumar N, 1994. *Introduction to Horticulture*. Rajalakshmi Publications, Nagercoil.
6. Pandey B P, 1984. *Plant Anatomy*. S Chand and Company, New Delhi.
7. Vasishta V C, 1978. *Plant Anatomy*. S Nagin and Company, Jalandhar.

B Sc BOTANY PROGRAMME – MODEL III (DUAL CORE)

PROGRAMME DESIGN

The UG programme in Botany (Model – III, Dual core) must include (a) Common courses*, (b) Two different core courses (c) Complementary Courses (d) Open courses (e) Choice based courses (f) Project work and (g) On the job training. No course shall carry more than 4 credits. The student shall select any one Open course in Semester V offered by different departments in the same institution. The number of courses for the restructured programme should contain 10 compulsory courses each for the two core subjects, 1 open course, 1 choice based elective course from the frontier area of the core courses, 14 core practical courses, 1 project work, 8 complementary courses and 4 complementary practical courses. There should be 2 common courses which is English.

PROGRAMME STRUCTURE: SUMMARY OF COURSES AND CREDITS

Sl. No.	Course type	No. of courses	Total credits
1	Common course I - English	2	8
2	Core 1 + Practical	10 + 8	38
3	Core 2 + Practical	10 + 6	36
4	Complementary I + Practical	4 + 2	14
5	Complementary II + Practical	4 + 2	14
6	Open course	1	3
7	Programme elective (Choice based core course)	1	3
8	Project work	1	3
9	OJT	1	1
Total		**52**	**120**
Total credits		120	
Programme duration		6 Semesters	
Minimum attendance required		75%	

*__Course:__ a segment of subject matter to be covered in a semester. Each course is designed variously under lectures / tutorials / laboratory or fieldwork / seminar / project / practical training / assignments/ evaluation etc., to meet effective teaching and learning needs.

SEMESTER-WISE DISTRIBUTION OF COURSES AND CREDITS

Course Title	Hrs/ week	Credits	Course Title	Hrs/ week	Credits
SEMESTER I			**SEMESTER II**		
Common course – English 1	5	4	Common course – English 2	5	4
Botany core course 1	4	2 + 1	Botany core course 2	4	2 + 1
Biotechnology Core Course 1 (IT)	4	2 + 1	Biotechnology core course 3	4	2 + 1
Biotechnology core course 2	4	2 + 1	Biotechnology core course 4	4	2 + 1
Ist Complementary - Biochemistry course 1	4	2 + 1	1st Complementary – Biochemistry course 2	4	2 + 1
2nd Complementary - Zoology course 1	4	2 + 1	2nd Complementary – Zoology course 2	4	2 + 1
Total	**25**	**19**	**Total**	**25**	**19**
SEMESTER III			**SEMESTER IV**		
Botany core course 3	5	3 + 1	Botany core course 4	5	3 + 1
Biotechnology core course 5	5	3 + 1	Biotechnology core course 7	5	3 + 1
Biotechnology core course 6	5	3 + 1	Biotechnology core course 8	5	3 + 1
Ist Complementary - Biochemistry course 3	5	3 + 1	Ist Complementary – Biochemistry course 4	5	3 + 1
2nd Complementary - Zoology course 3	5	3 + 1	2nd Complementary – Zoology course 4	5	3 + 1
Total	**25**	**20**	**Total**	**25**	**20**
SEMESTER V			**SEMESTER VI**		
Botany core course 5	5	3 + 1	Botany core course 8	5	3 + 1
Botany core course 6	5	3 + 1	Botany core course 9	5	3 + 1
Botany core course 7	5	3 + 1	Botany core course 10	6	3 + 1
Biotechnology core course 9	6	3 + 1	Biotechnology core course 10	6	3 + 1
Open course	4	3	Programme elective - Choice based core course	3	3
			Project work	--	3
Total	**25**	**19**	OJT	--	1
			Total	**25**	**23**

SEMESTER-WISE DISTRIBUTION OF CORE COURSES

Sem.	Course category	Course code	Course title	Instr. hrs.*		Credits
				Th.	Pr	
I	Core Bot-1	BO1CRT01	Methodology of Science & Introduction to Botany	36	36	2+1
	Core BT-1	BOBT 1CRT01	Operating system and Office automation	36	36	2+1
	Core BT-2	BOBT 1CRT02	Cell Biology, Developmental biology and Evolution	54	18	2+1
II	Core BO-2	BO2CRT02	Microbiology, Mycology & Plant Pathology	36	36	2+1
	Core BT-3	BOBT 2CRT03	Biophysics & Instrumentation	54	18	2+1
	Core BT-4	BOBT 2CRT04	Molecular Biology & Methods in Molecular Biology	54	18	2+1
III	Core BO-3	BO3CRT03	Phycology & Bryology	54	36	3+1
	Core BT-5	BOBT 3CRT05	Microbiology & Microbial Technology	54	36	3+1
	Core BT-6	BOBT 3CRT06	Immunology	54	36	3+1
IV	Core BO-4	BO4CRT04	Pteridology, Gymnosperms & paleo botany	54	36	3+1
	Core BT-7	BOBT 4CRT07	Animal Biotechnology & Nanotechnology	54	36	3+1
	Core BT-8	BOBT 4CRT08	Plant Biotechnology	54	36	3+1
V	Core BO-5	BO5CRT05	Anatomy, Reproductive botany, Microtechniques	54	36	3+1
	Core BO-6	BO5CRT07	Plant Physiology & Biochemistry	54	45	3+1
	Core BO-7	BO5CRT08	Environmental sciences and Human Rights	54	36	3+1
	Core BT-9	BOBT 5CRT09	Recombinant DNA Technology	54	45	3+1
	Open			72	--	3
VI	Core BO-8	BO6CRT09	Genetics, Plant Breeding and Horticulture	54	45	3+1
	Core BO-9	BO6CRT11	Angiosperm Morphology, Taxonomy & Economic Botany	72	45	3+1
	Core BO-10	BO6CRT13	Biostatistics	54	36	3+1
	Core BT-10	BOBT 6CRT10	Bioinformatics	54	36	3+1
	Elective			54	--	3
	Project	BO6PRT01	Investigatory project work done individually or in groups	--	--	3
	Core BT	-	OJT			1

* 18 instructional hours is equal to one teaching hour per week. BO- Botany: BT- Biotechnology

SEMESTER-I

Semester I Core course BO 1 Code: BO1CRT01

METHODOLOGY OF SCIENCE AND AN INTRODUCTION TO BOTANY

(See model I syllabus)

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Semester I Core course BT 1 Code: BOBT1CRT01

OPERATING SYSTEMS AND OFFICE AUTOMATION

(Theory 36 Hours; Practical 36 Hours; Credits 2 + 1)

Objectives:

- To understand the basic operation systems of the Computer and Office Automation.
- To access information in advanced biological sciences using internet
- To develop essential computer skills to solve biological problems
- To apply algorithmic principles to solve biological problems.

Theory (36 Hours)

Module1: Introduction to computers (3 hrs)

Input and output devices. Storage devices: Hard Disk, Diskette, Digital tape, CD – ROM, DVD (capacity and access time). Main Circuit board of a PC: chips, Ports Expansion slots. Memory: Register, buffer, RAM, ROM, PROM, EPROM, EEPROM. Types of processing: Batch, Real time, online, offline

Module 2: History – Evaluation, Generation of computers I, II, III, IV, V (2 hrs)

Classification of computers (Main Frames, mini computers, microcomputers, special purpose) - Comparison with respect to memory, power, cost, size. Modern computers: The mini computers, Main Frame computers, parallel processing computer and the super computer.

Module 3: Introduction to operating systems (5 hrs)

Operating system concept. Windows 98/XP. Windows server NT / 2007. Unix/ Linux and servers.

Module 4: Data processing and presentation (7 hrs)

Introduction. MS Office (Word, Excel, Power Point).

Module 5: Computer viruses (1 hr)

An overview of computer viruses. What is a virus? Virus symptoms, How do they get transmitted? What are the dangers? General Precautions.

Module 6: Computer Networking (4 hrs)

Introduction to networking: Various terminologies, Associated hardware device, gadgets (Router, Switch etc) tools, services and resource. Network topologies and protocols: LAN, WAN and MAN World Wide Web www, Network security: Fire walls.

Module 7: Internet searches (3 hrs)

Search Engines: Google, Yahoo etc. Concept of text based searching. Searching Medline, bibliographic databases.

Module 8: Algorithms, Flow charts and Programming concepts (6 hrs)

Algorithms: Concepts and Definition. Converting Algorithms to Flow charts. Coding: Flow charts to programmes. Comparing algorithms, flow charts and programs.

Module 9: Data Bases (5 hrs)

Introduction and need of databases; Types of Databases. Basic concepts in Data Abstraction, Data models, Instances and schemes, ER Model, Network data model (Basic concepts), Hierarchial data Model (Basic concept), multimedia data bases (Basic concepts and Applications). Text databases, Overview of biological databases.

PRACTICAL (36 hrs)

1. Computer – Getting familiar with hardware, booting and operating
2. Operating Systems – DOS, Windows 98/XP, UNIX etc.
3. File handling: copy, rename, delete type etc.
4. Directory: Structure, make, rename, move directory
5. Scanning of viruses and using antivirus programme.
6. Word processing (Microsoft word) Creating, saving and operating a document, editing, inserting, deleting, formatting, moving, copying text, Find and replace, spell checker, Grammar checker.
7. Document Enhancement (Borders, Shading, Header, Footer) Printing Document (Page Layout, Margins)
8. Introduction to the use of wizards and templates, working with graphics (Word Art), Working with table, charts, inserting files (Pictures, Databases, and Spreadsheets)
9. Use of internet – Downloading and installing software / programme on Windows 98/ XP, (Acrobat Rader, Post Script viewer etc)
10. Searching, Surfing on the www
11. Spread sheet application (Microsoft Excel)
12. Worksheet Basics: Entering information in a worksheet, saving and opening a worksheet, editing, copying, moving data, inserting, deleting, moving column and rows, clearing and formatting cells, printing worksheet
13. Usage of multimedia –Creation of computer presentation with graphics (Microsoft Power Point) Creation of slides, photoshop, Rapid presentation design using wizard.

REFERENCES

1. Introduction to computers, Data processing and networking
2. Computer fundamentals – PK Singha
3. Introduction to Bioinformatics – Artwood

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Semester I Core course BT 2 Code: BOBT1CRT02

CELL BIOLOGY, DEVELOPMENTAL BIOLOGY AND EVOLUTION

(Theory 54 Hours; Practical 18 Hours; Credits 2 + 1)

Objectives:

- To understand the ultra structure and functioning of the cell at submicroscopic and molecular level.
- To provide an idea of origin, concept of continuity and complexity of life activities.
- To appreciate developmental biology as one of the most exciting areas of contemporary biology.
- To understand the concept of unification of genomic, developmental, organismal, population and natural selection approaches to evolutionary change.
- To understand the process of evolution this acts through inherited changes in the development of organism.
- To relate embryonic development with life history evolution, adaptation and responses to and integration with environmental factors.

CELL BIOLOGY (27 hrs)

Module 1: History of cytology (9 hrs)

Historical account of cell biology: Cell theory and protoplasm theory, Cell: Physio-chemical nature of plasma membrane and cytoplasm, prokaryotic and eukaryotic cell. structural organization and function of intracellular organelles – cell wall, nucleus, mitochondria, ribosome, dictyosomes, microbodies, golgibodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles, chloroplast, structure and function of cytoskeleton and its role in motility.

Module 2: Chromosomes (10 hrs)

Chromosome morphology - fine structure, Dupraw model, Nucleosome model; chemical organization of nucleosome-nucleoproteins, karyotype and idiogram. Special types of chromosomes- salivary gland, lampbrush and B chromosome.

Organization of genes and chromosomes: operon, interrupted genes, structure of chromatin and chromosomes, unique and repetitive DNA, heterochromatin, euchromatin, transposons.

Numerical aberrations of chromosomes - Aneuploidy and euploidy. Structural aberrations of chromosomes - deletion, duplication, inversion and translocation and their meiotic behaviour.

Mutations: spontaneous and induced. Mutagens - physical and chemical mutagens. Chromosomal and point mutations. Molecular mechanism of mutation: transition, transversion and substitution.

Module 3: Cell division and cell cycle (8 hrs)

Cell division and cell cycle: mitosis and meiosis, cell cycle regulation, steps and control of cell cycle. Stem cells - definition, sources and applications. Interaction of cells with their environment, cell signaling.

DEVELOPMENTAL BIOLOGY (18 hrs)

Module 4: Introduction (4 hrs)

Introduction to developmental biology: basic concepts of development, potency, commitment, specification, induction, competence, determination and differentiation; genomic equivalence and cytoplasmic determinants: imprinting mutants and transgenics in analysis of development.

Module 5: Gametogenesis (14 hrs)

Gametogenesis, fertilization and early development: Animal development: oogenesis, fertilization, embryonic cleavage divisions: blastulation, gastrulation and morphogenesis; Development of model organisms – Drosophila and Caenorhabditis; maternal and zygotic gene activity in development.

Plant development: microsporogenesis and megasporogenesis; Embryogenesis (brief account only), establishment of symmetry in plants, seed formation and development of seedling, shoot and root meristem, leaf development, development of model organism – Neurospora and Arabidopsis.

EVOLUTION (9 hrs)

Module 6: NeoDarwinism, Molecular evolution (9 hrs)

Neo Darwinism - Reproductive isolation, mutation, genetic drift, speciation. Variation and evolution, hybridization and evolution, polyploidy and evolution. Mutation and evolution. Molecular evolution: concepts of neutral evolution, molecular divergence and molecular clocks; molecular tools in phylogeny: classification and identification; protein and nucleotide sequence analysis; origin of new genes and proteins; gene duplication and divergence. Paleontological evidences: Geological time scale; eras, periods and epoch; major events in the evolutionary time scale; origin of organisms: major groups of plants and animals; stages in primate evolution.

PRACTICAL (18 hrs)

1. Examination of different kinds of cells - Prokaryotic and eukaryotic cell
2. Blood grouping
3. Cell counting methods:
4. Haemocytometer: WBC, RBC
5. Differential counting using Leishman's stain
6. Micrometry: Calibration using ocular micrometer, Finding out average cell size
7. Squash Preparation, Study of mitotic stages.
8. Measurement of Chromosome length.
9. Staining of mitochondria.

REFERENCES

1. Lodish et al.2004. Molecular Cell Biology. (Scientific American Book)
2. Eduard Gasque – "Manual of Laboratory Expts in Cell Biol." W. C. Wilson Pub.
3. Alberts et al. 2002. The Biology of the Cell
4. Cooper & Hausman .2004. The Cell – A Molecular Approach
5. Maheaswari, P. 1950. An introduction to embryology of Angiosperms. Mc Graw Hill.
6. Balinsky, B.I., 1965. An Introduction to embryology, W.B. Saunders company
7. Bodemer, L.W., 1968. Modern Embryology, Winston Inc. USA
8. Dodd H I, Dodd J M, 1978. The biology of metamorphosis, In Physiology of amphibia, Vol. 3. Academic press, N.Y
9. Gilbert, S.F., 1997. Developmental Biology, 5th Edn, Sinauer, Associates, Massachusettes.
10. George, M. Malacinski (ed) 1988. Developmental genetics of higher organisms, Macmillan Publishing Co.
11. Tamarin, R., 1991, Principles of Genetics, 3rd edition.
12. Vasudeva Rao, 1994. Developmental Biology: A modern synthesis, Oxford & IBH, New Delhi
13. De Robertis, E.D.P. and Robertis, E.M.F. 1991. Cell and molecular biology. Lea and Febiger
14. Dobzhansky, B. 1961. Genetics and the origin of species. Coloumbia University Press. NY.

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SEMESTER-II

Semester II Core course BO 2 Code: BO2CRT02

MICROBIOLOGY, MYCOLOGY AND PLANT PATHOLOGY

(See model I syllabus)

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Semester II Core course BT 3 Code: BOBT2CRT03

BIOPHYSICS AND INSTRUMENTATION

(Theory 54 Hours; Practical 18 Hours; Credits 2 + 1)

Objectives:

- To understand rules, principles and models of atomic structure.
- To develop skills in separating different biomolecules.
- To apply various spectroscopic methods to characterize biomolecules.

Module 1: Atomic structure (5 hrs)

Historical account, significance 2nd and 3rd postulate of Bohr's model, derivatives of radius and energy value. Quantization of energy levels. Using Rydburg's constant, atomic spectra in signature of the element. Bohr-sommerfeld model. Vector atom model, quantum numbers. Selection rules. Paulis exclusion principles. Emission spectra with respect to NA atom to understand selection rules.

Module 2: Spectroscopy (12 hrs)

Definition - Electromagnetic wave, electromagnetic spectrum, application of each region of EM spectrum for spectroscopy. Introduction to molecular energy levels, excitation, absorption, emission. Rotational spectra. Energy levels of rigid diatomic molecules. Vibrational and rotational spectra. Energy levels of diatomic vibrating molecules, rotational vibrational spectroscopy, IR spectroscopy, principle, constructing and working of IR spectrometer. Application of IR spectroscopy to biomolecules. Electro spectroscopy: UV-Visible spectroscopy: Principle, construction and working of colorimeter, spectrophotometer and fluorometer, Application to biomolecules (proteins, DNA, Hb, chlorophyll), Raman Spectra.

Module 3: Radioactivity (10 hrs)

Nucleus - properties. Nuclear forces. Nuclear models (liquid drop and shell model), radioactive nucleus. Revision of nuclear radiation and their properties - alpha, beta and gamma. Half-life - physical and biological. Handling and standardization of alpha, and beta emiting isotopes. Radioimmunoassay, Radiopharmaceuticals and its uptake - dosimetry and detection Principle-construction and working of pen and batch dosimeter. GM counter, Scintillation counter (solid and liquid).

Module 4: Thermodynamics as applied to biological system (5 hrs)

Enthalpy, entropy, free energy, Gibb's free energy (G), Helmholtz free energy (A). Chemical potential, half cell potential. Redox potential, structure and bioenergetics of mitochondria and chloroplast.

Module 5: Cell membrane (8 hrs)

Organization of plasma membrane, Mass transport, diffusion, basics, passive and active transport, membrane potential. Nernst equation. Passive electrical properties of cell (capacitance and resistance). Active electrical properties. Electrical model (equivalent) of cell membrane. Depolarization,

hyperpolarization of membrane (neuronal). Generation of active potential. Types of biopotentials. Biopotential measurement instruments.

Module 6: Thermoregulation (2 hrs)

Thermometric properties and types of thermometers (clinical, thermocouple, bimetallic, platinum resistance, thermistor-thermometers). Body temperature and its regulation.

Module 7: Bioinstruments (6 hrs)

Concepts - analytical techniques, analytical method, procedure and protocol, principle construction, working and application for analysis of biomolecules of following instruments: pH meter, centrifuge (RCF, sedimentation concept),different types of centrifuges, Mass spectroscopy (Bainbridge mass spectrometer), Atomic absorption spectrometer (AAS), Nuclear magnetic resonance spectrometer (NMR), XRD.

Module 8: **Electron microscope (6 hrs)**

Concept of vacuum working electron gun, construction and working of SEM, TEM, STEM, sample preparation.

PRACTICAL (18 hrs)

1. Spectral properties (Colorimetric or UV/Visible Spectral analysis of colouring pigments- Beta cyanin, Anthocyanin, Xanthine, Lycopene, Curcumin, capsicin)
2. Separation Techniques: Chromatography (PC, TLC and Column), GC & HPLC, HPTLC (Demonstration only).
3. Electrophoretic separation of protein.

REFERENCES

1. Perspective of Modern Physics - Arthur Beisen (Mc Graw Hill)
2. Nuclear Physics: an introduction: SB Patel (New Age International)
3. Introduction to Atomic Spectra: HE White (Mc Graw Hill)
4. Text Book of optics and atomic physics: P P Khandelwal (Himalaya publications)
5. Molecular Cell Biology: Lodish, Berk, Matsudora, Kaiser, Kriegen (WH Freeman and Co.)
6. Biophysics: Cotrell (Eastern Economy Edition).
7. Clinical Biophysics: Principles and Techniques: P Narayanan (Bhalani Publ., Mumbai).

Biophysics: Pattabhi and Gautham.

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Semester II Core course BT 4 Code: BOBT2CRT04

MOLECULAR BIOLOGY AND METHODS IN MOLECULAR BIOLOGY
(Theory 54 Hours; Practical 18 Hours; Credits 2 + 1)

Objective:

- To familiarize with the genetic make up and control of cells at molecular level
- To familiarize with the modern tools and techniques associated with molecular biology research

Module 1: Identification of DNA as genetic material (4 hrs)

Introduction to heredity and the genetic material, characteristics of genetic material, the molecular basis of heredity, Early studies of DNA [works of F. Miescher, Albert Kossel, Phoebus Levene, Erwin Chargaff] DNA as the source of genetic information. The discovery of transforming principle

[Griffith's experiment], Identification of the transforming principle [Avery, MacLeod and McCarty's experiment]; [Hershey and Chase experiment], Watson and Crick's discovery of the structure of DNA, discovery of RNA as the genetic material in some viruses [Heinz Fraenkal-Conrat's experiment].

Module 2: DNA structure (3 hrs)

The structure of DNA, Primary structure; structure of ribose and deoxyribose sugars, Structure of N bases, structure of nucleosides and nucleotides, phosphodiester bond and structure of a polynucleotides, Secondary Structure; structure of DNA double helix, different secondary structures [A, B and Z] , circular DNA.

Module 3: Replication of DNA (10 hrs)

Suspected forms of DNA replication, conservative, dispersive and semi conservative, Meselson and Stahl's experiment. Requirements for replication; template, raw materials, enzymes and other proteins,direction of replication, mechanism of replication, Bacterial DNA replications, bacterial DNA polymerase, eukaryotic DNA replication, DNA polymerase, location of replication within the nucleus, DNA synthesis at the ends of chromosomes, telomerases. Modes of replication, theta replication, rolling circle replication, linear eukaryotic replication. Recombination; Holliday model, enzymes required for recombination.

Module 4: Gene expression (16 hrs)

Transcription, the structure of RNA, types of RNA, mRNA, tRNA, rRNA, snRNA, snoRNA, miRNA, requirements for transcription, the subscribed and unsubscribed strands of DNA, experiments by Julius Marmu, transcription factors.

Promoters; bacterial and eukaryotic, RNA polymerase; bacterial and eukaryotic, the process of bacterial transcription, the process of eukaryotic transcription, RNA processing; split genes, exons, introns (group I, II and nuclear types).

Messenger RNA, early studies of mRNA, Brenner, Jacob and Meselson's experiment, Pre-mRNA processing in eukaryotes, addition of 5' cap and 3' polyA tail, RNA splicing, spliceosome, the process of splicing in different groups of introns, nuclear location of splicing, mRNA editing, guide RNAs (gRNAs). Structure of tRNA, modified bases in tRNA, clover leaf model of tRNA, tRNA genes structure and processing, rRNA; rRNA gene structure and processing, small interfering RNAs, experiment of Fire and Mellow, RNA interference (RNAi).

Translation, the genetic code, breaking the genetic code, experiments of Nirenberg and Matthaei and Nirenberg and Leder, Contributions of H G Khorana in connection with the breaking of the genetic code, characteristics of the code, The process of translation, polyribosomes, RNA-RNA interaction in translation, mRNA surveilence; non-sense mediated mRNA decay, non-stop mRNA decay, stalled ribosome, translation inhibitors.

Module 5: Control of gene expression (4 hrs)

Gene regulation, principles of gene regulation, levels of gene control, gene regulation in bacterial cells; operon concept, negative and positive control, inducible and repressible operons, *lac* operon of E.coli, *trp* operon of *E.coli*, attenuation and anti-termination. Gene regulations in eukaryotes; chromatin structure, DNase I hypersensitivity, histone acetylaltion, DNA methylation, Alternative splicing of mRNA, RNA silencing.

Module 6: Mutation and repair of DNA (4 hrs)

Mutations, definition, importance of mutation, Types of mutations, gene mutations, types of gene mutations, causes of mutations, DNA repair, mismatch repair, direct repair, base-excision repair, nucleotide excision repair, photoreactivation, SOS response.

Module 7: Genetics of Cancer (4 hrs)

Cancer genetics, the nature of cancer, cancer as a genetic disease, role of environmental factors in cancer, genetic changes that contribute to cancer, oncogenes and tumor suppressor genes, changes in

chromosome number and structure, genomic instability, DNA repair genes, changes in patterns of DNA methylation, genes that promote vascularisation and the spread of tumors.

Module 8: Methods in Molecular Biology (9 hrs)

DNA sequencing; Sanger's dideoxy method, working of automated DNA sequencer, Gene synthesis; work of Khorana, working of automated nucleic acid synthesizer Polymerase chain reaction; An Overview ,Components and Conditions for PCR Optimization, Primer Design, Isolation of Nucleic Acids for PCR Amplification, Site-Directed Mutagenesis by PCR, Restriction Enzyme Analysis of PCR Products, Cloning of PCR Products, Symmetric PCR, Asymmetric PCR, Inverse PCR, Anchored PCR, RT-PCR, RT-PCR Applications Research Applications of PCR, Non-isotopic Probe Synthesis and Detection by Chemiluminiscence RAPD, RFLP, AFLP, DNA finger printing, DNA foot printing.

PRACTICAL (18 hrs)

1. Isolation of plant genomic DNA
2. Quantification of DNA
3. Isolation of plasmid DNA
4. Documentation of DNA by agarose gel electrophoresis

REFERENCES

1. Molecular biology of the gene, JD Watson, 2007, Addison-Wesley
2. Molecular Biology, RF Weaver, 2007, McGraw Hill
3. Biochemistry and molecular biology, TA Swanson, 2006, Lippin Cott Williams & Wilkins
4. Laboratory investigation in cell and molecular biology, A Bergman, 2001, John Wiley and sons
5. Molecular Biology of cancer: mechanisms, target and therapeutics, L pecorino, 2005, Oxford University press.

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SEMESTER III

Semester III Core course BO 3 Code: BO3CRT03

PHYCOLOGY AND BRYOLOGY

(See model I syllabus)

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Semester III Core course BT 5 Code: BOBT3CRT05

MICROBIOLOGY AND MICROBIAL BIOTECHNOLOGY

(Theory 54 Hours; Practical 36 Hours; Credits 3 + 1)

Objectives:

- To identify different types of microbes and their crucial roles in various bioprocesses
- To apply various microbial processes/systems/activities, which have been used for the development of industrially important products/processes.

MICROBIOLOGY (39 hrs)

Module 1: (3 hrs)

Definition Brief classification of microbes: bacteria, archaea, protozoa, algae, fungi, viruses History of microbiology, Golden age of microbiology, Germ theory, Koch's postulates. Economic importance of microbes

Module 2: (8 hrs)

Observing microorganisms Microscopy: compound light microscope, darkfield microscope, phase contrast microscope, fluorescent microscope, confocal microscope, scanning electron microscope, transmission electron microscope, scanning acoustic microscope. Preparing smears for microscopy. Staining, differential staining, Gram staining, acid fast staining, special stains, negative staining for capsules, endospore staining, flagella staining. Morphology of bacteria Size range of bacterial cells, shape and arrangement of bacterial cells. Methods to classify bacteria: biochemical methods, serological testing, phage typing, fatty acid profiling using FAME, ribotyping and rRNA sequencing Bergey's manuel, examples and characteristics (brief account) of gram negative bacteria, gram positive bacteria, bacteria with unusual properties, gram positive filamentous bacteria with complex morphology Structure of bacterial cell Structures external to cell wall: Glycocalyx Cell wall: composition, structure, function, cell wall and Gram staining mechanism. Flagella: structure of flagella, different types of arrangements of flagella. Fimbriae and pili. Structures internal to cell wall. Plasma membrane, composition, structure and function Spheroplast, cytoplasm, ribosome, nucleoid, plasmid, inclusions, endospores.

Module 3: (12 hrs)

Culturing Bacteria, Nutritional requirements, nutritional types of bacteria: phototrophs, chemotrophs, autotrophs, heterotrophs, obligate parasites, Bacteriological Media: selective media, differential media, media for characterization of bacteria, Solid and semi solid media, broth, Physical conditions required for growth: temperature, pH, oxygen, cultivation of aerobic and anaerobic bacteria, candle jar, anaerobic jar, CO_2 generating packet, CO_2 incubator, Batch culture, continuous culture, enrichment culture, pure culture, methods to obtain pure culture: streak plate method, serial dilution method, use of special media, Preserving bacterial culture: Glycerol stock, deep freezing, lyophilisation, Growth of bacterial cultures: binary fission, budding (eg. *Pseudomonas acidophila*), fragmentation (eg. *Nocardia*), Bacterial growth kinetics, Growth curve, different phases, Measurement of bacterial growth: direct microscopic count, serial dilution, pour plate, spread plate and plate count, membrane filter count, turbidometric method, dry weight method, most probable number method, Quorum sensing.

Module 4: (8 hrs)

Control of microbial growth, Sterilization, methods of sterilization, Heat treatment: thermal death point, thermal death time, moist heat and dry heat, autoclave, design, operation, pasteurization, flaming, hot air oven, low temperature treatment, Filtration: membrane filters, Chemical methods: phenols, bisphenols, biguanides, halogens, alcohols, compounds of heavy metals, soaps and detergents, acid anionic sanitizers, quaternary ammonium compounds, chemical preservatives; SO2, sodium benzoate, sorbic acid, calcium propionate, sodium nitrate, Antimicrobial drugs: drugs inhibiting cell wall synthesis, drugs inhibiting protein synthesis, drugs causing injury to plasma membrane, drugs inhibiting nucleic acid synthesis, drugs inhibiting the synthesis of essential metabolites, penicillins, penicillinase resistant penicillin, penicillin and β-lactamase inhibitors, cephalosporins, bacitracin, vanomycin, tetracyclines, sulfonamides. Antifungal Drugs: agents affecting fungal sterols, agents affecting fungal cell walls, agents inhibiting nucleic acid synthesis

Antiviral Drugs: nucleoside and nucleotide analogues, enzyme inhibitors, reverse transcriptase inhibitor, protease inhibitors, interferons, Determination of the efficiency of a drug: disk diffusion assay, broth dilution test and determination of minimal inhibitory concentration

Module 5: Genetic recombination in Bacteria (3 hrs)

Genetic recombination in bacteria: transformation, conjugation and transduction.

Module 6: Viruses (5 hrs)

Viruses: Characteristics of viruses, size range, host range, Classification of viruses, Structure of viruses: general morphology, nucleic acids, capsid and envelope, Culturing bacteriophages in the

laboratory, culturing animal viruses: in living animals, in embryonated eggs, in cell cultures: Viral multiplication: Multiplication of bacteriophages; lytic cycle, lysogenic cycle, multiplication of animal viruses, differences in the multiplication strategies of DNA and RNA viruses, Viruses and cancer, DNA and RNA oncogenic viruses

MICROBIAL BIOTECHNOLGY (15 hrs)

Module 7: (3 hrs)

Introduction, scope and historical developments, importance of microbes in industry; microbial biomass, microbial enzymes, microbial metabolites and microbial recombinant products.Isolation, screening and genetic improvement of industrially important organisms.

Module 8: (6 hrs)

Fermentation, Definition, chronological development of fermentation industry, Submerged fermentation and solid state fermentation, Media for industrial fermentation, major components, water, carbon sources, nitrogen sources, minerals, chelators, oxygen requirement, rheology, foaming and antifoaming agents. Medium optimization: one factor at a time approach, factorial approach, fractional factorial approach: statistical design of experiments, Plackett-Burman design and response surface method. Fermenter, functions of a fermenter, Design of a biofermenter, body constructon, types of fermenters: Waldhof type, tower type, air lift type, packed tower type , sterilization of the fermenter, aeration, porous sparger, orifice sparger, nozzle sparger, probes. Recovery of fermentation products, foam separation, precipitation, filtration, centrifugation

Module 9: (3 hrs)

Primary metabolism products, production of industrial ethanol as a case study; Secondary metabolites, bacterial antibiotics production; Recombinant DNA technologies for microbial processes; Strategies for development of industrial microbial strains with scale up production capacities; metabolic pathway engineering of microbes for production of novel product for industry.

Module 10: (3 hrs)

Microbial enzymes, role in various industrial processes, Bio-transformations, Bioaugmentation with production of vitamin C as a case study, Microencapsulation technologies for immobilization of microbial enzymes. Industrial biotechnology for pollution control, treatment of industrial and other wastes, biomass production involving single cell protein; Bioremediation of soil; Production of eco-friendly agricultural chemicals, biopesticides, bio-herbicides, bio-fertilizers, bio-fuels, etc.

PRACTICAL (36 hrs)

1. Isolation of bacteria through serial dilution and plating technique
2. Gram staining technique
3. Acid fast staining technique
4. Identification of bacteria using biochemical tests
5. Preparation of the growth curve of a bacterium using turbidometric method
6. Disk diffusion assay and determination of antimicrobial activity of medicinal plant extracts

REFERENCES

1. Kun LY. 2006. *Microbial Biotechnology*. World Scientific.
2. Tortora et al. 2008. Microbiology an introduction, Pearson Education
3. Michael J Pelczar et al. 2000. TATA McGraw Hill
4. PF Stanbury et al. 2008. Elsevier.

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Semester III Core course BT 6 Code: BOBT3CRT06

IMMUNOLOGY

(Theory 54 Hours; Practical 36 Hours; Credits 3 + 1)

Module 1: (12 hrs)

Introduction to immunology. Types of immunity: nonspecific- physiological and cellular barriers, acquired immunity- characteristics, Antigen, Haptens and Adjuvants, Antibody. Structure and types of immunoglobulins, distribution and function.

Module 2: (15hrs)

Organs of immune system - primary and secondary. Cells of immunsystem. Immuneresponse. Humoral and cell mediated immunity. MHC structure and function. Autoimmunity and hypersensitivity.

Module 3: (9hrs)

Antigen-antibody interactions: Affinity, avidity, cross reactivity, Precipitation reaction: radial immune diffusion, Ouchterlony double diffusion. Aagglutination reaction, agglutination titer, Incomplete agglutinins, complement fixation, ELISA. Immunocytochemistry.

Module 4: (9 hrs)

Transplant immunity. Immunology of malignancy. Immunohaematology. Blood groups and blood grouping. A, B, Rh antigens and antibodies, Rh typing. Bombay group,

Module 5: (9 hrs)

Immunization: Passive and active .Vaccines, types and applications. DNA vaccines, Polyclonal antibodies and monoclonal antibodies.

PRACTICAL (36 hrs)

1. Slide agglutination test
2. Bacterial agglutination test
3. Haemagglutination test
4. Precipitation in tube-Capillary test
5. Precipitation in gel-Immunodiffution (Demonstration only)
6. Immunoelectrophoresis (Demonstration only)
7. Blood grouping by slide agglutination method

REFERENCES

1. Essential Immunology - Ivan M. Roitt and Peter J delves, Blackwell Publishing
2. Immunology - Thomas J. Kindt, Barbara A. Osborne, Richard A. Goldsby, and Janis Kuby, W H Freeman and Co.
3. Immunobiology - Charles A. JanewayJr., Paul Travers, Mark Walport and Mark J. Shlomchik, Garland Publishing.
4. Essential Clinical Immunology – Helen Chappel and ManselHaeney, ELBS/Blackwell Scientific Publications
5. Introduction to Immunology – John W, Kimball Maxwell, Mac Millan International Edition.
6. Text book of Microbiology – R. Ananthanarayanan and C K Jayaram Panicker. Orient Longman.

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SEMESTER IV

Semester IV Core course BO 4 Code: BO4CRT04
PTERIDOLOGY, GYMNOSPERMS AND PALEOBOTANY
(See model I syllabus)
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Semester IV Core course BT 7 Code: BOBT4CRT07
ANIMAL BIOTECHNOLOGY AND NANO-BIOTECHNOLOGY
(Theory 54 Hours; Practical 36 Hours; Credits 3 + 1)

Objectives:

- To acquire basic knowledge of current developments in different areas of animal biotechnology.
- To understand and develop skills involved in the production of nanoparticles and their application in life sciences

ANIMAL BIOTECHNOLOGY (34 hrs)

Module 1: Animal cells (10 hrs)

Structure of animal cell: History of animal cell culture: Cell culture media and reagents, different type of cell culture media, growth supplements, serum free media, balanced salt solution, other cell culture reagents, culture of different tissues and its application. Infrastructure requirements, conditions required for culturing animal cells, Behavior of cells in culture conditions, division, their growth pattern, estimation of cell number. Culture of mammalian cells, tissues and organs, primary, culture, secondary culture, continuous cell lines, suspension cultures. Development of cell lines, characterization and maintenance of cell lines, stem cells, cryopreservation. Common cell culture contaminants. Commercial scale production of animal cells. Application of animal cell culture for *in vitro* testing of drugs, testing of toxicity of environmental pollutants in cell culture, application of cell culture technology in production of human and animal viral vaccines and pharmaceutical proteins.

Module 2: Immune system (5 hrs)

Introduction to immune system, cellular and humeral immune response, Vaccines, history of development of vaccines, introduction to the concept of vaccines, conventional methods of animal vaccine production, recombinant approaches to vaccine production, hybridoma technology. Antigen-antibody based diagnostic assays including radioimmunoassays and enzyme immunoassays, immunoblotting, commercial scale production of diagnostic antigens and antisera.

Module 3: *in vitro* techniques of animal breeding (14 hrs)

Structure of sperms and ovum, cryopreservation of sperms and ova of livestock, artificial insemination, super ovulation, *in vitro* fertilization, culture of embryos, cryopreservation of embryos, embryo transfer, embryo-splitting, embryo sexing, i*n utero* testing of foetus for genetic defects.

Animal cloning basic concept, cloning from embryonic cells and adult cells, cloning of different animals, cloning for conservation of endangered species. Ethical, social and moral issues related to cloning.

Transgenic manipulation of animal embryos, animal viral vectors, different applications of transgenic animal technology. Transgenic animal production and application in expression of therapeutic proteins, biopharming.ene knock out technology and animal models for human genetic disorders

Gene therapy, somatic cell therapy, germline therapy, gene augmentation therapy, gene replacement therapy: Candidate diseases for gene therapy: Methods of gene transfer, vectors used: Initial trials and observations: Current status of gene therapy

NANO-BIOTECHNOLOGY (20 hrs)

Module 4: (5 hrs)

Introduction to Biomacromolecules: The modern concepts to describe the conformation and dynamics of biological macromolecules: scattering techniques, micromanipulation techniques, drug delivery applications.

Module 5: (5 hrs)

Cellular engineering: signal transduction in biological systems, feedback, control signaling pathways, cell-cell interactions etc. Effects of physical, chemical and electrical stimuli on cell function and gene regulation.

Module 6: (6 hrs)

Chemical, physical and biological properties of biomaterials and bioresponse, Biosynthesis, and properties of natural materials (proteins, DNA, and polysaccharides), structure-property relationships in polymeric materials (synthetic polymers and structural proteins); Aerosol, properties, application and dynamics Statistical Mechanics in Biological Systems

Module 7: (4 hrs)

Characteristics of nanoparticles: Preparation and characterization of nanoparticles, biosynthesis of nanoparticles, Nanoparticular carrier systems, Micro- and Nano-fluidics, Drug and gene delivery system, Microfabrication, Biosensors, Chip technologies, Nano-imaging, Metabolic engineering and Gene therapy.

PRACTICAL (36 hrs)

1. Sterilization techniques for cell culture
2. Preparation of reagents and media for cell culture.
3. Cultivation of continuous cell lines.
4. Sub culturing: Trypsinization
5. Cell Counting
6. Nuclear staining

REFERENCES

1. Gordon I. 2005. Reproductive Techniques in Farm Animals. CABI.
2. Levine MM, Kaper JB, Rappuoli R, Liu MA, Good MF. 2004. New Generation Vaccines. 3rd Ed. Informa Healthcare.
3. Lincoln P J & Thomson J. 1998. *Forensic DNA Profiling Protocols*. Humana Press.
4. Portner R. 2007. *Animal Cell Biotechnology*. Humana Press.
5. Nalwa H S. 2005. Handbook of Nanostructured Biomaterials and Their Applications in Nanobiotechnology. American Scientific Publ.
6. Niemeyer CM & Mirkin CA. 2005. *Nanobiotechnology*. Wiley

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Semester IV Core course BT 8 Code: BOBT4CRT08

PLANT BIOTECHNOLOGY

(Theory 54 Hours; Practical 36 Hours; Credits 3 + 1)

Objectives:

- To familiarize with the tools and techniques of plant biotechnology
- Aware of the life forms and activities that can be exploited for human advancement.
- To impart an introductory knowledge about the potential of plant transgenics
- To discuss about various aspects of biosafety regulations, IPR and bioethic concerns arising from the commercialization of biotech products

Module 1: Introduction to plant tissue culture (10 hrs)

Introduction – The concept of biotechnology, landmarks in biotechnology: Plant tissue culture – Principles and techniques. Cellular totipotency, *in vitro* differentiation; dedifferentiation and redifferentiation, callus induction organogenesis and somatic embryogenesis. Tissue culture medium – Basic components in tissue culture medium – Solid and liquid medium – suspension culture – Murashige and Skoog medium – composition and preparation, Aseptic techniques in tissue culture – sterilization – different methods – sterilization of instruments and glass wares, medium, explants. Working principle of laminar air flow and autoclave; preparation of explants – surface sterilization, inoculation and incubation, sub culturing, Establishment of axenic explants, callus initiation and multiplication, production of suspension culture, cell.

Module 2: Micropropagation (10 hrs)

Micropropagation - advantages and disadvantages, different methods – axillary bud proliferation, direct and indirect organogenesis and somatic embryogenesis, different phases of micropropagation – hardening, transplantation and field evaluation. Applications of tissue culture: Micropropagation of elite plants, Synthetic seed production, Meristem culture for virus free plants, Somaclonal variation and *in vitro* mutagenesis, Embryo rescue – embryo culture, Protoplast isolation culture and regeneration, Somatic cell hybridization, I*n vitro* secondary metabolite production — cell immobilization, bio reactors, hairy root culture, *In vitro* production of haploids – anther and pollen culture, Cryopreservation, *in vitro* fertilization

Module 3: Plant transformation (20 hrs)

Methods of plant transformation; Gene cloning, genetic engineering: vectors and methods of transformation – electroporation, particle bombardment, *Agrobacterium* mediated, different types of Agrobacterium based vectors; Vectors for plant transformation; Target traits and transgenic crops; Genetic and molecular analyses of transgenics; Role of molecular markers in characterization of transgenic crops, fingerprinting of cultivars, Achievements, problems and future thrusts in horticultural biotechnology.

Biotechnology and floriculture, molecular approaches to control ethylene response, improving shelf life, improving resistance for environmental stress, approaches to improve flower development, pigment production. Achievements of bio-technology in flower crops: Extraction of biocolours, uses in food and textile industries. Examples of transgenic plants produced successfully, Bt crops, golden rice, Flavr Savr Tomato, virus and herbicide resistant crops, edible vaccines. Biosafety issues, regulatory procedures for commercial approval.

Module 3: Concerns over modern plant biotechnology (14 hrs)

Biosafety and risk assessment issues; Regulatory framework; National biosafety policies and law, The Cartagena protocol on biosafety, WTO and other international agreements related to biosafety, Cross border movement of germplasm; Risk management issues - containment.

General principles for the laboratory and environmental biosafety; Health aspects; toxicology, allergenicity, antibiotic resistance, Sources of gene escape, tolerance of target organisms, creation of superweeds/superviruses, etc.

Ecological aspects of GMOs and impact on biodiversity; Monitoring strategies, Radiation safety and nonradio isotopic procedures; Benefits of transgenics to human health, society and the environment.

Intellectual properties, copyrights, trademarks, trade secrets, patents, geographical indications, etc; Protection of plant variety and farmers right act; Indian patent act and amendments, patent filing; Convention on biological diversity; Implications of intellectual property rights on the commercialization of biotechnology products.

PRACTICAL (36 hrs)

1. Preparation of nutrient medium – Murashige and Skoog medium, sterilization, preparation of explants, inoculation.
2. Establishment callus culture, shoot and suspension
3. Immobilization of whole cells or tissues in sodium alginate.
4. Establishment of the suspension culture of one medicinal plant
5. Production of somatic embryos from one plant
6. Transformation of leaf discs using *Agrobacterium* and selection of transmormed leaf discs
7. Induction of hairy root culture in any one plant
8. Visit a well equipped biotechnology lab and submit a report along with the practical record.

REFERENCES

1. Keshavachandran R & Peter KV. 2008. Plant Biotechnology: Methods in Tissue Culture and Gene Transfer. Orient & Longman (Universal Press)
2. Debnath M. 2005. Tools and Techniques of Biotechnology. Pointer Publ.
3. Brown T A. 2001. Gene Cloning and DNA Analysis and Introduction. Blackwell Publ.
4. Chadha K L, Ravindran PN & Sahijram L. (Eds.). 2000. Biotechnology of Horticulture and Plantation Crops. Malhotra Publ. House.
5. Singh BD. 2007. Biotechnology: Expanding Horizon. Kalyani.

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SEMESTER V

Semester V Core course BO 5 Code: BO5CRT05

ANATOMY, REPRODUCTIVE BOTANY AND MICROTECHNIQUE

(See model I syllabus)

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Semester V Core course BO 6 Code: BO5CRT07

PLANT PHYSIOLOGY AND BIOCHEMISTRY

(See model I syllabus)

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Semester V Core course BO 7 Code: BO5CRT08

ENVIRONMENTAL SCIENCE AND HUMAN RIGHTS

(See model I syllabus)

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Semester V Core course BT 9 Code: BOBT5CRT09

RECOMBINANT DNA TECHNOLOGY

(Theory 54 Hours; Practical 45 Hours; Credits 3 + 1)

Objectives:

- To understand advances in field of genetic engineering and their applications.
- To familiarize with the various tools and techniques in genetic engineering

Module 1: Isolation of DNA and RNA (10 hrs)

Introduction to gene cloning. DNA isolation; DNA isolation solutions, isolation buffer pH, concentration and ionic strength, DNase inhibitors, detergents used for isolation, methods for breaking the cells Removal of proteins from cell homogenate; using organic solvents, Kirby method and Marmur method, using CTAB: Removal of RNA; using RNase A, RNase T1: Concentrating the isolated DNA; precipitating with alcohols, salts added along with alcohol: Determination of the concentration and purity of DNA; using UV spectrophotometry: Storage of DNA samples: Commercially available kits for genomic and plasmid DNA isolation: Preparation of genomic DNA from animal cells, plant cells and bacterial cells; protocol for small scale and large scale preparations: Isolation of plasmid DNA; protocol for small scale and large scale preparations: Isolation and purification of RNA; purification of total RNA, RNase inhibitors, preparation of cell material, preparation of glass wares, guanidinium hot phenol method, high salt lithium chloride method, isolation of poly A RNA

Module 2: (15 hrs)

Agarose Gel electrophoresis of DNA and RNA; principles of electrophoresis, buffers used for electrophoresis of nucleic acids, gel concentration, sample concentration, sample loading solutions, gel staining, determination of molecular weight using molecular weight markers, special precautions and treatments required for electrophoresis of RNA, elution of DNA from agarose gels; electroelution, using low-melting point agarose.

Nucleic acid transfer and hybridization; Southern blot transfer, dot-blot transfer, plaque and colony transfer, Southern blot hybridization, Northern blot transfer and hybridization, in situ hybridization

Preparation of probes for hybridization, radioactive labeling, digoxigenin labeling, nick translation, preparation of primer using PCR, RNA probes.

Module 3: Principles of gene cloning (15 hrs)

Cloning vectors; essential features of a cloning vector, plasmid derived vectors, bacteriophage derived vectors, hybrid vectors, high capacity cloning vectors; BACs, PACs and YACs, *Agrobacterium* based vectors, shuttle vectors, expression vectors

Enzymes used in recombinant DNA technology; type II restriction endonucleases, ligases, S1 nuclease, alkaline phosphatase, terminal transferase, DNA polymerase I, reverse transcriptase, exonuclease III, bacteriophages λ exonuclease,

Finding gene of interest; shot gun cloning followed by screening, construction and use of genomic DNA library and cDNA library, screening DNA libraries, chromosome walking, *in silico* gene discovery, cloning of the gene of interest, altering the gene of interest through site directed mutagenesis,

Preparation of recombinant DNA molecule, blunt ends and sticky ends, using tailing method, using polylinkers. Methods to transfer the recombinant DNA molecule into the cloning host; transformation, transfection, transduction, electroporation, microinjection, microprojectiles and DNA gun, *Agrobacterium* mediated transfer. Methods to select the recombinants; antibiotic markers, insertional inactivation, replica plating, blue-white selection, use of reporter genes; GUS, luciferase and GFP genes

Module 4: GMOs (14 hrs)

Transgenesis; introduction to transgenic organisms and their applications. Mechanism of gene transfer into eukaryotic cells, transfection methods; using polyethelene glycol, chemical transfection using lithium acetate, calcium phosphate, and DEAE-dextran, lipofection, electroporation, microinjection, DNA gun, fate of DNA transferred to eukaryotic cells, random integration transgenesis – gain of function effects and loss of function effects, gene targeting. Examples of transgenic crop plants and animals. Antisense and RNAi technology. Production of knock out models and their use. Applications of recombinant DNA technology. Ethical, Social and legal issues associated with recombinant DNA technology.

PRACTICAL (18 hrs)

1. Primer Designing
2. PCR assay for gene amplification
3. Isolation of plasmid DNA and Restriction Digestion
4. Agarose gel electrophoresis of the isolated plasmid DNA, its visualization and photography
5. Preparation of competent E.coli cells
6. Preparation of recombinant plasmids, transformation of *E.coli* and selection of transformants

REFERENCES

1. Recombinant DNA, JD Watson, 1992, Scientific American Books
2. Recombinant DNA: genes and genomes; a short course. J D Watson *et al*., 2006, W H Freeman & Co.
3. Recombinant DNA technology and applications, Alex Prokop et al., 1997, McGraw Hil
4. Principles of Gene Manipulation: An Introduction to Genetic Engineering, by R.W. Old and S B Primrose 2000, Blackwell Scientific
5. Molecular Cloning: a Laboratory Manual. Sambrook J, Russel D W & Maniatis T. 2001, Cold Spring Harbour Laboratory Press.

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SEMESTER VI

Semester VI Core course BO 8 Code: BO6CRT09

GENETICS, PLANT BREEDING AND HORTICULTURE

(See model I syllabus)

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Semester VI Core course BO 9 Code: BO6CRT11

ANGIOSPERM MORPHOLOGY, TAXONOMY AND ECONOMIC BOTANY

(See model I syllabus)

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Semester VI Core course BO 10 Code: BO6CRT13

BIOSTATISTICS

(Theory 54 Hours; Practical 36 Hours; Credits 3 + 1)

Module 1: Introduction (10 hrs)

Introduction to statistics - application of statistics in biosciences with examples. Statistical data – various types of data: Primary data, secondary data, quantitative and qualitative data, collection and classification of data, frequency distribution. Diagrammatic representation of data – significance and utility, types of diagrams-bar diagrams, pie diagram, histograms, frequency polygon, frequency curve. Population and sampling techniques- significance and utility, random sampling, stratified sampling, systematic sampling, multistage sampling.

Module 2I: Descriptive statistics (8 hrs)

Measures of central tendency- introduction, definition, Advantages and limitations. Mean, median and mode - computation in grouped and ungrouped data. Comparison: Measures of dispersion- introduction, definition and objectives. Range, Mean deviation, standard deviation, standard error - computation in grouped and ungrouped data; comparison: Skewness and Kurtosis- definition, types, graphical representation with examples.

Module 3: Probability (9 hrs)

Probability - introduction, classical definition, theorems of probability - addition theorem and multiplication theorem, conditional probability. Applications. Standard probability distributions - introduction and applications. Binomial distribution - definition, assumption with respect to a biological example. Poisson distribution - definition, forms of poisson distribution, assumption with respect to a biological example. Normal distribution - definition, properties, standard normal curve, assumption with respect to a biological example.

Module 4: Inferential statistics (12 hrs)

Testing of hypothesis - Hypothesis - definition, hypothesis testing, procedure of hypothesis testing, errors in hypothesis testing – type I and type II errors, two tailed and one tailed test of hypothesis. Chi square test and estimation of linkages, student t-test and F test: Experimental designs – introduction, principles, replication and randomisation. CRD, RBD, Latin square design, factorial design: Interpolation and extrapolation - introduction, definitions, significance and utility, assumptions, graphic methods. Computer analysis of data – application of computer in statistical data

processing, statistical programmes, preparation of charts and graphs, formula application with respect to M Stat.

Module 5: Analysis of variants (8 hrs)

ANOVA - introduction, Assumptions, technique of analyzing variance, one way and two-way ANOVA followed by t-test: Multivariate analysis of variants and its application in biological sciences.

Module 6: Correlation and regression (7 hrs)

Correlation - introduction, definition and utility. Types of correlation, positive and negative correlation, scatter diagram and correlation graph, coefficient of correlation calculation. Regression - introduction, utility, regression coefficient, comparison of correlation and regression,

PRACTICAL (36 hrs)

1. Classify a given data using frequency distribution and represent it graphically.
2. Analyse a data for mean, median and mode.
3. Analyse a data for mean deviation, standard deviation and standard error
4. Application of addition and multiplication theorem of probability.
5. Test the significance of the given data using chi-square test, t test and f test.
6. Analyse a set of data for correlation and regression
7. Analyse a given data in CRD, RBD and LSD.
8. Analyse the given data using M stat.
9. Prepare graphs with the help of MS excel or M stat.

REFERENCES

1. Bernard Rosner, 2005. Fundamentals of Biostatistics. Duxbury Press.
2. Marcello Pagano, Kimberlee Gauvreau. 2000. Principles of Biostatistics. Duxbury Press
3. Panse, V.G. and Sukathme, P.V. 1995. Statistical methods for agricultural workers. ICAR, New Delhi.
4. Pranab Kumar Banerjee, 2004. Introduction to Biostatistics. S. Chand and company Limited.
5. Roland Ennos, 2006. Statistical and Data Handling Skills in Biology, 2nd Edition. Pearson Education.

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Semester VI Core course BT 10 Code: BOBT6CRT10

BIOINFORMATICS

(Theory 54 Hours; Practical 36 Hours; Credits 3 + 1)

Objectives:

- To acquire detailed information about ourselves and other species
- To understand the role of computer science in biological investigations.
- To access data and techniques through the World Wide Web and utilize them for analysis.
- To use computers with confidence and handle biological databases, information retrieval and make him/her able to extend these skills by self-directed 'field work' on the Web.
- To apply principles of bioinformatics in molecular biology, clinical medicine, pharmacology, biotechnology, agriculture, forensic science, anthropology and other disciplines
- To develop a sense of optimism that the data and methods of bioinformatics will create profound advances in our understanding of life, and improvements in the health of humans and other living things.

Module 1: An Introduction to bioinformatics (5 hrs)

Scope and relevance of bioinformatics: Genomics: Definition: Sequencing genes to sequencing genomes. Sequence assembly: Major findings of the following genome projects: Human, *Arabidopsis thaliana, Drosophila melanogaster, Caenorhabditis elegans*

Module 2: Biological Data bases (20 hrs)

Detailed study of the following Biological Data bases: Bibliographic databases Finding Scientific Articles PubMed: Genome sequence databases: Entrez Genome: TIGR database

Nucleic acid sequence databases: GenBank

Protein sequence databases: GenBank, SWISS-PROT: Protein structure database: Protein Data Bank.

Searching Biological databases: Saving search results: FASTA format: ASN.1 format: Batch Entrez: PDB flat file format: mmCIF format: DNA micro array data bases

Gene expression Omnibus, NCBI: Stanford microarray database: 2D gel electrophoresis data bases: ExPASy SWISS-2DPAGE: Danish Centre for Human Genome Research database

Module 3: Sequence alignment (15 hrs)

Sequence comparison: Pair wise sequence alignment: Global alignment: Use of ALIGN: Local alignment: Use of BLAST, FASTA: Multiple sequence alignment: Use of ClustalW: Phylogenetic analysis: Use of: PHYLIP: Data mining: Use of PERL in bioinformatics

Module 4: Molecular visualization tools (14 hrs)

Structure visualization: Molecular structure viewers: RasMol: SWISS-PDB Viewer: Predicting protein structure and function from sequence: Protein modeling, Docking and drug discovery

PRACTICAL (36 hrs)

1. Familiarize with the various databases given in the syllabus
2. Practice retrieving data from the various databases
3. Learn how to store the retrieved data
5. 4. Practice the use of BLAST

Familiarize with the use of RasMol

REFERENCES

1. Bioinformatics: A Machine Learning Approach. P Baldi and S Brunak. MIT Press
2. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins
3. Developing Bioinformatics Computer Skills. Cynthia Gibas and Per Jambeck. O'Reilly Genomes. TA Brown. Wiley-Liss.
4. Genomics: The Science and Technology Behind the Human Genome Project. CR Cantor and CL Smith. John Wiley and Sons.

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Semester VI **Programme elective course** **Theory 54 hours; Credit 3**

(Any one of the following)

1. Code: BO6PET01 AGRIBUSINESS

2. Code: BO6PET02 PLANT GENETIC RESOURCES MANAGEMENT

3. Code: BO6PET03 PHYTOCHEMISTRY AND PHARMACOGNOSY

(See model I syllabus)

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THE COCHIN COLLEGE, COCHIN-2
DEPARTMENT OF BOTANY
TIME TABLE

I, III AND V SEMESTERS **JUNE 2021- OCT 2021**

DAY	CLASS	I	II	III	IV	V
MON	I ZOO	CHEM	ENG	S	SL	ENG
	II ZOO	ENG	CHEM	SL	S ⟷ M (BOT)	
	I BOT	N ⟷	J(BIOC/BIOT)	A	ENG	SL
	II BOT	M	M	ENG	J	N
	III BOT	A⟷	S (PHY/RM)	G	A	A
TUE	I ZOO	ENG	S ⟷ G (BOT)		ENG	SL
	II ZOO	SL	ZOO	ZOO	CHEM	ENG
	I BOT	J	SL	ENG	G⟷A (BOT)	
	II BOT	ENG	N ⟷	J (BIOC/BIOT)	J	J
	III BOT	M	A	A	S	M
WED	I ZOO	ENG	CHEM	ENG	ZOO	ZOO
	II ZOO	ZOO	CHEM	SL	ENG	M
	I BOT	J	SL	ENG	N	J
	II BOT	N	J	J	J	ENG
	III BOT	S ⟷	M (ANA)	G	A ⟷	M (ENVT)
THU	I ZOO	G	ENG	SL	ENG	ZOO
	II ZOO	CHEM	CHEM	ENG	S	SL
	I BOT	SL	N ⟷	J(BIOC/BIOT)	ENG	N
	II BOT	N	G	ENG	M⟷	J(BOT/BIOT)
	III BOT	S	M	A	A	S
FRI	I ZOO	CHEM	CHEM	SL	ZOO	ENG
	II ZOO	ENG	ZOO	ZOO	S	SL
	I BOT	J	N	ENG	SL	G
	II BOT	ENG	M ⟷	J(BOT/BIOT)	N ⟷	J(BIOC/BIOT)
	III BOT	A ⟷	S (RM/PHY)	S/A(PHY/RM)	M	S

M-MINI P. MATHAI (BOTANY) **N-NAYANA JOSE C. (BIOCHEMISTRY)**

S-SUPRABHA G. NAIR (BOTANY) **J-JAYESH KURIAKOSE (BIOTECHNOLOGY)**

A-ARUN KUMAR G (BOTANY)

G-GUEST LECTURER (BOTANY)

M.Sc

MASTER OF SCIENCE

IN

CHEMISTRY

PROGRAM STRUCTURE AND SYLLABUS

2019-20 ADMISSION ONWARDS

(UNDER MAHATMA GANDHI UNIVERSITY PGCSS REGULATIONS 2019)

BOARD OF STUDIES IN CHEMISTRY (PG)

MAHATMA GANDHI UNIVERSITY

2019

PREFACE

I feel privileged in presenting the revised curriculum and syllabus of **CH01 M Sc CHEMISTRY PROGRAM** for favour of approval by the Faculty of Science and Academic Council of Mahatma Gandhi University, Kottayam, Kerala, India.

With effect from 2012-2013 academic year, the University has introduced the Credit& Semester System for all the PG programmes in affiliated colleges/institutions, as per Mahatma Gandhi University PG Program Regulations for Credit& Semester System 2011(MGU-CSS-PG). The University has decided to revise the syllabus and curriculum as per University Order No.7484/Ac.AIX/syllabus revision committee dated 22/02/2018 with effect from 2019 academic year.

Based on the guidelines of M.G.University for Credit&Semester System, the PG BoS prepared draft proposals for revised curricula and syllabi of all the five branches of M ScChemistry. With the active participation of resource persons and teacher representatives from all the colleges, a three-day workshop was conducted during 17-19 January 2019 at St.Thomas College, Palai for revising the existingcurriculaand syllabi. Finalisation of the proposal of the restructured curricula and syllabi was made by the BoS by incorporating many of the suggestions raised by the participants in the workshop.

With dedicated efforts, wholehearted support and involvement of all the members of the BoS, the task of preparing the curricula and syllabi and bringing it out in the present form was made possible. I sincerely express my whole-hearted gratitude to all the fellow members of the BoS for their endless help, cooperation and encouragement showered on me for the completion of this great task. I am also thankful to all Resource Persons and Teacher Representatives from Postgraduate Chemistry Departments of various colleges for their active participation and fruitful suggestions during the three-day workshop.

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Chairperson, PG Board of Studies in Chemistry

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TABLE OF CONTENTS

S No	Title	Page Nos
1	**General Information**	**05-08**
2	**Program Structure**	**09-10**
3	**Syllabus**	**11-80**
	Semester 1	**11-23**
	Semester 2	**24-41**
	Semester 3	**42-53**
	Semester 4	**54-80**
4	**Model Question Papers**	**81-111**

General Information

M.Sc Chemistry Degree Program

(Mahatma Gandhi University Regulations PGCSS2019 from 2019-20 Academic Year)

1.Aim of the Programme

Chemistry, being central to all other sciences, its study provides a fundamental insight into the changes taking place in and around our fascinating nature.No one can understand the modern world without the basic knowledge of Chemistry and its advanced study help us to have a thorough knowledge of the entire world.

Through lectures, laboratory work, exercises, project work, and its independent master's thesis, students will gain knowledge about relevant working methods for research, industry, administration, and education. The Master's degree program in Chemistry lays the foundation for doctoral programs in Chemistry.

2. Eligibility Criteria for admissions

Graduation in Chemistry/Petrochemicals with not less thanCCPA of 5.00 out of 10.00 in CoreGroup (Core + Complementary +Open Courses).

Relaxation in Marks in the qualifying examination:

1. For SC/ST category,a pass in the qualifying examination is the minimum requirementfor admission.
2. For OEC categoryCCPA of 4.5in the qualifying examination is required.

3. Medium of instruction

English

Assessment

The weightage for internal & external evaluation of theory/practical/ project/comprehensive viva-voce is 5 & 15 and the maximum Weighted Grade Point (WGP) is 25 & 75 respectively, (ratio 1:3)

Pattern of Questions

Sl.No.	Type of Questions	Weight	Number of questions to be answered
1.	Short Answer type questions	1	8 out of 10
2	Short essay/ problem solving type questions	2	6 out of 8
3.	Long Essay type questions	5	2 out of 4

Direct Grading System

Direct Grading System based on a 7–point scale is used to evaluate the performance (External and Internal Examination of students)

For all courses (theory & practical)/semester/overall programme Letter grades and GPA/SGPA/CGPA are given on the following scale:

Range	**Grade**	**Indicator**
4.50 to 5.00	A+	Outstanding
4.00 to 4.49	A	Excellent
3.50 to 3.99	B+	Very good
3.00 to 3.49	B	Good(Average)
2.50 to 2.99	C+	Fair
2.00 to 2.49	C	Marginal
up to 1.99	D	Deficient(Fail)

Minimum **C grade** is required for pass in a course.

Evaluation first stage - Both internal and external (to be done by the teacher)

Grade	**Grade Points**
A+	5
A	4
B	3
C	2
D	1
E	0

Weightage Distribution for External and Internal Examination

Theory-External

Maximum weight & Maximum Weighted Grade Point (WGP) for external evaluation is **30** and**150**respectively.

Theory-Internal (Components and Weightage)

	Components	**Weightage**
i.	Assignment	1
ii	Seminar	2
iii	Best Two Test papers	1 each (2)
	Total	**5**

Practical-External (Components and Weightage)

Components	**Weightage**
Written / Lab test	10
Record	2
Viva	3
Total	**15**

Practical-Internal (Components and Weightage)

Components	**Weightage**
Written/Lab test	3
Lab involvement	1
Viva	1
Total	**5**

Project- External (Components and Weightage)

Components	**Weightage**
Relevance of the topic and analysis	2
Project content and presentation	8
Project viva	5
Total	**15**

Project- Internal (Components and Weightage)

Components	Weightage
Relevance of the topic and analysis	1
Project content and presentation	3
Project viva	1
Total	**5**

Comprehensive viva-voce (External)-components and weightage

Components	Weightage
Course viva (all courses from first semester to fourth semester)	15
Total	**15**

Comprehensive viva (Internal) - Components and Weightage

Components	Weightage
Course viva (all courses from first semester to fourth semester)	5
Total	**5**

4. Faculty under which the Degree is awarded

Science

5. Note on compliance with the UGC minimum standards for the conduct and award of Post Graduate Degrees

Credit and Semester system is followed in this program. The program has 4 semesters with 18 weeks in each semester. In each week, there are 15 lecture hours and 10 laboratory hours. In each semester there are 270 lecture hours and180 practical hours; thus a total of 450 calendar hours in each semester which is in compliance with the minimum 390hours stipulated by the UGC.

PROGRAM STRUCTURE

	Code	Course	Hours / Week	Total Hours	Credit
Semester 1	CH 50 01 01	Organometallics and Nuclear Chemistry	4	72	4
	CH 50 01 02	Structural and Molecular Organic Chemistry	4	72	4
	CH 50 01 03	Quantum Chemistry and Group Theory	4	72	4
	CH 50 01 04	Thermodynamics, Kinetic Theory and Statistical Thermodynamics	3	54	4
	CH 50 02 05	Inorganic Chemistry Practical-1	3	54	Evaluation at the end of second semester
	CH 50 02 06	Organic Chemistry Practical-1	3	54	
	CH 50 02 07	Physical Chemistry Practical-1	4	72	
		Total	**25**	**450**	**16**
Semester 2	CH 50 02 01	Coordination Chemistry	4	72	4
	CH 50 02 02	Organic Reaction Mechanisms	4	72	4
	CH 50 0203	Chemical Bonding and Computational Chemistry	4	72	3
	CH 50 0204	Molecular Spectroscopy	3	54	3
	CH 50 0205	Inorganic Chemistry Practical-1	3	54	3
	CH 50 0206	Organic Chemistry Practical-1	3	54	3
	CH 50 0207	Physical Chemistry Practical-1	4	72	3
		Total	**25**	**450**	**23**
Semester 3	CH 50 03 01	Structural Inorganic Chemistry	4	72	4
	CH 50 03 02	Organic Syntheses	4	72	4
	CH 01 03 03	Chemical Kinetics, Surface Chemistry and Crystallography	4	72	4
	CH 50 03 04	Spectroscopic Methods in Chemistry	3	54	4
	CH 01 0405	Inorganic Chemistry Practical-2	3	54	Evaluation at the end of fourth semester
	CH 01 0406	Organic Chemistry Practical-2	3	54	
	CH 01 0407	Physical Chemistry Practical-2	4	72	

		Total	**25**	**450**	**16**
Semester 4		**Elective(Group A)**			
	CH 80 04 01	Advanced Inorganic Chemistry	5	90	4
	CH 80 04 02	Advanced Organic Chemistry	5	90	4
	CH 80 04 03	Advanced Physical Chemistry	5	90	4
		Elective(GroupB)			
	CH 81 04 01	Advances In Polymer Science And Technology	5	90	4
	CH 81 04 02	Analytical Chemistry	5	90	4
	CH 81 04 03	Medicinal Chemistry	5	90	4
	CH 01 0404	Project			2
	CH 01 0405	Inorganic Chemistry Practical-2	3	54	3
	CH 01 0406	Organic Chemistry Practical-2	3	54	3
	CH 01 0407	Physical Chemistry Practical-2	4	72	3
	CH 01 0408	Viva			2
		Total	**25**	**450**	**25**
GRAND TOTAL					**80**

SEMESTER 1

CH 50 01 01 ORGANOMETALLICS AND NUCLEAR CHEMISTRY

Credit: 4 **Contact Lecture Hours: 72**

Objective of the course

The learners should be able to apply and analyse themethods of synthesis and the mechanism of selected catalytic organic reactions from the structure-bonding aspects and reactivity of simple organometallic compounds, the functions of transition metal ions in biologicalsystems and the applications of radioactive isotopes in various fields

Unit 1: Organometallic Compounds-Synthesis, Structure and Bonding (18 Hrs)

1.1 Haptonomenclature of organometallic compounds,organometallic compounds with linear pi donor ligands-olefins, acetylenes, dienes and allyl complexes-synthesis, structure and bonding.

1.2 Synthesis and structure of complexes with cyclic pi donors,metallocenes and cyclic arene complexes,bonding in ferrocene and dibenzenechromium,carbene and carbyne complexes.

1.3 Metal carbonyls: CO as a π-bonding ligand, synergism, preparation, properties, structure and bonding of simple mono and binuclear metal carbonyls, metal nitrosyls, metal cyanides and dinitrogen complexes. Polynuclear metal carbonyls with and without bridging. Carbonyl clusters-LNCCS and HNCCS, Isoelectronic and isolobal analogy, Wade-Mingos rules, cluster valence electrons. IR spectral studies of bridging and non-bridging COligands.

Unit 2: Reactions of Organometallic Compounds (9 Hrs)

2.1 Substitution reactions:Nucleophilic ligand substitution, nucleophilic and electrophilic attack on coordinated ligands.

2.2 Addition and elimination reactions-1,2 additions to double bonds, carbonylation and decarbonylation. Oxidative addition- concerted addition, S_N2, radical and ionic mechanisms. Reductive elimination- binuclear reductive elimination and σ-bond metathesis.Oxidative coupling and reductive decoupling.Insertion (migration) and elimination reactions – insertions of CO and alkenes, insertion into M–H versus M–R, α, β, γ and δ eliminations.

2.3 Redistribution reactions, fluxional isomerism of allyl, cyclopentadienyl and allene systems.

Unit 3: Catalysis by Organometallic Compounds (18 Hrs)

3.1 Homogeneous and heterogeneous organometallic catalysis: Tolman catalytic loops, alkene hydrogenation using Wilkinson catalyst.

3.2 Reactions of carbon monoxide and hydrogen-the water gas shift reaction, the Fischer-Tropsch reaction (synthesis of gasoline).

3.3 Hydroformylation of olefins using cobalt and rhodium catalysts.

3.4 Polymerization by organometallic initiators and templates for chain propagation-Ziegler Natta catalysts,polymerisation by metallocene catalysts.

3.5 Carbonylation reactions: Monsanto acetic acid process, olefin hydroformylation- oxo process,carbonylation of alkenes and alkynes in the presence of a nucleophile- the Reppe reaction. Carbonylation of aryl halides in the presence of a nucleophile.

3.6 Olefin methathesis-synthesis gas based reactions, photodehydrogenation catalyst ("Platinum Pop").

3.7 Oxidation of olefins: Palladium catalysed oxidation of ethylene-the Wacker process,epoxidation of olefins, hydroxylation by metal-oxo complexes

3.8 Asymmetric catalysis- Asymmetric hydrogenation, isomerisation and epoxidation.

3.9 C-H activation and functionalization of alkanes and arenes: Radicaltype oxidation, hydroxylation, dehydrogenation, carbonylation and regioselective borylation of alkanes and cycloalkanes. Radicaltype reactions, electrophilic reactions, carbonylation and borylation of arenes.Insertion of alkenes and alkynes in the Ar-H bond.

3.10 Application of palladium catalysts in the formation of C-O and C-N bonds,oxidative coupling reactions of alkynes with other unsaturated fragments for the formation of cyclic and heterocylic compounds. The Dötz reaction.

Unit 4: Bioinorganic Compounds (18 Hrs)

4.1 Essential and trace elements in biological systems, toxic effects of metals (Cd, Hg, Cr,Pband As), structure and functions of biological membranes, mechanism of ion transport across membranes, sodium pump, ionophores, valinomycin. Phosphate esters in biology, Redox metalloenzymes, cytochromes-cytochrome P450.

4.2 Oxygen carriers and oxygen transport proteins:Structure and functions of haemoglobins and myoglobin,oxygen transport mechanism, cooperativity, Bohreffect. Structure and functions of haemerythrinsand haemocyanin.

4.3 Biochemistry of zinc and copper:Structure and functions of carbonic anhydrase, carboxypeptidase A and superoxide dismutase.

4.4 Other important metal containing biomolecules:Vitamin B_{12} and the vitamin B_{12} coenzymes, photosynthesis-chlorophyll a, PS I and PS II.

4.5 Role of calcium in muscle contraction, blood clotting mechanism and biological calcification. Metals in medicine-therapeutic applications of cis-platin, radioisotopes and MRI agents.

Unit 5: Nuclear Chemistry (9 Hrs)

5.1 Nuclear Reactions:Q value and reaction threshold, reaction cross section, cross section and reaction rate, neutron capture cross section- variation of neutron capture cross section with energy (1/V law). Nuclear fission - fission fragments and mass distribution, fission yields, fission energy, fission cross section and threshold fission neutrons, nuclear fusion reactions and their applications.

5.2 Principles of counting technique:G.M. counter, proportional, ionization and scintillation counters,cloud chamber.

5.3 Synthesis of transuranic elements: Neptunium, Plutonium, Curium, Berkelium, Einsteinium, Mendelevium, Nobelium, Lawrencium

5.4 Analytical applications of radioisotopes-radiometric titrations, kinetics of exchange reactions, measurement of physical constants including diffusion constants, Radioanalysis, Neutron Activation Analysis, Prompt Gama Neutron Activation Analysis and Neutron Absorptiometry.

5.5 Radiation chemistry of water and aqueous solutions. Measurement of radiation doses.Relevance of radiation chemistry in biology, organic compounds and radiation polymerization.

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CH 50 01 02 STRUCTURAL AND MOLECULAR ORGANIC CHEMISTRY

Credit: 4 **Contact Lecture Hours: 72**

Objectives of the Course

To learn and apply the fundamental conceptsand mechanisms of organicand photochemical reactions, stereochemistry and conformational analysis of organic compounds

Unit 1: Basic Concepts in Organic Chemistry (18 Hrs)

1.1 Review of basic concepts in organic chemistry: Bonding, hybridisation, MO picture of butadiene and allyl systems.

1.2 Electron displacement effects: Inductive effect, electromeric effect, resonance effect, hyperconjugation, steric effect. Bonding weaker than covalent bonds.

1.3 Concept of aromaticity: Delocalization of electrons - Hückel's rule, criteria for aromaticity, examples of neutral and charged aromatic systems - annulenes. NMR as a tool ,carbon nanotubes and graphene

1.4 Mechanism of electrophilic and nucleophilic aromatic substitution reactions with examples. Arenium ion intermediates. SN1, SNAr, SRN1 and benzyne mechanisms.

Unit 2: Physical Organic Chemistry (9Hrs)

2.1 Energy profiles. Kinetic versus thermodynamic control of product formation, Hammond postulate, kinetic isotope effects with examples. Linear free energy relationships-Hammet equation, Taft equation.

2.2 Catalysis by acids,bases and nucleophiles with examples from acetal, cyanohydrin .Ester formation and hydrolysis reactions of esters-AAC2, AAC1, AAL1, BAC2and BAL1 mechanisms. Hard and soft acids, bases - HSAB principle and its applications (organic reactions only)

Unit 3: Organic Photochemistry (9hrs)

3.1 Photoreactions of carbonyl compounds: Norrish reactions of ketones. Patterno-Buchi reaction.Barton (nitrite ester reaction); Di-π-methane and Photo Fries rearrangements, photochemistry of conjugated dienes (butadiene only), photochemistry of vision.

Unit 4: Stereochemistry of Organic Compounds (18Hrs)

4.1 Stereoisomerism: Definition based on symmetry and energy criteria, configuration and conformational stereoisomers,introduction to Akampptisomerism(basic idea only)

4.2 Center of chirality: Molecules with C, N, S based chiral centers,absolute configuration, enantiomers, racemic modifications, R and S nomenclature using Cahn-Ingold-Prelog rules,molecules with a chiral center and Cn, molecules with more than one center of chirality,definition of diastereoisomers, constitutionally symmetrical and unsymmetrical chiral molecules, erythro and threo nomenclature.

4.3 Axial, planar and helical chirality with examples,stereochemistry and absolute configuration of allenes, biphenyls and binaphthyls, ansa and cyclophanic compounds, spiranes, exo-cyclic alkylidenecycloalkanes.

4.4 Topicity and prostereoisomerism, topicity of ligands and faces as well as their nomenclature, NMR distinction of enantiotopic/diastereotopic ligands.

4.5 Geometrical isomerism: nomenclature, E-Z notation, methods of determination of geometrical isomers,interconversion of geometrical isomers.

Unit 5: Conformational Analysis (18 Hrs)

5.1 Conformational descriptors :Factors affecting conformational stability of molecules,conformational analysis of substituted ethanes, cyclohexane and its derivatives, decalins, adamantane, norbornane,sucrose and lactose.

5.2 Conformation and reactivity of elimination (dehalogenation, dehydrohalogenation, semipinacolic deamination and pyrolytic elimination - Saytzeff and Hofmann eliminations), substitution and oxidation of 2^{o} alcohols.

5.3 Chemical consequence of conformational equilibrium - Curtin Hammett principle.

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CH 50 01 03 QUANTUM CHEMISTRY AND GROUP THEORY

Credit: 4 **Contact Lecture Hours: 72**

Objective of the course

Revise and update the fundamental ideas,mathematical concepts,applications of Group theory and quantum mechanics to molecular systems.The learners should be able to categorise common molecules into various point groups and apply the great orthogonality theorem to derive the character tables of various point groups.

Unit 1 Group Theory and Applications in Chemical Bonding (36 Hrs)

1.1. Symmetry elements and symmetry operations.

1.2. Determination of point groups of molecules and ions (organic / inorganic / complex) belonging to C_n, C_s, C_i, C_{nv}, C_{nh}, $C_{\infty v}$, D_{nh}, $D_{\infty h}$, D_{nd}, T_d and O_h point groups.

1.3. Symmetry in crystals:32 crystallographic point groups (no derivation), Hermann-Mauguin symbols.Screw axis-pitch and fold of screw axis, glide planes,space groups(elementary idea only)

1.4. Mathematical groups :Properties, Abelian groups, cyclic groups, sub groups, similarity transformation ,classes - C_{2v}, C_{3v} and C_{2h}.

1.5. Group multiplication tables (GMTs) - C_{2v}, C_{3v} and C_{2h}, isomorphic groups.

1.6. Matrix representation of elements like E,Cn,Sn,I, σ-matrix representation of point groups like C_{2v},C_{3v},C_{2h},C_{4v} - trace /character,block factored matrices.

1.7. Reducible and irreducible representations, standard reduction formula, statement of great orthogonality theorem (GOT). ,construction of character tables for C_{2v}, C_{2h}, C_{3v} and C_{4v}.

1.8. Application in chemical bonding:Projection operator,transformation properties of atomic orbitals,construction of symmetry adapted linear combination of atomic orbitals (SALCs) of C_{2v}, C_{3v},D_{3h} and C_{2h} molecules.

Unit 2 Quantum Mechanics and Applications (36Hrs)

2.1. Experimental foundation of quantum mechanics: Elementary ideas of black body radiation, photoelectric effect and atomic spectra. Need of quantum mechanics. Concept of matter wave, de Broglie relation,uncertainty principle and its consequences.

2.2. Postulates of Quantum Mechanics: State function or wave function postulate: Born interpretation of the wave function, well behaved functions, orthonormality of wave functions.Operator postulate: Operator algebra, linear and nonlinear operators, Laplacian operator, commuting and noncommuting operators, Hermitian operators

and their properties, eigen functions and eigen values of an operator.Eigen value postulate: eigen value equation, eigen functions of commuting operators.Expectation value postulate. Postulate of time-dependent Schrödinger equation, conservative systems and time-independent Schrödinger equation.

2.3. Translational motion: Free particle in one-dimension, particle in a one dimensional box with infinite potential walls, particle in a one-dimensional box with finite potential walls-tunneling, particle in a three dimensional box ,separation of variables, degeneracy.

2.4. Vibrational motion: One-dimensional harmonic oscillator (complete treatment), Hermiteequation(solving by method of power series), Hermite polynomials, recursion relation, wave functions and energies-important features, harmonic oscillator model and molecular vibrations.

2.5. Rotational motion: Co-ordinate systems, cartesian, cylindrical polar and spherical polar coordinates and their relationships. The wave equation in spherical polar coordinates-particle on a ring, the phi equation and its solution, wave functions in the real form. Non-planar rigid rotor (or particle on a sphere),separation of variables, the phi and the theta equations and their solutions, Legendre and associated Legendre equations, Legendre and associated Legendre polynomials. Spherical harmonics (imaginary and real forms),polar diagrams of spherical harmonics.

2.6. Quantization of angular momentum, quantum mechanical operators corresponding to angular momenta (Lx, Ly, Lz and L^2),commutation relations between these operators. Spherical harmonics as eigen functions of angular momentum operators Lz and L^2. Ladder operator method for angular momentum, space quantization.

2.7. Quantum Mechanics of Hydrogen-like Atoms:Potential energy of hydrogen-like systems. The wave equation in spherical polar coordinates: separation of variables-r, theta and phi equations and their solutions, wave functions and energies of hydrogen-like atoms. Orbitals:Radial functions, radial distribution functions, angular functions and their plots. Dirac's relativistic equation for hydrogen atom (Elementary idea only).

2.8. Spin orbitals:Construction of spin orbitals from orbitals and spin functions,spin orbitals for many electron atoms, symmetric and antisymmetric wave functions. Pauli's exclusion principle,slater determinants.

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CH 50 01 04THERMODYNAMICS, KINETIC THEORY AND STATISTICALTHERMODYNAMICS

Credit: 4 **Contact Lecture Hours: 54**

Objective of the course

The learners should be able to apply principles and laws of equilibrium thermodynamics to multicomponent systems, to calculate thermodynamic properties of ideal gasesand real gasesusing the principlesand techniquesof statistical thermodynamics**.** They should be familiar with the properties and theories of gases.

Unit 1:Classical Thermodynamics (18 Hrs)

1.1 Mathematical foundations for thermodynamics-variables of thermodynamics, extensive and intensive quantities, equation for total differential, conversion formulas, exact differentials-general formulation, reciprocity characteristics, homogeneous functions, Euler's theorem.(Non-evaluative)

1.2 Thermodynamic equations of state. Maxwell relations and significance, irreversible processes - Clausius inequality.

1.3 Free energy, thermodynamic equilibria and free energy functions, temperature dependence of free energy - Gibbs Helmholtz equation, applications of Gibbs Helmholtz equation.

1.4 Partial molar quantities, chemical potential and Gibbs-Duhem equations, variation of chemical potential with temperature and pressure, determination of partial molar volume and enthalpy.

1.5 Fugacity, relation between fugacity and pressure, determination of fugacity of a real gas, variation of fugacity with temperature and pressure. Activity, dependence of activity on temperature and pressure.

1.6 Thermodynamics of mixing, Gibbs-Duhem-Margules equation, applications of Gibbs-Duhem- Margules equation- Konovalov's first and second laws, excess thermodynamic functions-free energy, enthalpy, entropy and volume, determination of excess enthalpy and volume.

1.7 Chemical affinity and thermodynamic functions, effect of temperature and pressure on chemical equilibrium- Vant Hoff reaction isochore and isotherm.

1.8 Third law of thermodynamics, Nernst heat theorem, determination of absolute entropies using third law.

1.9 Three component systems-graphical representation. Solid-liquid equilibria, ternary solutions with common ions, hydrate formation, compound formation. Liquid-liquid

equilibria-one pair of partially miscible liquids, two pairs of partially miscible liquids, three pairs of partially miscible liquids.

Unit 2: Kinetic Theory of Gases (9 Hrs)

2.1 Derivation of Maxwell's law of distribution of velocities, graphical representation, experimental verification of the law, most probable velocity, derivation of average, RMS and most probable velocities, collision diameter, collision frequency in a single gas and in a mixture of two gases, mean free path, frequency of collision, effusion, the rate of effusion, time dependence of pressure of an effusing gas, the law of corresponding states, transport properties of gases.

Unit 3: Statistical Thermodynamics (27Hrs)

3.1 Brief history about the macroscopic and microscopic approach in science, permutation, probability, Stirling's approximation, macrostates and microstates, equal-apriori principle and thermodynamic probability, phase-space, ensemble, types of ensembles.

3.2 Boltzmann distribution law, partition function and its physical significance, relation between molecular partition function and molar partition function, distinguishable and indistinguishable particles, partition function and thermodynamic functions, separation of partition function-translational, rotational, vibrational, and electronic partition functions, partition function for hydrogen.Thermal de-Broglie wavelength

3.3 Calculation of thermodynamic functions and equilibrium constants, thermodynamic probability and entropy, Sakur-Tetrode equation, statistical formulation of third law of thermodynamics, residual entropy, heat capacity of gases - classical and quantum theories.

3.4 Need for quantum statistics, Bosons and Fermions, Bose-Einstein statistics:, Bose-Einstein distribution law, Bose-Einstein condensation, first order and higher order phase transitions, liquid helium, Fermi- Dirac statistics:, Fermi- Dirac distribution law, application in electron gas, thermionic emission. Comparison of three statistics.

3.5 Heat capacity of solids- the vibrational properties of solids, Einstein's theory and its limitations, Debye theory and its limitations.

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SEMESTER 2

CH 50 02 01COORDINATION CHEMISTRY

Credit: 4 **Contact Lecture Hours: 72**

Objective of the course

The student shall acquire a foundation of chemistry of sufficient breadth and depth of co-ordination compounds which enable them to understand and apply their knowledge

Unit 1: Structural Aspects and Bonding (18 Hrs)

1.1 Classification of complexes based on coordination numbers and possible geometries,sigma and pi bonding ligands such as CO, NO, CN^-, R_3P, and Ar_3P. Stability of complexes, thermodynamic aspects of complex formation-Irving William order of stability, chelate effect.

1.2 Splitting of d orbitals in octahedral, tetrahedral, square planar, square pyramidal and triagonal bipyramidal fields, LFSE, Dq values, Jahn Teller (JT) effect, theoretical failure of crystal field theory, evidence of covalency in the metal-ligand bond, nephelauxetic effect, ligand field theory, molecular orbital theory- M.O energy level diagrams for octahedral and tetrahedral complexes without and with π-bonding, experimental evidences for pi-bonding.

Unit 2: Spectral and Magnetic Properties of Metal Complexes (18 Hrs)

2.1 Electronic Spectra of complexes:Term symbols of d^n system, Racah parameters, splitting of terms in weak and strong octahedral and tetrahedral fields,correlation diagrams for d^1 and d^9 ions in octahedral and tetrahedral fields (qualitative approach), d-d transitions, selection rules for electronic transitions-effect of spin orbit coupling and vibronic coupling.

2.2 Interpretation of electronic spectra of complexes:Orgel diagrams and demerits, TanabeSugano diagrams, calculation of Dq, B and β (Nephelauxetic ratio) values, spectra of complexes with lower symmetries, charge transfer spectra, luminescence spectra.

2.3 Magnetic properties of complexes-paramagnetic and diamagnetic complexes, molar susceptibility, Gouy method for the determination of magnetic moment of complexes, spin only magnetic moment. Temperature dependence of magnetism- Curie's law, Curie-Weiss law,temperature independent paramagnetism (TIP), spin state cross over, antiferromagnetism-inter and intra molecular interaction,anomalous magnetic moments.

Unit 3: Kinetics and Mechanism of Reactions in Metal Complexes (18 Hrs)

3.1 Thermodynamic and kinetic stability, kinetics and mechanism of nucleophilic substitution reactions in square planar complexes- trans effect-theory and applications, effect of entering ligand, effect of leaving group and effect of ligands already present on reaction rate, effect of solvent and reaction pathways,substitution in tetrahedral and five-coordinate complexes.

3.2 Kinetics and mechanism of octahedral substitution- water exchange, dissociative and associative mechanisms, base hydrolysis, racemization reactions, solvolytic reactions (acidic and basic). Replacement reactions involving multidendate ligands- formation of chelates, effect of H^+ on the rates of substitution of chelate complexes, metal ion assisted and ligand assisted dechelation.

3.3 Electron transfer reactions: Outer sphere mechanism-Marcus theory, inner sphere mechanism-Taube mechanism,mixed outer and inner sphere reactions,two electron transfer and intramolecular electron transfer.

Unit 4: Stereochemistry of Coordination Compounds (9 Hrs)

4.1 Geometrical and optical isomerism in octahedral complexes, resolution of optically active complexes, determination of absolute configuration of complexes by ORD and circular dichroism, stereoselectivity and conformation of chelate rings, asymmetric synthesis catalyzed by coordination compounds,

4.2 Linkage isomerism: Electronic and steric factors affecting linkage isomerism, symbiosis-hard and soft ligands, Prussian blue and related structures, Macrocycles-crown ethers.

Unit 5: Coordination Chemistry of Lanthanoids and Actinoids (9 Hrs)

5.1 Term symbols for lanthanide ions, inorganic compounds and coordination complexes of the lanthanoids upto coordination No.12, electronic spectra and magnetic properties of lanthanoid complexes,organometallic complexes of the lanthanoids- σ-bonded complexes, cyclopentadienyl complexes, organolanthanoid complexes as catalysts.

5.2 General characteristics of actinoids-difference between 4f and 5f orbitals, coordination complexes of the actinoids- sandwich complexes, coordination complexes and organometallic compounds of thorium and uranium,comparative account of coordination chemistry of lanthanoids and actinoids with special reference to electronic spectra and magnetic properties.

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1. F.A. Cotton, G. Wilkinson, Advanced Inorganic Chemistry: A Comprehensive Text, 3rdEdn., Interscience,1972.

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CH 50 02 02 ORGANIC REACTION MECHANISMS

Credit: 4 **Contact Lecture Hours: 72**

Objective of the course

To learn and understand the involvement of reactive intermediates, their structure and reactivity through various organic reactions, the orbital interactions (Woodward Hoffmann rules) in concerted reactions and apply knowledge for solving problems.

Unit 1: Review of Organic Reaction Mechanisms (9 Hrs)

1.1 Review of organic reaction mechanisms with special reference to nucleophilic and electrophilic substitution at aliphatic carbon (SN_1, SN_2, SN_i, SE_1, SE_2), elimination (E_1 and E_2) and addition reactions (regioselectivity: Markovnikov's addition-carbocation mechanism, anti-Markovnikov's addition-radical mechanism). Elimination vs substitution.

1.2 A comprehensive study on the effect of substrate, reagent, leaving group, solvent and neighbouring group on nucleophilic substitution(SN_2 and SN_1) and elimination (E_1 and E_2) reactions.

Unit 2: Chemistry of Carbanions (9 Hrs)

2.1 Formation, structure and stability of carbanions; Reactions of carbanions: C-X bond (X = C, O, N) formations through the intermediary of carbanions. Chemistry of enolates and enamines.Kinetic and Thermodynamic enolates- lithium and boron enolates in aldol and Michael reactions, alkylation and acylation of enolates.

2.2 Nucleophilic additions to carbonyls groups: Name reactions under carbanion chemistry-mechanism of Claisen, Dieckmann, Knoevenagel, Stobbe, Darzen and acyloin condensations, Shapiro reaction and Julia elimination. Favorski rearrangement.

2.3 Ylids: chemistry of phosphorous and sulphurylids - Wittig and related reactions, Peterson olefination.

Unit 3: Chemistry of Carbocations (9 Hrs)

3.1 Formation, structure and stability of carbocations. Classical and non-classical carbocations.

3.2 C-X bond (X = C, O, N) formations through the intermediary of carbocations. Molecular rearrangements including Wagner-Meerwein, Pinacol-pinacolone, Semi-pinacol, Dienone-phenol and Benzilic acid rearrangements, Noyori annulation, Prins reaction.

3.3 C-C bond formation involving carbocations: Oxymercuration, Halolactonisation.

Unit 4: Carbenes, Carbenoids, Nitrenes and Arynes (9 Hrs)

4.1 Structure of carbenes (singlet and triplet), generation of carbenes, addition and insertion reactions.

4.2 Reactions of carbenes such as Wolff rearrangement, Reimer-Tiemannreaction. Reactions of ylides by carbenoid decomposition

4.3 Structure, generation and reactions of nitrene and related electron deficient nitrene intermediates.

4.4 Hoffmann, Curtius, Lossen, Schmidt and Beckmann rearrangement reactions.

4.5 Arynes: Generation, structure, stability and reactions. Orientation effect - amination of haloarenes.

Unit 5: Radical Reactions (9 Hrs)

5.1 Generation of radical intermediates and its (a) addition to alkenes, alkynes (inter and intramolecular) for C-C bond formation - Baldwin's rules (b) fragmentation and rearrangements - Hydroperoxide: formation, rearrangement and reactions. Autooxidation.

5.2 Name reactions involving radical intermediates: Barton deoxygenation and decarboxylation, McMurry coupling.

Unit 6: Chemistry of Carbonyl Compounds (9 Hrs)

6.1 Reactions of carbonyl compounds: Oxidation, reduction (Clemmensen and Wolf-Kishner), addition (addition of cyanide, ammonia, alcohol) reactions, Aldol condensation, Cannizzaro reaction, Addition of Grignard reagent. Structure and reactions of α, β- unsaturated carbonyl compounds involving electrophilic and nucleophilic addition - Michael addition, Mannich reaction, Robinson annulation.

Unit 7: Concerted Reactions (18 Hrs)

7.1 Classification :Electrocyclic, sigmatropic, cycloaddition, chelotropic,ene and dyotropic reactions. Woodward Hoffmann rules - Frontier orbital and orbital symmetry correlation approaches - PMO method (for electrocyclic and cycloaddition reactions only).

7.2 Highlighting pericyclic reactions in organic synthesis such as Claisen, Cope, Wittig, Mislow-Evans and Sommelet-Hauser rearrangements. Diels-Alder and Ene reactions (with stereochemical aspects), dipolar cycloaddition (introductory).

7.3 Unimolecular pyrolytic elimnination reactions: Cheletropic elimination, decomposition of cyclic azo compounds, β-eliminations involving cyclic transition states such as N-oxides (Cope reaction), Acetates and Xanthates (Chugaeve reaction).

7.4 Problems based on the above topics

References

1. R. Bruckner, Advanced Organic Chemistry: Reaction Mechanism, Academic Press, 2002.
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CH 50 02 03 CHEMICAL BONDING AND COMPUTATIONAL CHEMISTRY

Credit: 3 **Contact Lecture Hours: 72**

Ojective of the course

The learners should be able to apply, analyze and evaluate group theoretical concepts in spectroscopy, extent the ideas of quantum mechanics from one electron system to many electron systems and various theories of chemical bonding.

Unit 1: Application of Group Theory in Spectroscopy (18hrs)

1.1. Vibrational mode analysis using group theory taking H_2O,NH_3 and trans-N_2F_2 as examples using symmetry coordinates and internal coordinates method,prediction of IR and Raman activity,-rule of mutual exclusion,-redundant modes , out of plane modes.

1.2. Application in uv-visible spectroscopy,selection rules,orbital selection rules,transitions between non-degenerate states,prediction of electronic transitions in C_{2v},C_{3v},C_{4v},C_{2h} and C_{4h} using direct product terms , spin selection rules, relaxation in selection rules and distortion .

1.3. Application in hybridization,determination of hybridization and hybrid functions in CH_4,BF_3 and PCl_5

1.4. Group theory and optical activity (brief study)

Unit 2 : Approximation Methods in Quantum Mechanics (18 Hrs)

2.1 Many-body problem and the need of approximation methods, independent particlemodel. Variation method:Variation theorem with proof, illustration of variationtheorem using the trial function x(a-x) for particle in a 1D-box and using the trial function $e^{-\alpha r}$ for the hydrogen atom, variation treatment for the ground state ofhelium atom.

2.2 Perturbation method, time-independent perturbation method (non-degenerate case only), first order correction to energy and wave function, illustration by application to particle in a 1D-box with slanted bottom, perturbation treatment of the ground state of the helium atom. Qualitative idea of Hellmann-Feynman theorem.

2.3 Hartree-Fock method,multi-electron atoms. Hartree-Fock equations (no derivation). The Fock operator, core hamiltonian, coulomb operator and exchange operator.Qualitative treatment of Hartree-Fock Self-Consistent Field (HFSCF) method. Roothan's concept of basis functions, Slater type orbitals (STO) and Gaussian type orbitals (GTO), sketches of STO and GTO.

Unit 3: Chemical Bonding **(18 Hrs)**

3.1 Schrödinger equation for molecules. Born-Oppenheimer approximation,valencebond (VB) theory, VB theory of H_2 molecule, singlet and triplet state functions (spin orbitals) of H_2.

3.2 Molecular Orbital (MO) theory, MO theory of H_2^+ ion, MO theory of H_2 molecule, MO treatment of homonuclear diatomic molecules Li_2, Be_2, N_2, O_2 and F_2 and hetero nuclear diatomic molecules LiH, CO, NO and HF,bond order. Correlation diagrams, non-crossing rule,spectroscopic term symbols for diatomic molecules,comparison of MO and VB theories.

3.3 Hybridization, quantum mechanical treatment of sp, sp^2 and sp^3 hybridisation. Semiempirical MO treatment of planar conjugated molecules, Hückel Molecular Orbital (HMO) theory of ethene, allyl systems, butadiene and benzene.Calculation of charge distributions, bond orders and free valency.

Unit 4: Computational Quantum Chemistry **(18 Hrs)**

4.1 Introduction and scope of computational chemistry,potential energy surface,conformational search,global minimum, local minima, saddle points.

4.2 Ab initio methods: A review of Hartee-Fock method,selfconsistentfield (SCF) procedure. Roothan concept basis functions.Basis sets and its classification:Slater type and Gaussian type basis sets, minimal basis set, Pople style basis sets .Hartree-Fock limit. Post Hartree-Fock methods - introduction to Møller Plesset perturbation theory, configuration interaction, coupled cluster and semi empirical methods.

4.3 Introduction to Density Functional Theory (DFT) methods: Hohenberg-Kohn theorems,Kohn-Sham orbitals,exchange correlation functional,local density approximation,generalized gradient approximation,hybrid functionals (only the basic principles and terms need to be introduced).

4.4 Comparison of ab initio, semi empirical and DFT methods.

4.5 Molecular geometry input:Cartesian coordinates and internal coordinates, Z matrix, Z-matrix of single atom, diatomic molecule, non-linear triatomic molecule, linear triatomic molecule, polyatomic molecules like ammonia, methane and ethane. General format of GAMESS / Firefly input file , single point energy calculation, geometry optimization, constrained optimization and frequency calculation. Koopmans' theorem.

4.6 Features of molecular mechanics force field-bond stretching, angle bending, torsional terms, non-bonded interactions and electrostatic interactions. Commonly used force fields- AMBER and CHARMM.

References

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20. C.J. Cramer, Essentials of Computational Chemistry: Theories and Models, 2nd Edn., John Wiley & Sons, 2004.
21. D.C. Young, Computational Chemistry: A Practical Guide for Applying Techniques to RealWorld Problems, John Wiley & Sons, 2001.

Softwares

A) Molecular Mechanics:

Arguslab, Tinker, NAMD, DL-POLY, CHARMM, AMBER

B) Ab initio, semiempirical and dft:

1.Firefly / PC GAMESS available from http://classic.chem.msu.su/gran/gamess/

2.WINGAMESS available from http://www.msg.ameslab.gov/gamess/

C) Graphical User Interface (GUI):

1. Gabedit available from http://gabedit.sourceforge.net/

2.wxMacMolPlt available from http://www.scl.ameslab.gov/MacMolPlt

CH 50 02 04 MOLECULAR SPECTROSCOPY

Credit: 3 **Contact Lecture Hours: 54**

Objective of the course

To learn basic principles and theory of microwave, NMR, IR,Raman, UV-Visspectroscopy.

Unit 1: Foundations of Spectroscopic Techniques (3 Hrs)

Regions of the electromagnetic radiation, origin of spectrum, intensity of absorption, signal to noise ratio, natural line width. Doppler broadening, Lamb dip spectrum, Born Oppenheimer approximation.

Unit 2: Microwave Spectroscopy (6 Hrs)

2.1 Principal moments of inertia and classification (linear, symmetric tops, spherical tops and asymmetric tops), selection rules, intensity of rotational lines, relative population of energy levels, derivation of J_{max}, effect of isotopic substitution, calculation of intermolecular distance, spectrum of non rigid rotors.

2.2 Rotational spectra of polyatomic molecules, linear and symmetric top molecules. Stark effect and its application, nuclear spin and electron spin interaction, chemical analysis by microwave spectroscopy.

Unit 3: Infrared and Raman Spectroscopy (9 Hrs)

3.1 Morse potential energy diagram,fundamental vibrations, overtones and hot bands, determination of force constants, diatomic vibrating rotator, break down of the Born-Oppenheimer approximation, effect of nuclear spin.

3.2 Vibrational spectra of polyatomic molecules, normal modes of vibrations, combination and difference bands, Fermi resonance. FT technique, introduction to FTIR spectroscopy. Instrumentation of FTIR

3.3 Scattering of light, polarizability and classical theory of Raman spectrum, rotational and vibrational Raman spectrum, complementarities of Raman and IR spectra, mutual exclusion principle, polarized and depolarized Raman lines, resonance Raman scattering and resonance fluorescence.

Unit 4: Electronic Spectroscopy (9 Hrs)

4.1 Term symbols of diatomic molecules, electronic spectra of diatomic molecules, selection rules, vibrational coarse structure and rotational fine structure of electronic spectrum. Franck-Condon principle, predissociation, calculation of heat of dissociation, Birge and Sponer method.

4.2 Electronic spectra of polyatomic molecules, spectra of transitions localized in a bond or group, free electron model. Different types of lasers-solid state lasers, continuous wave lasers, gas lasers and chemical laser, frequency doubling, applications of lasers.

Unit 5: Nuclear Magnetic Resonance Spectroscopy (18 Hrs)

5.1 Theory of NMR Spectroscopy: Interaction between nuclear spin and applied magnetic field, important magnetically active nuclei. Nuclear energy levels, population of energy levels, Larmor precession, relaxation methods. Chemical shift and its representation- δ scale of PMR and CMR. Spin-spin coupling: Theory and illustration with AX system.

5.2 Fourier Transformation (FT) NMR Spectroscopy: Instrumentation of NMR technique, magnets, probe and probe tuning, Creating NMR signals, effect of pulses, rotating frame reference, FID, FT technique, data acquisition and storage.Pulse sequences-Pulse width, spins and magnetisation vector.

5.3 Solid state NMR-Applications. Magic Angle Spinning(MAS).

Unit 6: Other Magnetic Resonance Techniques (9 Hrs)

6.1 EPR Spectroscopy: Electron spin in molecules, interaction with magnetic field, g factor, factors affecting g values, determination of g values ($g_{||}$ and $g_{\perp}$), fine structure and hyperfine structure, Kramers' degeneracy, McConnell equation.

6.2 Theory and important applications of NQR Spectroscopy.

6.3 Mossbauer Spectroscopy: Principle, Doppler effect, recording of spectrum, chemical shift, factors determining chemical shift, application to metal complexes.

References

1. C.N. Banwell, E.M. McCash, Fundamentals of Molecular Spectroscopy, 4thEdn., Tata McGraw Hill, 1994.
2. G. Aruldhas, Molecular Structure and Spectroscopy, Prentice Hall of India, 2001.
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SEMESTERS 1 AND 2

CH 50 02 05 INORGANIC CHEMISTRY PRACTICAL-1

Credit: 3 **Contact Lab Hours: 54+54=108**

Objective of the Course

The learners should be able to apply the principles of qualitative and quantitative analytical techniques in inorganic chemistry for identification of ions and preparation and characterization of inorganic complexes

PART I

Separation and identification of a mixture of four cations (a mixture of two familiar ions such as Ag^{+} , Hg^{2+}, Pb^{2+}, Cu^{2+}, Bi^{2+}, Cd^{2+}, As^{3+}, $Sn^{2+,}$ Sb^{3+}, Fe^{2+}, Fe^{3+}, Al^{3+}, Cr^{3+}, Zn^{2+} , Mn^{2+}, Co2+, Ni^{2+}, Ca^{2+}, Sr^{2+}, Ba^{2+}, Mg^{2+}, Li^{+} , Na^{+} , K^{+} and $NH4^{+}$ and two less familiar metal ions such as Tl, W, Se, Mo, Ce, Th, Ti, Zr, V, U and Li). Anions which need elimination not to be given.Minimum eight mixtures to be given.

PART II

Colorimetric estimation of Fe, Cu, Ni, Mn, Cr, NH4+, nitrate and phosphate ions.

PART III

Preparation and characterization complexes using IR, NMR and electronic spectra.

(a) Tris (thiourea)copper(I) complex

(b) Potassium tris (oxalate) aluminate (III).

(c) Hexammine cobalt (III) chloride.

(d) Tetrammine copper (II) sulphate.

(e) Schiff base complexes of various divalent metal ions.

(f) Bis(dimethylglyoximato)nickel(II)

(g) Prussian blue

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1. A.I. Vogel, G. Svehla, Vogel's Qualitative Inorganic Analysis, 7th Edn., Longman,1996.
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CH 50 02 06 ORGANIC CHEMISTRY PRACTICAL-1

Credit: 3 **Contact Lab Hours:54+54=108**

Objective of the Course

The learners should be able to apply class room learning separation and purification of organic compounds and binary mixtures.They should be able to use the computational tools to draw the reaction schemes and spectral data to various organic reactions

PART I

General methods of separation and purification of organic compounds such as:

1. Solvent Extraction
2. Soxhlet Extraction
3. Fractional crystallization
4. TLC and Paper Chromatography
5. Column Chromatography
6. Membrane Dialysis

PART II

1. Separation of Organic binary mixtures by chemical/solvent separation methods
2. Quantitative separation of organic mixtures by column chromatography – Purity assessment of the components by TLC.

PART III

Drawing the reaction schemes (Based on Semester 1 and 2 theory) by ChemDraw, Symyx Draw and Chemsketch. Draw the structures and generate the IR and NMR spectra of the substrates and products in the following reactions:

1. Condensation
   - (a) Dieckmann condensation
   - (b) Claisen condensation
   - (c) Darzen condensation
   - (d) Aldol condensation
2. Oxidation / Reduction
   - (a) Ozonolysis
   - (b) Baeyer Villiger oxidation
   - (c) Cannizaro reaction
   - (d) Clemmenson reduction
3. Rearrangement
   - (a) Benzilic acid rearrangement
   - (b) Pinacol – Pinacolone rearrangement
   - (c) Dienone – Phenol rearrangement
   - (d) Wagner – Meerwein rearrangement

4. Pericyclic reaction
   (a) Diels – Alder reaction
   (b) Cope rearrangement

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CH 50 02 07 PHYSICAL CHEMISTRY PRACTICAL-1.

Credit: 3 **Contact Lab Hours: 72+72 =144**

Objective of the Course

The learners should be able to apply the conceptual understanding acquired from the theory classes

(One question each from both parts A and B will be asked for the examination)

PART A

I. Adsorption

Verification of Freundlich and Langmuir adsorption isotherm Charcoal Acetic acid or Charcoal-Oxalic acid system

Determination of concentration of given acid using the isotherm

II. Phase diagrams

Construction of phase diagram of simple eutectics

Effect of KCl/Succinic acid on Critical Solution Temperature of phenol water system

Construction of phase diagram of three component system with one pair of partially miscible liquids

III. Distribution law

Distribution coefficient of Iodine between an organic solvent and water

Determination of the equilibrium constant of the reaction $KI+I_2 \rightarrow KI_3$

Determination of unknown concentration of KI

IV. Surface tension

1. Determination of the surface tension of a liquid by

   (a) Capillary rise method

   (b) Drop number method

   (c) Drop weight method

2. Determination of Parachor values

3. Determination of the composition of two liquids by surface tension measurements

4. Determination of CMC of surfactants by surface tension measurements

V. Determination of heat of solution from solubility measurements

PART B

Computational chemistry experiments

VI. Experiments illustrating the capabilities of modern open source/ free computational chemistry packages in computing.

(a) Single point energy

(b) Geometry optimization

(c) Vibrational frequencies

(d) Population analysis

(e) Conformational analysis of ethane, transition state search

(f) Molecular orbitals, ionisation energy, electron affinity

(g) Dipolemoment, freevalence, bond order

(h) Determination of inversion barrier of simple molecules like NH_3 , H_2O, H_2O_2

(I) Determination of Z-matrices /Cartesian coordinates of furan, thiophene, pyrrole and benzene using structure drawing programs like Chemsketch and wwMacMolPlt.

References

1. J.B. Yadav, Advanced Practical Physical Chemistry, Goel Publishing House, 2001.
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SEMESTER 3

CH 50 03 01 STRUCTURAL INORGANIC CHEMISTRY

Credit: 4 **Contact Lecture Hours: 72**

Objective of the Course

The students must acquire basic information about the imperfections of solids,electrical and magnetic properties of solidsand properties of inorganic chains , rings,cages and clusters.They should have an awareness about organometallic polymers and magnetic nanoparticles.

Unit 1: Solid State Chemistry (18 Hrs)

1.1 Structure of solids: Imperfections in solids- line defects and plane defects. Structure of the following compounds - Zinc blende, Wurtzite, Rutile, fluorite, antifluorite, Nickel Arsenide, Perosvskite and Ilmenite. Spinels,inverse spinel structures.

1.2 Solid state reactions,diffusion coefficient, mechanisms, vacancy diffusion.Thermal decomposition of solid:Type I reactions, Type II reactions.

1.3 Phase transition in solids: Classification of phase transitions,first and second order phase transitions,martensitic transformations, order-disorder transitions and spinodal decomposition,kinetics of phase transitions, sintering,growing single crystals-crystal growth from solution, growth from melt and vapour deposition technique.

Unit 2: Electrical, Magnetic and Optical Properties (18 Hrs)

2.1 Free electron theory of solids. Band theory of solids: Applications to Transition metal compounds and compounds like NaCl, MgO and fullerenes. Energy bands-conductors and non-conductors, Mechanism of intrinsic and extrinsic semiconductors. Mobility of charge carriers- Hall Effect (derivation required). Piezo electricity, pyroelectricity and ferro electricity- hysteresis.

2.2 Magnetic properties of transition metal oxides, garnets, spinels, ilmenites and perovskites, magnetoplumbites. Photoconductivity, photovoltaic effects, luminescence,applications of optical properties-phosphors, solid state lasers and solar cells.

2.4 Conductivity of pure metals. Super conductivity-Type I and Type II superconductors, Meisner effect, BCS theory of superconductivity (derivation not required)-Cooper pairs. High temperature superconductors, super conducting cuprates - YBaCu oxide system.Josephson's Junction, conventional superconductors, organic superconductors, fullerenes, carbon nanotubes and graphenes.

Unit 3: Inorganic Chains and Rings (9 Hrs)

3.1 Chains:Catenation, heterocatenation, silicones. Zeolites:Synthesis, structure and applications, isopoly acids of vanadium, molybdenum and tungsten, heteropoly acids of Mo and W,polythiazil-one dimensional conductors. Infinite metal chains

3.2 Rings,topological approach to boron hydrides, styx numbers. Heterocyclic inorganic ring systems:Structure and bonding in phosphorous-sulphur and sulphur-nitrogen compounds. Homocyclic inorganic ring systems:Structure and bonding in sulphur, selenium and phosphorous compounds.

Unit 4: Inorganic Cages and Clusters (9 Hrs)

4.1 Synthesis, structure and bonding of cage like structures of phosphorous. Boron cage Aluminium, indium and gallium clusters, cages and clusters of germanium, tin and lead, cages and clusters of tellurium, Mercuride clusters in amalgams. Medical applications of boron clusters- nucleic acid precursors, DNA binders, application of C_2B_{10} for Drug Design, Nuclear receptor ligands bearing C_2B_{10}cages.

Unit 5: Organometallic Polymers (9 Hrs)

5.1 Polymers with organometallic moieties as pendant groups, polymers with organometallic moieties in the main chain, condensation polymers based on ferrocene and on rigid rod polyynes, poly(ferrocenylsilane)s, applications of Poly(ferrocenylsilane)s and related polymers, applications of rigid-rod polyynes, polygermanes and polystannanes, polymers prepared by ring opening polymerization, organometallic dendrimers.

Unit 6: Magnetic Nanoparticles and Synthesis of Solids (9 Hrs)

6.1 Synthesis of Solids: Nucleation, growth, epitaxy and topotaxy,methods for the synthesis of $MgAl_2O_4$, silica glass, indium tin oxide and their coatings, zeolites and alumina based abrasives, hydrothermal synthesis, intercalation and deintercalation,preparation of thin films, electrochemical methods, chemical vapour deposition. Synthesis of amorphous silica and diamond films, sputtering and laser ablation.

6.2 Magnetic nanoparticles, superparamagnetism and thin films, applications of magnetic nanoparticles- data storage, Magnetic Resonance Imaging (MRI) and Contrast Enhancement using magnetic nanoparticles, biomedical applications of magnetic nanoparticles.

References

1. L.V. Azaroff, Introduction to Solids, Mc Graw Hill, 1984.
2. A.R. West, Solid State Chemistry and its Applications, Wiley-India, 2007.
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13. Richard J.D. Tilley, Understanding Solids, 2nd edition, Wiley, 2013.
14. G.L. Hornyak, J.J. Moore, H.F. Tibbals, J. Dutta, Fundamentals of Nanotechnology, CRC Press, 2009.
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CH 50 03 02 ORGANIC SYNTHESES

Credit : 4 **Contact Lecture Hours: 72**

Objective of the course

To understand the various organic reactions and reagents as tools for the synthesis of organic compounds. To learn the principles of protecting group chemistry and retrosynthetic approach towards organic synthesis.

Unit 1: Organic Synthesis via Oxidation and Reduction (18 Hrs)

1.1 Survey of organic reactions with special reference to oxidation and reduction. Metal based and non-metal based oxidations of (a) alcohols to carbonyls [(Chromium-John's oxidation,Collin's oxidation,Sarrett oxidation),Manganese, aluminium and DMSO(Swern oxidation, Moffatt–Pfitzneroxidation, Kornblumoxidation,Corey-Kim oxidation)] based reagents (b) alkenes to epoxides (peroxides/peracids based)-Sharpless asymmetric epoxidation, Jacobsen epoxidation, Shi epoxidation (c) alkenes to diols (Manganese and Osmium based)-Prevost reaction and Woodward modification (d) alkenes to carbonyls with bond cleavage (Manganese based, ozonolysis) (e) alkenes to alcohols/carbonyls without bond cleavage-hydroboration-oxidation, Wacker oxidation, selenium based allylic oxidation (f) ketones to ester/lactones- Baeyer-Villiger oxidation.

1.2 (a)Catalytic hydrogenation (Heterogeneous: Palladium/Platinum/Rhodium and Nickel. Homogeneous: Wilkinson). (b) Metal based reductions- Birch reduction, pinacol formation, acyloin formation (c)Enzymatic reduction using Baker's yeast.

Unit 2: Modern Synthetic Methods (18Hrs)

2.1 Baylis-Hillman reaction, Henry reaction, Nef reaction, Kulinkovich reaction, Ritter reaction, Sakurai reaction, Tishchenko reaction. Brook rearrangement. Tebbe olefination. Metal mediated C-C and C-X coupling reactions: Heck, Stille, Suzuki-Miyaura, Negishi, Sonogashira, Nozaki-Hiyama-Kishi, Buchwald-Hartwig, Ullmann and Glaser coupling reactions. Click reactions (Huisgen 1,3-dipolar addition).

2.2 Multicomponent reactions-Ugireaction,Passerini reaction and Biginelli reaction.

Unit 3: Synthetic Reagents (9Hrs)

3.1. Hydride transfer reagents from Group III and Group IV in reductions - $LiAlH_4$, DIBAL-H, Red-Al, $NaBH_4$ and $NaCNBH_3$, selectrides, trialkylsilanes and trialkyl stannane. Aluminum isopropoxide (oxidation and reduction).Reagents such as NBS, DDQ and DCC.Gilmann reagent.DMAP-Borane, PCC,DEAD (Mitsunobu reaction).

Unit 4: Construction of Carbocyclic and Heterocyclic Ring Systems (9 Hrs)

4.1 Synthesis of four, five and six-membered rings, photochemical approaches for the synthesis of four membered rings-oxetanes and cyclobutanes, ketene cycloaddition (inter and intra molecular), Pauson-Khand reaction, Volhardt reaction, Bergman cyclization, Nazarovcyclization,cation-olefin cyclization and radical-olefin cyclization.

4.2 Inter-conversion of ring systems (contraction and expansion)-Demjenov reaction, Reformatsky reaction. Construction of macrocyclic rings-ring closing metathesis (Grubb's catalyst).

4.3 Formation of heterocyclic rings: 5-membered ring heterocyclic compounds with one or more than one hetero atom like N, S or O - pyrrole, furan, thiophene, imidazole, thiazole and oxazole.

Unit 5: Protecting Group Chemistry (9 Hrs)

5.1 Protection and deprotection of hydroxy, carboxyl, carbonyl, and amino groups. Chemo and regio selective protection and deprotection.

5.2 Protection and deprotection in peptide synthesis: common protecting groups used in peptide synthesis, protecting groups used in solution phase and solid phase peptide synthesis (SPPS).

Unit 6: Retrosynthetic Analysis (9 Hrs)

6.1 Basic principles and terminology of retrosynthesis: synthesis of aromatic compounds, one group and two group C-X disconnections; one group C-C and two group C-C disconnections.

6.2 Amine and alkene synthesis: important strategies of retrosynthesis, functional group transposition, important functional group interconversions. Retrosynthesis of D-luciferin.Functional equivalents and reactivity-Umpolung reaction (Ireland-Claisen rearrangement).

References

1. M.B. Smith, Organic Synthesis, 3rdEdn.,Wavefunction Inc., 2010.
2. F.A. Carey, R. I. Sundberg, Advanced Organic Chemistry, Part A and B, 5thEdn., Springer, 2007.
3. S. Warren, P. Wyatt, Organic Synthesis: The Disconnection Approach, 2ndEdn., Wiley, 2008.
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CH 01 03 03 CHEMICAL KINETICS, SURFACE CHEMISTRY AND CRYSTALLOGRAPHY

Credit: 4 **Contact Lecture Hours: 72**

Objective of the Course

To recognise the fundamental theories of reaction rates, mechanism of chain reactions, different types of surfaces, application of various isotherms in surface catalysed reactions, symmetries of different crystal point groups and types and examples of liquid crystals

Unit 1: Chemical Kinetics (27 Hrs)

1.1 Theories of reaction rates: Collision theory,kinetic theory of collisions, steric factor, potential energy surfaces. Conventional transition state theory, thermodynamic formulation of the reaction rate-Eyring equation.Comparison of the two theories.Significance of $\Delta G\neq$, $\Delta H\neq$ and $\Delta S\neq$, volume of activation.Effect of pressure and volume on velocity of gas reactions.

1.2 Unimolecular reactions: Lindemann- Hinshelwood mechanism, qualitative idea of RRKM theory.

1.3 Chain reactions: Chain initiation processes, steady state treatment, kinetics of H_2-Cl_2 and H_2-Br_2 reactions, Rice-Herzfeld mechanism for decomposition of ethane and acetaldehyde, Goldfingr-Letort-Niclause rules, branching chains, Semenov-Hinshelwood mechanism of branching chains, upper and lower explosion limits, the H_2-O_2 reaction, kinetics of step growth, free radical, cationic and anionic polymerization reactions.

1.4 Fast reactions: Relaxation, flow and shock methods, flash photolysis, NMR and ESR methods of studying fast reactions.

1.5 Reactions in solution: Factors determining reaction rates in solutions, effect of dielectric constant and ionic strength, cage effect, Bronsted-Bjerrum equation, primary and secondary kinetic salt effect.

1.6 Acid-base catalysis: Specific and general catalysis, Skrabal diagram, Bronsted catalysis law, prototropic and protolytic mechanism with examples, acidity function.

1.7 Enzyme catalysis and its mechanism, Michelis-Menten equation, effect of pH and temperature on enzyme catalysis.

1.8 Introduction to oscillating chemical reactions: autocatalysis, autocatalytic mechanism of oscillating reactions, the Lotka-Volterra mechanism, the brusselator, the oreganator, bistability.

Unit 2: Surface Chemistry **(27 Hrs)**

2.1 Different types of surfaces, thermodynamics of surfaces, Gibbs adsorption equation and its verification, surfactants and micelles, surface films, surface pressure and surface potential and their measurements and interpretation.

2.2 Application of low energy electron diffraction and photoelectron spectroscopy, ESCA and Auger electron spectroscopy, scanning probe microscopy-AFM and STM, ion scattering, SEM and TEM in the study of surfaces.

2.3 Surface Enhanced Raman Scattering, surfaces for SERS studies, chemical enhancement mechanism, surface selection rules, principle and application of SERS in surface chemistry.

2.4 Adsorption: The Langmuir theory, kinetic and statistical derivation, multilayer adsorption-BET theory, Use of Langmuir and BET isotherms for surface area determination. Application of Langmuir adsorption isotherm in surface catalysed reactions, the Eley-Rideal mechanism and the Langmuir-Hinshelwood mechanism, flash desorption.

2.5 Colloids: structure and stability, the electrical double layer, zeta potential, electrokinetic phenomena- sedimentation potential and streaming potential, Donnan membrane equilibrium.

2.6 Macromolecules: Different averages, methods of molecular mass determination - osmotic, viscosity, sedimentation and light scattering methods.

Unit 3: Crystallography **(18 Hrs)**

3.1 Miller indices, point groups (derivation not expected), translational symmetry, glide planes and screw axes, space groups, simple cases like triclinic and monoclinic systems, interplanar spacing and method of determining lattice types, reciprocal lattices, methods of characterizing crystal structure, rotating crystal method, powder X-ray diffraction method, determination of structure of sodium chloride by powder method, comparison of the structures of NaCl and KCl, brief outline of single crystal X-ray diffraction and crystal growth techniques.

3.2 Structure factor: Atomic scattering factor, coordinate expression for structure factor, structure by Fourier synthesis.

3.3 Liquid crystals: Mesomorphic state, types, examples and application of liquid crystals.

References

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10. A.R. West, Basic Solid State Chemistry, John Wiley & Sons, 1999.

CH 50 03 04 SPECTROSCOPIC METHODS IN CHEMISTRY

Credit :4 **Contact Lecture Hours: 54**

Objective of the Course

The learners should be able to apply the different spectroscopic methods to solve problems based on it,spectral data for explaining important organic reactions and functional transformations.

Unit 1: Ultraviolet-Visible and Chiro-optical Spectroscopy (9 Hrs)

1.1 Energy levels and selection rules, Woodward-Fieser and Fieser-Kuhn rules.

1.2 Influence of substituent, ring size and strain on spectral characteristics. Solvent effect, Stereochemical effect, non-conjugated interactions. Chiro-optical properties-ORD, CD, octant rule, axial haloketone rule, Cotton effect-applications.

1.3 Problems based on the above topics.

Unit 2: Infrared Spectroscopy (9 Hrs)

2.1 Fundamental vibrations, characteristic regions of the spectrum (fingerprint and functional group regions), influence of substituent, ring size, hydrogen bonding, vibrational coupling and field effect on frequency, determination of stereochemistry by IR technique.

2.2 IR spectra of C=C bonds (olefins and arenes) and C=O bonds.

2.3 Problems on spectral interpretation with examples.

Unit 3: Nuclear Magnetic Resonance Spectroscopy (18 Hrs)

3.1 Magnetic nuclei with special reference to ^{1}H and ^{13}C nuclei. Chemical shift and shielding/deshielding, factors affecting chemical shift, relaxation processes, chemical and magnetic non-equivalence, local diamagnetic shielding and magnetic anisotropy. ^{1}H and ^{13}C NMR scales.

3.2 Spin-spin splitting: AX, AX_2, AX_3, A_2X_3, AB, ABC, AMX type coupling, first order and non-first order spectra, Pascal's triangle, coupling constant, mechanism of coupling- Dirac model.Karplus curve, quadrupole broadening and decoupling, homotopic, enantiotopic and diastereotopic protons, virtual coupling, long range coupling. NOE and cross polarization.

3.3 Simplification non-first order spectra to first order spectra: shift reagents, spin decoupling and double resonance, off resonance decoupling. Chemical shifts and homonuclear/heteronuclear couplings. Basis of heteronuclear decoupling.

3.4 2D NMR and COSY, HOMOCOSY and HETEROCOSY

3.5 Polarization transfer, selective population inversion, DEPT.,sensitivity enhancement and spectral editing, MRI.

3.6 Problems on spectral interpretation with examples

Unit 4: Mass Spectrometry (9 Hrs)

4.1 Molecular ion: Ion production methods (EI). Soft ionization methods: SIMS, FAB, CA, MALDI-TOF, PD, field desorption electrospray ionization,fragmentation patterns (polyenes, alkyl halides, alcohols, phenols, aldehydes and ketones, esters),nitrogen and ring rules, McLafferty rearrangement and its applications, HRMS, MS-MS, LC-MS, GC-MS.

4.2 Problems on spectral interpretation with examples.

Unit 5: Structural Elucidation Using Spectroscopic Techniques (9 Hrs)

5.1 Identification of structures of unknown organic compounds based on the data from UV-Vis, IR, ^{1}H NMR and ^{13}C NMR spectroscopy (HRMS data or Molar mass or molecular formula may be given).

5.2 Interpretation of the given UV-Vis, IR and NMR spectra.

5.3 Spectral analysis of the following reactions/functional transformations:

1. Pinacol-Pinacolone rearrangement
2. Benzoin condensation
3. (4+2) cycloaddition
4. Beckmann rearrangement
5. Cis-trans isomerisation of azo compounds
6. Benzil-benzilic acid rearrangement
7. Fries rearrangement

References

1. D.L. Pavia, G.M. Lampman, G.S. Kriz, Introduction to Spectroscopy, 3rd Edn., Brooks Cole, 2000.
2. A.U. Rahman, M.I. Choudhary, Solving Problems with NMR Specroscopy, Academic Press, 1996.
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11. E.B. Wilson Jr., J.C. Decius, P.C. Cross, Molecular Vibrations: The Theory of Infrared and Raman Vibrational Spectra, Dover Pub., 1980.
12. Online spectral databases including RIO-DB.

SEMESTER 4

ELECTIVE COURSES

(Any one group of 3 courses to be opted from the following two groups)

GROUP A

CH 80 04 01 ADVANCED INORGANIC CHEMISTRY

Credit: 4 **Contact Lecture Hours: 90**

Objective of the course

To analyse and apply group theoretical principles in hybridisation technique of molecules, in complexes for explaining well known theories. To have a knowledge about the preparation and characteristics of nanomterials, metal organic frame works and types of supramolecules

Unit 1: Applications of Group Theory (27 Hrs)

1.1 Transformation properties of atomic orbitals, hybridization schemes for sigma and pi bonding with examples, symmetry adapted linear combination of atomic orbitals in tetrahedral, octahedral and sandwich complexes- ferrocene,formation of symmetry adapted group of ligand, MO diagrams.

1.2 Ligand field theory,splitting of d orbitals in different environments using group theoretical considerations, construction of energy level diagrams, correlation diagrams, method of descending symmetry, splitting terms for orbitals, energy levels, d-d transition-selection rules. Determination of modes of vibrations in IR and Raman spectra using character tables in tetrahedral, octahedral and square planar complexes.

Unit 2: Inorganic Spectroscopic Methods (9 Hrs)

2.1 Infrared and Raman Spectroscopy: Structural elucidation of coordination compounds containing the following molecules/ions as ligands-NH_3, H_2O, CO, NO, OH^-, SO_4^{2-}, CN^-, SCN^-, NO_2^- and X^- (X=halogen). Use of isotopes in interpreting and assigning vibrational spectra.

2.2 Electron Paramagnetic Resonance Spectroscopy: EPR of d^1 and d^9 transition metal ions in cubic and tetragonal ligand fields, evaluation of g values and metal hyperfine coupling constants, electron-electron interactions, multiple resonance.

2.3 Mössbauer Spectroscopy: Applications of Mössbauer spectroscopy in the study of Fe(III) complexes. Compound Identification- the interhalogen compound $I_2Br_2Cl_4$, iron in very high oxidation states – Fe(V) and Fe(VI) nitride complexes.

Unit 3: Inorganic Photochemistry (9 Hrs)

3.1 Excited states in transition metal complexes:Intra-ligand excited states and metal-centred excited states.Photochemical reactions:Substitution and redox reactions of Cr(III), Co(III), Rh(III) and Ru(II) complexes, manganese-based photosystems for the conversion of water into oxygen, applications-synthesis and catalysis, chemical actinometry and photochromism, metal-metal multiple bonds, dissociative photochemistry, ligand loss.

3.2 Metal complex sensitizers,electron relay, semiconductor supported metal oxide systems, water photolysis, nitrogen fixation and CO_2 reduction, dinitrogen splitting.

Unit 4: Nanomaterials (18 Hrs)

4.1 Inorganic nanomaterials: General introduction to nanomaterials,synthesis and applications of nanoparticles of gold, silver, rhodium, palladium and platinum,synthesis and applications of metal oxides of transition and non-transition elements-SiO_2, TiO_2, ZnO, Al_2O_3, iron oxides and mixed metal oxide nanomaterials, non-oxide inorganic naomaterials, porous silicon nanomaterials- fabrication and chemical and biological sensing applications.

4.2 Characterisation of Nanomaterials: UV-visible, Raman, XRD, SEM, TEMand AFM techniques.

4.3. Diversity in nanosystems: Self-assembled monolayers on gold-growth process and phase transition, gas phase clusters- formation, detection and analysis, quantum dots-preparation, characterization and applications, nanoshells-types of systems, characterization and application, inorganic nanotubes-synthetic strategies, structures, properties and applications. Nanocomposites- natural nanocomposites, polymer nanocomposites, metal and ceramic nanocomposites and clay nanocomposites.

4.4. Evolving interfaces of nanotechnology:Nanobiotechnology, nano-biosensors, nanotechnology for manipulation of biomolecules- optical tweezers, dielectrophoresis, biochips, labs on chips, and integrated systems, nanocatalysts, nanomedicines- importance of nanomaterials in the pharmaceutical industry and future possibilities for medical nanotechnology, nanoparticles for medical imaging, nanoparticles for targeting cancer cells, nanoencapsulation for drug delivery to tumours.

Unit 5: Chemistry of Materials (9 Hrs)

5.1 Ceramic Structures:Mechanical properties, clay products, refractories-characterisation, properties and applications, non-silicon semiconductors as light emitting diodes, thermoelectric (TE) materials, applications of metals and alloys in hydrogen storage, inorganic organic hybrid composites- sol-gel ceramics, fillers in elastomers, polymer- modified ceramics.

5.2 Synthetic strategies for inorganic material design: Direct Combination, low temperature techniques, combinatorial synthesis.

Unit 6: Metal Organic Frame Works (9 Hrs)

6.1 Introduction, porous coordination polymers, frameworks with high surface area, Lewis acid frameworks, soft porous crystals, design of metal organic frameworks and design of functional metal organic frameworks by post-synthetic modification.

6.2 Applications of metal organic frameworks- separation and purification of gases by MOFs, hydrogen storage, MOFs in the pharmaceutical world.

Unit 7: Inorganic Supramolecular Chemistry (9 Hrs)

7.1 Types of Supermolecules, examples of inorganic supermolecules, synthetic strategies for inorganic super molecules and coordination polymers, molecular polygons and tubes, molecular polyhedra.

7.2 Diamondoid networks, inorganic crystal engineering using hydrogen bonds, organometallic crystal engineering, supramolecular self-assembly caused by ionic interactions- hydrocarbyls, amides and phosphides.

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CH 80 04 02 ADVANCED ORGANIC CHEMISTRY

Credit : 4 **Contact Lecture Hours: 90**

Objective of the Course

To analyse and interpret molecular recognition and supramolecular chemistry**,**to study the basic principles of green chemistry, the method of biosynthesis and biomimetic synthesis,to learn the importance of drug design and different categories of polymers .To understand the basic principles of research and how to write a scientific report

Unit 1: Molecular Recognition and Supramolecular Chemistry (18 Hrs)

1.1 Introduction to supramolecular chemistry: Host, Guest, Host-Guest complex, Lock and key principle, Preorganisation, Complementarity.

1.2 Molecular recognition, forces involved in molecular recognition.

1.3 Cation binding Hosts: Crown ethers, Lariat ethers, Podands, Cryptands, Spherands, Calixarenes

1.4 Anion binding hosts: Cyclophanes. A naturally occurring cyclic host: Cyclodextrin - industrial applications.

1.5 Molecular clefts and tweezers. Macrocyclic polyamines – Nitrogen based cyclic hosts.

1.6 Naturally occurring Siderophores. Rhodopsin – A Supramolecular photonic device.

Unit 2: Green Alternatives to Organic Synthesis (9 Hrs)

2.1 Introduction to Green Chemistry, atom economy

2.2 Twelve principles of Green Chemistry, how to plan a green synthesis.

2.3 Green Solvents: Ionic liquids, supercritical CO_2, fluorous solvents, PEG

2.4 Microwave assisted organic synthesis : Principle, example.

2.5 Sonochemical synthesis : Principle, example

2.6 Green alternatives to organic synthesis: Thiamine catalyzed benzoin condensation, Montmorillonite K-10 catalysed Pinacol-Pinacolone rearrangement, photochemical reduction of benzophenone to benzopinacol, synthesis of adipic acid from cyclohexene, synthesis of Ibuprofen.

Unit 3: Biosynthesis and Biomimetic Synthesis (9 Hrs)

3.1 Basic principles of the biosynthesis of terpenes, steroids, alkaloids, carbohydrates, proteins and nucleic acids, biosynthesis of cholesterol, α- terpineol, morphine, glucose

and phenyl alanine,biogenesis of isoprenoids and alkaloids,biomimetic synthesis of progesterone (Johnson synthesis).

Unit 4: Stereoselective Transformations (9 Hrs)

4.1 Assymmetric induction - chiral auxiliaries and chiral pool.

4.2 Enantioselective catalytic hydrogenation developed by Noyori and Knowels.

4.3 Assymetricaldol condensation pioneered by Evans.

4.4 Assymmetric Diels-Alder reactions.

4.5 Enatioseletive synthesis of Corey lactone

Unit 5: Chemistry of Natural Products and Biomolecules (18 Hrs)

5.1 Synthesis of camphor, atropine, papaverine, quinine, cyanin, quercetin, β-carotene, testosterone, biosynthesis of PGE2 and PGF2α.

5.3 Structure of proteins, nucleic acids and methods for primary structure determination of peptides (N-terminal - Sanger's method and Edmond's method; C-terminal - Akabora method and carboxy peptidase method),replication of DNA, flow of genetic information, protein biosynthesis, transcription and translation, genetic code, regulation of gene expression, DNA sequencing, The Human Genome Project, DNA profiling and the Polymerase Chain Reaction (PCR).

Unit 6: Medicinal Chemistry and Drug Designing (9 Hrs)

6.1 Introduction to Drug design: Modelling techniques, receptor proteins, drug-receptor interaction, drug action, drug selectivity, drug metabolism (Phase I and Phase II).

6.2 Mode of action of Warfarin (anticoagulant), organic nitrates (anti-anginal drug), Captoril (antihypertensive agent), Chloroquin (antimalarial drug).

6.3 Antibiotics: Penicillins (SAR expected), mode of action of chloramphenicol, tetracyclins and cephalosporins,drugs for cancer (Methotrexate), AIDS (Zidovudin) and diabetes (Metformin).

Unit7: Advances in Polymer Chemistry (9 Hrs)

7.1 Conducting polymers, temperature resistant and flame retardant polymers, polymers for medical applications.

7.2 Dendrimers and dendritic polymers: Terminology, classification of dendrimers. Methods of synthesis: convergent and divergent approaches, applications of dendrimers. Hyperbranched polymers: Definition, synthesis, applications.

Unit 8: Research Methodology of Chemistry (9 Hrs)

8.1 The search of knowledge, purpose of research, scientific methods, role of theory, characteristics of research.

8.2 Types of research: Fundamental, applied, historical and experimental research.

8.3 Chemical literature: Primary, secondary and tertiary sources of literature. Classical and comprehensive reference. Literature databases: ScienceDirect, SciFinder. Chemical Abstract.

8.4 Scientific writing: Research reports, thesis, journal articles, books. Types of publications: articles, communications, reviews.

8.5 Important scientific and Chemistry Journals. Impact factor.

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CH 80 04 03 ADVANCED PHYSICAL CHEMISTRY

Credit: 4 **Contact Lecture Hours: 90**

Objective of the course

To know the excited states involved in a photochemical reaction, to analyse and apply diffraction methods and atomic spectroscopic techniques.The students should be able to apply theories in electrochemistry to analyse the kinetics of electrode reactions.

Unit 1: Photochemistry (18 Hrs)

1.1 Quantum yield, chemical actinometry, excimers and exciplexes, photosensitization, chemiluminescence,bioluminescence, thermoluminescence, pulse radiolysis, hydrated electrons, photostationary state, dimerization of anthracene, ozone layer in the atmosphere.

1.2 Principle of utilization of solar energy: solar cells, types of solar cells-amorphous silicon solar cell, cadmium telluride solar cell, copper indium gallium selinide solar cell.

1.3 Quenching of fluorescence and its kinetics, Stern-Volmer equation, concentration quenching, fluorescence and structure, delayed fluorescence, E-type and P-type, effect of temperature on emissions, photochemistry of environment, green house effect, two photon absorption spectroscopy, lasers in photochemical kinetics.

Unit: 2 Fluorescence Spectroscopy (9 Hrs)

2.1 Instrumentation: light source, monochromator, optical filters, photomultiplier tube, polarizers, fluorescence sensing, mechanism of sensing, sensing techniques based on collisional quenching, energy transfer and electron transfer, examples of pH sensors. Novel fluorephores: long life time metal-ligand complexes.

Unit 3: Diffraction Methods and Atomic Spectroscopic Techniques (9 Hrs)

3.1 Electron diffraction of gases, Wierl's equation, Neutron diffraction method, Comparison of X-ray, electron and neutron diffraction methods.

3.2 Atomic absorption spectroscopy (AAS), principle of AAS, absorption of radiant energy by atoms, classification of atomic spectroscopic methods, measurement of atomic absorption, instrumentation.

3.3 Atomic emission spectroscopy (AES), advantages and disadvantages of AES, origin of spectra, principle and instrumentation.

3.4 Flame emission spectroscopy (FES), flames and flame temperature, spectra of metals in flame, instrumentation.

Unit 4: Electrochemistry and Electromotive Force (27 Hrs)

4.1 Theories of ions in solution, Drude and Nernst's electrostriction model and Born's model, Debye-Huckel theory, derivation of Debye-Huckel-Onsager equation, validity of DHO equation for aqueous and non aqueous solutions, Debye-Falkenhagen effect, conductance with high potential gradients, activity and activity coefficients in electrolytic solutions, ionic strength, Debye-Huckel limiting law and its various forms, qualitative and quantitative tests of Debye-Huckel limiting equation, deviations from the DHLL, ion association, triple ions and conductance minima.

4.2 Electrochemical cells, concentration cells and activity coefficient determination, liquid junction potential, evaluation of thermodynamic properties, the electrode double layer, electrode-electrolyte interface, different models of double layer, theory of multilayer capacity, electro capillary, Lippmann equation, membrane potential.

4.3 Fuel cells- Theory and working of fuel cells- methanol fuel cell, H_2-O_2 fuel cell and solid oxide fuel cells.

4.4. Corrosion and methods of prevention, Pourbaix diagram and Evans diagrams.

4.5 Overvoltage: hydrogen and oxygen overvoltage, theories of overvoltage, Tafel equation and its significance, Butler-Volmer equation for simple electron transfer reactions, transfer coefficient, exchange current density, rate constants.

Unit 5: Electroanalytical Techniques (18 Hrs)

5.1 Voltametry: Cyclic voltametry, ion selective electrodes, anodic stripping voltametry.

5.2 Polarography-decomposition potential, residual current, migration current, supporting electrolyte, diffusion current,polarogram, half wave potential, limiting current density, polarograph,explanation of polarographic waves.

5.3 The dropping mercury electrode, advantages and limitations of DME, quantitative analysis- pilot ion procedure, standard addition methods, qualitative analysis-determination of half wave potential of an ion, advantages of polarography.

5.4 Amperometric titrations: General principles of amperometry, instrumentation, application of amperometry in the qualitative analysis of anions and cations in solution, merits and demerits of amperometric titrations.

5.5 Coulometry: Coulometer-Hydrogen Oxygen coulometers, silver coulometer, coulometric analysis with constant current, coulometric tritrations, application of coulometric titrations-neutralization titrations, complex formation titrations, redox titrations, advantages of coulometry.

Unit:6 Advanced Thermodynamics (9 hrs)

6.1 Thermodynamics of irreversible processes with simple examples, general theory of non-equilibrium processes, entropy production, the phenomenological relations, the principle of microscopic reversibility, Onsager reciprocal relations, thermal osmosis and thermoelectric phenomena.

6.2 Bioenergetics, coupled reactions, ATP and its role in bioenergetics, high energy bond, free energy and entropy change in ATP hydrolysis, thermodynamic aspects of metabolism and respiration, glycolysis, biological redox reactions.

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GROUP B

CH 81 04 01 ADVANCES IN POLYMER SCIENCE AND TECHNOLOGY

Credit: 4 **Contact Lecture Hours: 90**

Objective of the Course

To have a well organised knowledge about speciality polymers,polymer blends and composites, polymer mixing and compounding, adhesives,techniques of surface coating and to have an idea about fibre science and technology

Unit 1: Speciality Polymers (18Hrs)

1.1 Poly electrolytes-the water soluble charged polymers, ionomers (ion containing polymers, conducting polymers, solid polymer electrolytes (SPE), electroluminescent polymers, fluoropolymers, block copolymers(multiphase polymers), polymer colloids, thermoplastic elastomers(TPE), polyblends (heterogeneous plastics), inter penetrating network (IPN) polymers, thermally stable polymers, telechelic polymers (functional polymers) polymer microgel, biomedical polymers.

1.2. Liquid crystalline polymers: definition and synthesis, main chain liquid crystalline polymers, side chain liquid crystalline polymers, combined side chain- main chain liquid crystalline polymers, liquid crystalline polymer networks, liquid crystalline elastomers, application of liquid crystalline polymers.

1.3. Dendritic polymers: origin of dendrimers, structure, properties, design and synthesis-divergent growth method, convergent growth method, medicinal application.

1.4. Introduction to: polymers for organic light-emitting diodes (OLEDs), organic and hybrid solar cell, supramolecular polymer science.

Unit 2: Adhesives and Surface Coating (12Hrs)

2.1. Adhesives: introduction, theory, surface treatment, joint design, physical nature of adhesives, types of adhesives, natural glues, applications, elastomer adhesives, synthetic adhesives, olefinic polymer adhesives, types of epoxy adhesives, inorganic adhesives, bio adhesives, test methods in determining the strength and properties of adhesives.

2.2. Surface coating: introduction, types of coating, drying oils, types of resins, surfactants, surface preparation, coating methods, solvent selection, methods of coating, theory of powder coating, application of powder coating, curving process.

2.3. Corrosion, electroplating, hazards and safety measures in paint industry.

Unit 3: Polymer Blends and Composites (18 Hrs)

3.1. Polymer blends: classification, principles and methods involved in the preparation of different polymer blends, study of polymer blends and alloys on the basis of miscibility, criteria for selection of polymer.

3.2 Compatibility of blends: principles of solubility and compatibility, thermodynamics of miscibility, mechanical compatibility.

3.3 Phase morphology: phase separation behaviour, morphology of blends and its determination- electron microscopy- domain structure.

3.4. Introduction to rheology of polymer blends: its relevance in processing, rheology–phase morphology relationships and their relevance, micro rheology, rheological models-solution, and suspension models.

3.5. Industrial applications of polymer blends.

3.6. Polymer composites: fundamental concepts, factors influencing the performance of polymer composites-aspect ratio, void content, length of the fibre, nature of the fibre, structure property relationship between fibre and matrix, modifications of the fibre surface, degree of interaction between fibre and matrix, wetting behaviour, degree of cross linking etc.,

3.7 Processing of thermoplastic composites- types of processing methods, solution, film, lamination, sandwitch etc., processing conditions, advantages and disadvantages.

3.8. Fabrications of thermoset composites: hand layup method, compression and transfer moulding, pressure and vacuum bag process, filament winding, protrusion, reinforced RIM, RRIM, injection moulding of thermosets, SMC and DMC, advantages and disadvantages of each method.

3.9. Nano-composites- definition, types, methods of fabrication, characterization, uses and applications.

Unit 4: Polymer Compounding and Processing (18Hrs)

4.1. Polymer mixing: introduction, basic concepts, mechanism of mixing and dispersion, mixing of solid-solid, liquid-liquid and liquid-solid, dispersive mixing, distributive mixing and laminar mixing, mixing indices, scale of segregation and intensity of segregation, kinetics of mixing, rheology of filled polymers.

4.2. Compounding: introduction, types and characteristics of compounds-polymer blends, polymer formulations, filled polymers and polymer composites, compounding practice, mixing types, solid additives, morphology of filler additives, filler reinforcement, compatibilizers-mechanism and theory, filler surface modification and interfacial agents, dispersion of polymer nanoparticles in polymer melt, fillers and

reinforcements viz. carbon black, ZnO, calcium carbonate, titanium oxide, nano clay, glass fibers, organic fillers, nanofillers.

4.3. Polymer processing: casting-die casting, rotational casting, film casting, thermoforming, foaming, lamination, reinforcing, processing of fibres-dry spinning, wet spinning, melt spinning, moulding processes-compression moulding, injection moulding, transfer moulding, blow moulding, extrusion moulding, calendaring.

Unit 5: Fibre Science and Technology (12Hrs)

5.1. Basic concepts, structural attributes of fibres, Fibre characteristics

5.2. Natural fibres: natural fibres of vegetable origin, the seed and fruit fibres, natural fibres of animal origin-silk, natural mineral fibre

5.3. Man-made fibres: introduction, spinning, semi-synthetic fibres from cellulose, regenerated protein fibres, synthetic fibres-rayon, polyethylene terephthalate, nylon 6 and nylon 66, acrylics, polyolefins, polyvinyl chloride, polyvinyl alcohol.

5.4. Miscellaneous fibres -carbon fibre, glass fibre, boron fibre, ceramic fibre-alumina fibre.

5.5. Brief outline of manufacture of textiles: fibres to yarn, yarns to fabrics-weaving, knitting, braiding, compound fabric constructions, finishing processes, dyeing and printing.

Unit 6: Latex Technology (12Hrs)

6.1. Natural rubber latex: composition of latex, conservation, gelation, stability of latex & flocking, chemical modifications of natural latex- prevulcanisation, grafting, halogenations, hydro halogenations.

6.2. Synthetic latex: SBR lattices and its types like XSBR, properties, NBR lattices and its types and properties, poly chloroprene and its properties, butyl lattices, comparative study of natural, SBR, NBR & poly chloroprene.

6.3. Latex testing: sampling, total solids, dry rubber content, pH, VFA number, KOH number, mechanical & chemical stability.

6.4. Manufacturing techniques: dipping-principle & process, foam making-principle, dunlop process, talalay process.

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CH 81 04 02 ANALYTICAL CHEMISTRY

Credit: 4 **Contact Lecture Hours: 90**

Objective of the Course

To analyse and apply various instrumental methods and analytical procedures to molecular systems. To have an idea about renewable and non renewable aquatic resources

Unit 1: Instrumental Methods (36 Hrs)

1.1 Electrical and nonelectrical data domains-transducers and sensors, detectors, examples for piezoelectric, pyroelectric, photoelectric, pneumatic and thermal transducers. Criteria for selecting instrumental methods-precision, sensitivity, selectivity, and detection limits.

1.2 Signals and noise: sources of noise, S/N ratio, methods of enhancing S/N ratio-hardware and software methods.

1.3 Electronics: transistors, FET, MOSFET, ICs, OPAMs. Application of OPAM in amplification and measurement of transducer signals.

1.4 UV-Vis spectroscopic instrumentation: types of optical instruments, components of optical instruments-sources, monochromators, detectors. Sample preparations.Instrumental noises.Applications in qualitative and quantitative analysis.

1.5 Molecular fluorescence and fluorometers: photoluminiscence and concentration-electron transition in photoluminescence, factors affecting fluorescence, instrumentation details. Fluorometric standards and reagents.Introduction to photoacoustic spectroscopy.

1.6 IR spectrometry: instrumentation designs-various types of sources, monochromators, sample cell considerations, different methods of sample preparations, detectors of IR-NDIR instruments. FTIR instruments.Mid IR absorption spectrometry.Determination of path length.Application in qualitative and quantitative analysis.

1.7 Raman Spectrometric Instrumentation: sources, sample illumination systems. Application of Raman Spectroscopy in inorganic, organic, biological and quantitative analysis.

1.8 NMR Spectrometry-magnets, shim coils, sample spinning, sample probes (^{1}H, ^{13}C, ^{32}P).Principle of MRI.

Unit 2: Sampling (18 hrs)

2.1 The basis and procedure of sampling, sampling statistics, sampling and the physical state, crushing and grinding, the gross sampling, size of the gross sample, sampling liquids, gas and solids (metals and alloys), preparation of a laboratory sample,

moisture in samples-essential and non essential water, absorbed and occluded water, determination of water (direct and indirect methods).

2.2 Decomposition and dissolution, source of error, reagents for decomposition and dissolution like HCl, H_2SO_4, HNO_3, $HClO_4$, HF, microwave decompositions, combustion methods, use of fluxes like Na_2CO_3, Na_2O_2, KNO_3, NaOH, $K_2S_2O_7$,B_2O_3 and lithium metaborate. Elimination of interference from samples-separation by precipitation, electrolytic precipitation, extraction and ion exchange.Distribution ratio and completeness of multiple extractions.Types of extraction procedures.

Unit 3: Applied Analysis (9 Hrs)

3.1 Analytical procedures involved in environmental monitoring. Water quality-BOD, COD, DO, nitrite, nitrate, iron, fluoride.

3.2 Soil-moisture, salinity, colloids, cation and anion exchange capacity.

3.3 Air pollution monitoring sampling, collection of air pollutants-SO_2, NO_2, NH_3, O_3 and SPM.

3.4 Analysis of metals, alloys and minerals. Analysis of brass and steel.Analysis of limestone.Corrosion analysis.

Unit 4: Capillary Electrophoresis and Capillary Electro Chromatography (9 Hrs)

4.1 Capillary electrophoresis-migration rates and plate heights, instrumentation, sample introduction, detection(indirect)-fluorescence, absorbance, electrochemical, mass spectrometric, applications. Capillary gel electrophoresis.Capillary isotachophoresis.Isoelectric focusing.

4.2 Capillary electro chromatography-packed columns. Micellar electro kinetic chromatography.

Unit 5: Process Instrumentation (9 Hrs)

5.1 Automatic and automated systems, flow injection systems, special requirements of process instruments, sampling problems, typical examples of C, H and N analysers.

Unit 6: Aquatic Resources (9 Hrs)

6.1 Aquatic resources: renewable and non renewable resources, estimation, primary productivity and factors affecting it, regional variations.

6.2 Desalination: principles and applications of desalination-distillation, solar evaporation, freezing, electrodialysis, reverse osmosis, ion exchange and hydrate formation methods. Relative advantages and limitations. Scale formation and its prevention in distillation process.

6.3 Non-renewable resources: inorganic chemicals from the sea-extraction and recovery of chemicals, salt from solar evaporation.

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CH 81 04 03 MEDICINAL CHEMISTRY

Credit : 4 **Contact Lecture Hours: 90**

Objective of the Course

To study the different types of drugs and their mode of action in biological systems.

Unit 1: Drugs Acting on ANS (18 Hrs)

1.1 Adrenergic stimulants: Phenyl ethanolamine derivatives-adrenaline, isoprenaline, salbutamol, ephedrine, and phenylephrine. Imidazole derivatives-naphazoline, xylometazoline and oxymetazoline.

1.2 Adrenergic blockers: α and β adrenoreceptor antagonists-ergot akaloids, phenoxybenzamine, phentolamine, tolazoline, DCI, propranolol, atenolol, labetolol. Neurone blockers–Bretilium and Xylocholine.

1.3 Cholinergic stimulants: nicotinic and muscarinic receptors, acetyl choline and analogues, pilocarpine, bethanechol and carbachol.

1.4 Cholinergic blockers: tertiary and quaternary antimuscarinics, antispasmodic drugs-dicyclomine, glycopyrrolate, antiulcer drugs-pirenzepine, cycloplegic drugs-tropicamide, homatropine

1.5 Anticholinesterases: Competitive inhibitors-physostigmine and neostigmine.

1.6 Non competitive inhibitors: organophosphorus compounds, Nerve gases, Cholinesterase regenerators-2 PAM.

1.7 Ganglion blocking agents: mecamylamine and trimethophan

1.8 Curareform drugs: curare alkaloids, erythrina alkaloids and gallamine.

1.9 Synthesis of the following drugs: salbutamol, naphazoline, tolazoline, propranolol, bretilium, carbachol, mecamylamine and gallamine.

Unit 2: Drugs Acting on CVS (9 Hrs)

2.1 Cardiotonic drugs: cardiac glycosides-their chemistry and stereochemistry, Digoxin and digitoxin.

2.2 Antiarrhythmic drugs: quinidine, disopyramide, lidocaine, phenytoin and procainamide, β-blockers-propranolol. Calcium channel blockers-verapamil and Neurone blockers-bretilium.

2.3 Antihypertensive Drugs: peripheral antiadrenergics-prazosin and terazosin. Centrally acting drugs-reserpine, clonidine and methyl dopa. β-blockers- propranolol, atenolol and labetalol.Calcium channel blockers-nifedipine and amlodipine.ACE inhibitors-captopri.Angiotensin receptor blockers-losartan.Diuretics-thiazide diuretics.

2.4 Antianginal drugs: vasodilators-nitrites and nitrates, β-blockers-propranolol. Calcium channel blockers-verapamil and nifedipine.Miscellaneous-dipyridamol and aspirin.

2.5 Anticoagulants: heparin, coumarin derivatives and indane dione derivatives.

2.6 Antilipidemic agents: atherosclerosis (mention only), Statins-lovastatin, simvastatin, fluvastatin, Fibrates-clofibrate, Miscellaneous-bile acid sequestrants and cholestyramine resin.

2.7 Synthesis of the following drugs: procainamide, disopyramide, amlodipine, verapamil, captopril and fluvastatin.

Unit 3: Chemotherapy (27 Hrs)

3.1 Antibiotics: β-lactam antibiotics-penicillins and cephalosporins, natural, biosynthetic and semisynthetic penicillins, tetracyclines and chloramphenicol, a brief study of macrolide antibiotics, aminoglycoside antibiotics, polyene antibiotics, fluoroquinolones.

3.2 Sulphonamides: sulphanilamide, N-substituted sulphanilamide derivatives, mechanism of action, sulphones-dapsone, dihydrofolate reductase inhibitors-trimethoprim and cotrimoxazole.

3.3 Antitubercular agents: first line drugs-isoniazid, rifampicin, pyrazinamide, ethambutol, and streptomycin. Second line drugs-ethionamide, paraaminosalicylic acid and fluoroquinolones.

3.4 Antifungal agents: Antibiotics-amphotericinB, griseofulvin and nystatin. Azole derivatives-ketoconozole, terconozole, fluconozole and clotrimazole. Pyrimidine derivatives- 5 Flucytosine.

3.5 Antiviral drugs: amantidine, interferon and ribavirin. Anti HIV agents- zidovudine, and abacavir. Anti-herpes simplex agents-brivudine, vidarabin and acyclovir. Anti-influeza agents-oseltamivir(tamiflu).

3.6 Antiprotozoal agents: Amoebicides-metranidazole and tinidazole. Antimalarials-chloroquine, primaquine, mefloquine, quinacrine and proguanil.Anthelmintics-piperazines and benzimidazoles.Miscellaneous-eflornithine and pentamidine. Synthesis of the following drugs: ampicillin, cephalexin, chloramphenicol, sulphamethoxazole, dapsone, trimethoprim, ethambutol, griseofulvin, clotrimazole, acyclovir, metranidazole, primaquine, mebendazole.

Unit 4: Antineoplastic Drugs (9 Hrs)

4.1 Neoplasm-cause therapeutic approaches. Alkylating agents-nitrogen mustards, nitrosourea, aziridines and aryl sulphonates.Antimetabolites-folic acid.Antagonists-purine and pyrimidine antagonists. Antibiotics-anthracyclines, actinomycinD,

bleomycin. Plant products-vinca alkaloids, taxol derivatives.Hormones and their antagonists-tamoxifen.Miscellaneos-procarbazine, cisplatin.

4.2 Synthesis of the following drugs: chlorambucil, carmustin, thiotepa, methotrexate, 5-fluoro uracil, procarbazine.

Unit 5: Psychopharmocological Agents (9 Hrs)

5.1 Tranquilisers: rauwolfia alkaloids, meprobamate, oxazepim, benzodiazepines, chlordiazepoxide, phenothiazene derivatives.

5.2 Antidepressants: MAO inhibitors-Isocarboxazide, tranylcypromine and phenelzine. Tricyclic compounds-imipramine, trimipramine, amitriptynine, doxepine, amoxapine.Miscellaneous compounds-fluoxetine and trazodone.

5.3 Antipsychotics: phenothiazine and thiothixene derivatives, butyrophenones-haloperidol, droperidon, rauwolfia alkaloids.

5.4 Hallucinogens: triptaminederivatives-DMT, psilocybin, phenylalkylamines-mescaline, lysergic acid derivatives-LSD.

5.5 Synthesis of the following drugs: chlordiazepoxide, meprobamate, imipramine chlorpromazine, tranylcypromine and haloperidol.

Unit 6: Miscellaneous Class of Compounds (18 Hrs)

6.1 Diuretics: common diuretics and their mechanism of action-mercurial and nonmercurial diuretics, carbonic anhydrase inhibitors- acetazolamide and methazolamide, thiazide derivatives-hydrochlorothiazide, Loop diuretics- furosemide and ethacrynic acid, potassium sparing diuretics-amiloride, spironolactone.

6.2 Antihistaminic drugs: histamine and its biological role, H1 antagonists- aminoalkyl ethers, diphenhydramine and doxylamine, ethylenediamine derivatives-pyrilamine, phenothiazines-promethazine, trimeprazine, piperazine derivatives-cyclizines, miscellaneous compounds-cetrizine and cyproheptadine.

6.3 Hypogycemic agents: type 1 and type 2 diabetes, insulin, suphonyl ureas-tolbutamide, acetohexamide and glibenclamide, biguanides-metformin, thiazolidinediones-rosiglitazone.

6.4 Local anaesthetics: clinical application of local anaesthesia, coca and cocaine, hexylcaine, paraaminobenzoic acid derivative-benzocaine, procaine, tetracaine, chloroprocaine, anilides, lidocaine, etiodacaine and prilocaine.

6.5 Antitussives: centrally acting antitussives-opium alkaloids and synthetic substitutes-codaine, noscapine, pholcodine, ethylmorphine, dextromethorphan, Non narcotic antitussives-diphenhydramine, expectorants-terpin hydrate, guaicol and bromhexine.

6.6 Gastrointestinal drugs: purgatives-irritant, osmotic, bulk and lubricant purgatives, Antacids-systemic and non systemic antacids, H2 antagonists-cimetidine and ranitidine, proton pump inhibitors-omeprazole and pantaprazole, digestants, carminatives and antidiarrheals.

6.7 Synthesis of the following drugs: acetazolamide, chlorthiazide furosemide, ethacrynic acid, amiloride, diphenhydramine, pyrilamine, promethazine, omeprazole, tolbutamide, phenformin, benzocaine, procaine lidocaine, dextromethorphan.

References

1. G.L. Patrick, Medicinal Chemistry, BIOS, 2001.
2. T. Nogrady, D.F. Weaver, Medicinal Chemistry, Oxford University Press, 2005.
3. W.O. Foye, T.L. Lemke, D.A. Williams, Principles of Medicinal Chemistry, 4th Edn., Williams & Wilkins, 1995.
4. J.P. Remington, Remington's Pharmaceutical Sciences, Vol.13, 19th Edn., Mack, 1990.
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6. K.D. Tripathi, Essentials of medical Pharmacology, 6th Edn., Jaypee, 2008
7. L.S. Goodman, A. Gillman, The Pharmacological Basis of Therapeutics, 10th Edn., McGraw Hill, 2001.
8. S.S. Kadam, Principles of Medicinal Chemistry, Vol.I & II, Pragati Books, 2008.
9. A. Kar, Medicinal Chemistry, New Age International, 2007.
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SEMESTERS 3 AND 4

CH 01 04 05INORGANIC CHEMISTRY PRACTICAL-2

Credit: 3 **Contact Lab Hours: 54+54 =108**

Objective of the Course

They must be able to apply theoretical learning to separate simple binary mixtures of metallic ions in solution,analysis of alloys and application of paper chromatography to separate a mixture of three cations

PART I

Estimation of simple binary mixtures (like Cu-Ni, Cu-Zn, Fe-Cr, Fe-Cu, Fe-Ni, Pb-Ca) of metallic ions in solution by volumetric and gravimetric methods.

PART II

Analysis of one of the alloys of brass, bronze and solder.Analysis of one of the ores from hematite, chromite, dolomite, monazite, illmenite.

PART III

Paper chromatographic Separation of a mixture of 3 cations.

(a) Separation of Ag(I), Pb(II) and Hg(II) ions
(b) Separation of Ni(III), Co(II) and Zn(II) ions
(c) Separation of Ni(III), Co(II) and Cu(II) ions
(d) Separation of Ba(II), Sr(II) and Ca(II) ions

PART IV

(a) Preparation of cis and trans-Dichlorobis(ethylenediamine)cobalt(III) chloride and kinetic study of cis to trans isomerisation using a UV-vis spectrophotometer.

(b) Synthesise the following complexes of Ni(II) (a d8 system) and prepare 0.05M solutions of the complexes in the solvents specified.

Complex	Solvent and Blank.	Concentration
1. $[Ni(bipy)_3]SO_4.6H_2O$	Water	0.05M
2. $[Ni(en)_3]Cl_2.2H2O$	20% en	0.05M
3. $[Ni(NH_3)_6]CI_2$	Aqueous NH_3	0.05M
4. $[Ni(H_2O)_6]SO_4$	Water	0.05M
5. $[Ni(DMSO)_6](ClO_4)_2$	DMSO	0.05M
6. $K4[Ni(NCS)_6]4H_2O$	10M KSCN in water	0.05M

Record the electronic spectrum of each solution in the region 200 – 1100 nm. Calculate Δ values for all six complexes. Arrange the ligands in the spectrochemical series i.e. in the order of increasing Δ.

(c) Estimation of equilibrium constant of the reaction, $Fe^{3+} + SCN^{-} \leftrightarrow FeSCN^{2+}$ with the help of a colorimeter or UV-vis spectrophotometer.

References

1. A.I. Vogel, A Text Book of Quantitative Inorganic Analysis, Longman, 1966.
2. I.M. Koltoff, E.B. Sandell, Text Book of Quantitative Inorganic Analysis, 3rd Edn., Mc Millian, 1968.
3. G. Pass, H. Sutcliffe, Practical Inorganic Chemistry, Chapman & Hall, 1974.
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CH 01 04 06 ORGANIC CHEMISTRY PRACTICAL-2

Credit: 3 **Contact Lab Hours: 54+54=108**

They should be able to apply classroom learning for the preparation of organic compounds by two step synthetic sequences.They should also be capable of applying green alternative methods of synthesis

PART I

Preparation Involving Two step Synthetic Sequences by Chemical Methods

(1) Metanitrobenzoic acid from methyl benzoate

(2) Paranitroaniline from acetanilide

(3) 1,3,5-tribromoaniline from acetanilide

(4) Parabromoaniline from acetanilide

(5) Benzanilide from benzophenone

(6) Schiff's base from aniline

(7) Paracetamol from phenol

(8) Phenol from aniline

(9) Methyl red from anthranilic acid

(10) Para nitrobenzoic acid from toluene

PART II

Spectrophotometric (UV-Vis) estimations of organic compounds (eg:Nitro compounds, azo compounds etc.)

PART III

Preparation Involving Multistep Synthetic Sequences by the Green Alternatives of Chemical Methods

(1) 1,1-bis -2-naphthol from 2-naphthol

(2) Benzopinacol from benzophenone

(3) Benzopinacolone from Benzopinacol

(4) o-Methyl acetanilide from o-toludine

(5) Acetanilide from aniline

PART IV

Microwave assisted Organic Synthesis

(1) Benzoic acid from ethyl benzoate

(2) Benzoic acid from benzyl alcohol

(3) Ethyl-3-nitrobenzoate from 3-nitrobenzoic acid

(4) 2-hydroxychalcone from salicylaldehyde

(5) Anthracene-maleic anhydride adduct

PART V

Prediction of FTIR, UV-Visible, 1H and 13C NMR spectra of the substrates and products at each stage of the products synthesized by the above methods**.**

References

1. A.I. Vogel, A Textbook of Practical Organic Chemistry, Longman,1974.
2. A.I. Vogel, Elementary Practical Organic Chemistry, Longman, 1958.
3. F.G. Mann and B.C Saunders, Practical Organic Chemistry, 4thEdn., Pearson Education India, 2009.
4. J.R. Adams, J.R. Johnson, J.F. Wilcox, Laboratory Experiments in Organic Chemistry, Macmillan, 1979.
5. V.K. Ahluwalia, Green Chemistry: Environmentally Benign Reactions, Ane Books, 2009.
6. Monograph on Green Chemistry Laboratory Experiments, Green Chemistry Task Force Committee, DST, 2009.

CH 01 04 07 PHYSICAL CHEMISTRY PRACTICAL 2

Credit: 3 **Contact Lab Hours: 72+72=144**

Objective of the Course

Analyse and apply the theoretical principles of various branches of physical chemistry whereby class room learning can be transformed to laboratory practice

I. Chemical Kinetics

1. Determination of the rate constant of the hydrolysis of ester by sodium hydroxide
2. Determination of the rate constant of the hydrolysis of ester by acid
3. Kinetics of reaction between $K_2S_2O_8$ and KI.

II Polarimetry

1. Kinetics of the inversion of sucrose in presence of HCl.
2. Determination of the concentration of a sugar solution
3. Determination of the concentration of HCl
4. Determination of the relative strength of acids

III Refractometry

1. Identification of pure organic liquids and oils
2. Determination of molar refractions of pure liquids
3. Determination of concentration of solutions (KCl-Water, Glycerol—water)
4. Determination of molar refraction of solids
5. Study of complex formation between potassium iodide and mercuric iodide system

IV Viscosity

1. Determination of viscosity of pure liquids
2. Verification of Kendalls equation-full experiment
3. Determination of composition of binary liquid mixture (toluene-nitrobenzene)
4. Determination of molecular weight of a polymer (polystyrene in toluene)

V Conductance Measurements

1. Titration of a dibasic acid against strong base
2. Titration of a mixture of acids against a strong base
3. Titration of weak acid vs strong base
4. Verification of Onsagar equation

5. Determination of dissociation constant of a weak acid

VI Potentiometry

1. Titration of strong acid vs strong base
2. Titration of weak acid vs strong base
3. Titration of a mixture of acids against a strong base
4. Application of Henderson equation
5. Determination of single electrode potential (Cu and Zn)

References

1. J.B. Yadav, Advanced Practical Physical Chemistry, Goel Publishing House, 2001.
2. G.W. Garland, J.W. Nibler, D.P. Shoemaker, Experiments in Physical Chemistry, 8th Edn., McGraw Hill, 2009.
3. B. Viswanathan, Practical Physical chemistry, Viva Pub., 2005.

MODEL QUESTION PAPERS

QP Code **Reg. No. …..**

Name ……

M.Sc Degree (C.S.S) Examination

First Semester

Faculty of Science-Chemistry

CH01 Chemistry

CH 50 01 01- Organometallics and Nuclear Chemistry

(Common for all branches of Chemistry)

(2019 admissions onwards)

Time: Three hours Max. Weight: 30

Section- A

(Answer any **eight** questions. Each question carries a weight of 1)

1. What is synergism?

2. Define the term "isolobal".

3. Give an example for a β-elimination reaction.

4. What are Ziegler- Natta catalysts?

5. What is Bohr effect?

6. What is *cis*-platin? What are its important applications?

7. What is radiation polymerisation?

8. How is nuclear reaction cross section related to reaction rate?

9. List the important functions of biological membranes.

10. Give an example for the use of palladium catalysts in the formation of C-N bond.

(8 x 1 = 8)

Section B

(Answer any **six** questions. Each question carries a weight of 2)

11. Discuss the bonding in ferrocene.

12. What are oxidative addition reactions? Discuss the important mechanisms involved in oxidative additions.

13. What is Wilkinson's catalyst? What are its uses? Describe alkene hydrogenation using Wilkinson's catalyst with the help of Tolman catalytic loops.

14. Explain the structure and functions of carbonic anhydrase, carboxypeptidase A and superoxide dismutase.

15. Write a note on the synthesis of transuranic elements.

16. Outline the role of chlorophyll in photosynthesis.

17. What are insertion reactions? Discuss insertion of alkenes and alkynes in the Ar-H bond.

18. Write a note on carbonyl clusters. (**6 x 2 = 12**)

Section C

(Answer any **two** questions. Each question carries a weight of 5.)

19. What are π-bonding ligands? Explain the preparation, properties, structure and bonding of simple mono and binuclear metal carbonyls, metal nitrosyls, metal cyanides and dinitrogen complexes.

20. a) Write a note on carbonylation reactions.

    b) Write a note on asymmetric catalysis. Discuss asymmetric hydrogenation, isomerisation and epoxidation.

21. Discuss oxygen transport mechanism. What are the functions of haemoglobin and myoglobin in oxygen transport?

22. a) Discuss important analytical applications of radioisotopes.

    b) Outline fluxional isomerism of allyl, cyclopentadienyl and allene systems.

(**2 x 5 = 10**)

QP Code: **Reg. No. …..**
Name ……

M .Sc Degree (C.S.S) Examination
First Semester
Faculty of Science-Chemistry
CH01 Chemistry
CH 50 01 02 STRUCTURAL AND MOLECULAR ORGANIC CHEMISTRY
(Common forall branches of Chemistry)
(2019 admissions onwards)

Time: Three hours Max. Weight: 30

Section- A

(Answer any **eight** questions. Each question carries a weight of 1)

1. Explain inductive effect with suitable examples
2. What is meant by 1) chirality 2) diastereoisomers
3. What is meant by topicity? Explain by examples
4. Explain the mechanism of photo Fries rearrangement
5. Give the mathematical form of Hammet equation and explain the terms.
6. What is primary kinetic isotope effect?
7. What type of compounds are named by using the prefixes erythro and threo? Give one example.
8. What is Hammond postulate?
9. Draw the structure of the following molecules
    1. (2R, 3S)-2,3-dichloropentane
    2. S-1-bromo-1-chloropropane
10. Draw the conformations of cyclohexane derivatives.

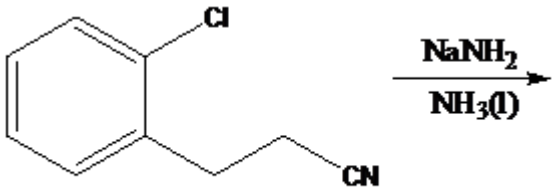
(8 x 1 = 8)

Section B

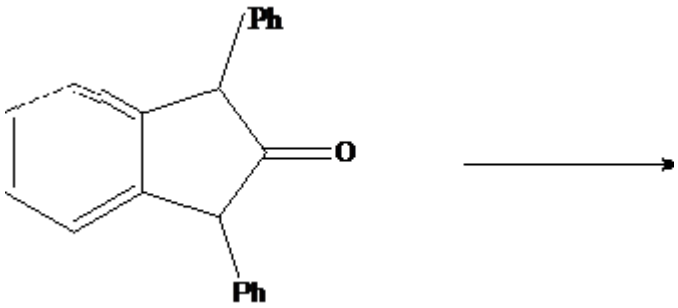
(Answer any **six** questions. Each question carries a weight of 2)

11.Predict the product and explain the mechanism

a)



b)



12.What are the applications of Taft equation in ester hydrolysis?

13.Write a note on Fullerenes and Graphene.

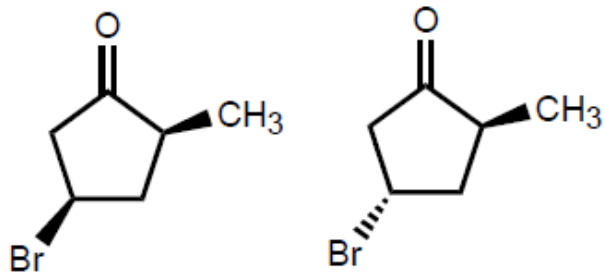
14.What are hard and soft acids? Use HSAB principle to distinguish them

15.Differentiate between kinetic and thermodynamic control of organic reactions.

16.Explain Curtin Hammett principle

17.Explain with example how NMR used to distinguish enantiotopic/ diastereotopic ligands.

18.Is it theoretically possible to separate the pair of compounds below by distillation? Explain briefly.



(**6 x 2 = 12**)

Section C

(Answer any **two** questions. Each question carries a weight of 5.)

19. a) Illustrate the conformational studies of i) Decalin ii) Adamanatane

    b)Explain the mechanism of semipinacolic deamination.

20. How do mesomeric ,hyperconjugative and steric effects influence the strength of organic bases ?

21. Explain the Nucleophilic substitution reactions in aromatic systems

22. Explain in detail about;

    a) Carbon based chiral centers.

    b) N based chiral centers.

    c) S based chiral centers.

(2 x 5 = 10)

QP Code **Reg. No. …..**

Name ……

M. Sc Degree(C.S.S) Examination, 2019

First Semester

Faculty of Science-Chemistry

CH01 Chemistry

CH 50 01 03-Quantum Chemistry and Group Theory

(Common for all branches of Chemistry)

(2019 admissions onwards)

Time: Threehours Max. Weight: 30

Section- A

(Answer any **eight**questions. Each question carries a weight of 1)

1. Predict the point group of (i) glyoxal (ii) cis-$[Co(en)_2Cl_2]^+$
2. Explain what are cyclic groups?
3. What are sub groups? How many sub groups are possible for D_3h?
4. List all the elements of benzene
5. Obtain the inverse of Sn^m,when n is even and m is even/odd
6. What are nodes? How many nodes are there in the plot of radial probability function for a 4p orbital?
7. Given below are the certain wave functions. State which of them are eigen function of d^2/dx^2. If so give the eigen values : a) A+B sin ax; (b) A cos ax (c) Ae^{ax}
8. Define recursion relation
9. What are Ladder operators?
10. Explain the term spherical harmonics. **(8 x 1 = 8)**

Section B

(Answer any**six**questions. Each question carries a weight of 2)

11. Show that L^2 and L_y commute

12. Show that the normalized wave function for a particle in a 3D box with sides of length a, b and c is $\Psi(x,y,z) = (8/abc)^{1/2}$ $(sinnx\Pi x/a)$ $(sinny\Pi y/b)(sinnz\Pi z/c)$ and discuss the degeneracies of the first few energy levels.

13. Explain the postulate of spin by Uhlenbeck and Goudsmith, discovery of spin-Stern Gerlach experiment.
14. Derive an expression for wave equation of particle on a ring
15. Prepare GMT for (i) C_{2h} (ii) C_{3v}
16. Discuss screw axis and glide planes for crystals.
17. Derive the matrix for C_n and hence S_n element.
18. State and explain Great Orthogonality Theorem (**6 x 2 = 12**)

Section C

(Answer any **two** questions. Each question carries a weight of 5.)

19. Construct the character table for C_3v and hence obtain the SALC.
20. Obtain the matrix representations for symmetry elements of NH_3
21. Explain the wave equation in spherical polar coordinates: separation of variables-R, theta and phi equations and their solutions, wave functions and energies of hydrogen-like atoms
22. What are hermite polynomials? How they are used for solving Schrödinger equation for a harmonic oscillator

(**2 x 5 = 10**)

QP Code **Reg. No. …..**

Name ……

M. Sc Degree (C.S.S) Examination, ……

First Semester

Faculty of Science-Chemistry

CH01 Chemistry

CH 50 01 04- THERMODYNAMICS, KINETIC THEORY AND STATISTICAL THERMODYNAMICS

(Common for all branches of chemistry)

(2019 admissions onwards)

Time: Three hours Max. Weight: 30

Section- A

(Answer any **eight** questions. Each question carries a weight of 1)

1. Explain the term fugacity. What is the physical significance of fugacity?
2. What are Maxwell relations? Explain.
3. Explain the term chemical potential? Derive the Gibbs-Duhem equation?
4. Define thermodynamic excess functions. Formulate expression for excess Gibbs free energy.
5. Define mean free path and collision frequency. How do they vary with pressure and temperature?
6. Explain the terms (a) phase space,(b)microstates, (c) macrostates
7. Derive the relation between thermodynamic probability and entropy.
8. Briefly explain the statistical formulations of third law of thermodynamics.
9. What is partition function ? How is it factorised into contributing parts ?
10. Distinguish between Bosons and Fermions**.**

(8 x 1 = 8)

Section B

(Answer any **six** questions. Each question carries a weight of 2)

11. What is meant by thermodynamics of mixing? Derive Gibbs-Duhem- Margules equation.
12. Derive Gibb's –Helmholtz equation. What are it's applications.
13. Derive Maxwell's law of distribution of velocities.
14. Explain Bose-Einstein condensation.

15. Derive Sackur – Tetrode equation applicable to monoatomic gases.
16. The free energy change ΔG accompanying a given process is -85.77 kJ at 25^oC and –83.68 kJ at 35^oC. Calculate the change in enthalpy (ΔH) for the process at 30^oC.
17. Calculate the translational entropy of gaseous iodine at 298K and 1 atm.
18. Calculate the rotational partiton function for hydrogen molecule at 300K. Moment of inertia of hydrogen molecule is $4.59 \times 10^{-47} Kgm^2$ symmetry number $\sigma=2$.

(**6 x 2 = 12**)

Section C

(Answer any **two** questions. Each question carries a weight of 5)

19. What is Nernst heat theorem? Explain the determination of absolute entropies using third law?
20. Discuss about a three component system taking suitable example and give its graphicalrepresentation.
21. (a) Derive an expression for Fermi-Dirac statistics (b) Give comparative account of the three statistics.
22. Derive Debye theory of heat capacity of solids. How does it differ from Einstein theory?

(**2 x 5 = 10**)

QP Code **Reg. No. …..**

Name ……

M Sc Degree (C.S.S) Examination, ……

Second Semester

Faculty of Science-Chemistry

CH01 Chemistry

CH 50 02 01 - COORDINATION CHEMISTRY

(Common for all branches of Chemistry)

(2019 admissions onwards)

Time: Three hours Max. Weight: 30

Section- A

(Answer any **eight** questions. Each question carries a weight of 1)

1. What is chelate effect?
2. What is nephelauxetic effect?
3. Write the term symbol for a d1 configuration.
4. What are the demerits of Orgel diagrams?
5. Give an example for mixed outer and inner sphere reactions.
6. What do you mean by hard and soft ligands?
7. How do 4f orbitals differ from 5f orbitals?
8. Give two applications of organolanthanoid complexes in catalysis.
9. Give an example for the use of coordination compounds as catalysts in asymmetric synthesis.
10. Discuss effect of H+ on the rates of substitution of chelate complexes.

(8 x 1 = 8)

Section B

(Answer any **six** questions. Each question carries a weight of 2)

11. Write a note on the thermodynamic aspects of complex formation.
12. Discuss Jahn Teller effect.
13. Explain trans-effect theory for the substitution reactions in square planar complexes.
14. Sketch the Tanabe-Sugano diagram for [V(H2O)6]3+.
15. a) Discuss geometrical isomerism in octahedral complexes.
    b) Write a note on electronic and steric factors affecting linkage isomerism.
16. Compare the coordination chemistry of lanthanoids and actinoids with special reference to electronic spectra and magnetic properties.
17. Discuss inner sphere and outer sphere mechanisms of electron transfer reactions.
18. Give an account of qualitative treatment for the correlation diagram of d9 system.

(6 x 2 = 12)

Section C

(Answer any **two** questions. Each question carries a weight of 5)

19. Give an account of crystal field theory. Discuss splitting of d orbitals in octahedral, tetrahedral, square planar, square pyramidal and triagonal bipyramidal fields. List the drawbacks of crystal field theory.
20. Give an account of magnetic properties of complexes.
21. Write a note on optical isomerism in octahedral complexes. Describe resolution of optically active complexes and determination of absolute configuration of complexes by ORD and circular dichroism.
22. Give an account of kinetics and mechanism of substitution in octahedral complexes with special reference to dissociative and associative mechanisms, base hydrolysis and solvolytic reactions.

(2 x 5 = 10)

QP Code: **Reg. No. …..**

Name ……

M. Sc Degree (C.S.S) Examination

Second Semester

Faculty of Science-Chemistry

CH01 Chemistry

CH500202- ORGANIC REACTION MECHANISM

(Common for all branches of Chemistry)

(2019 admissions onwards)

Time: Three hours Max. Weight: 30

Section- A

(Answer any **eight** questions. Each question carries a weight of 1)

1. Give one example each for the insertion reaction and addition reaction of carbenes.
2. Distinguish between classical and non-classical carbocations
3. Briefly explain the Woodward Hoffmann rule
4. Write a note on oxymercuration
5. How can you obtain cycloheptanone from cyclohexanone
6. Discuss the regioselectivity of addition reactions with suitable examples.
7. What is Clemmenson reduction. Give mechanism
8. Write down the product and mechanism of the following reaction
9. Discuss Baldwin's rules.
10. What are Grignard reagents? Write down their applications? **(8 x 1 = 8)**

Section B

(Answer any **six** questions. Each question carries a weight of 2)

11. Discuss anti Markovnikov's addition mechanism
12. Identify the reaction and discuss the mechanism of the following reaction
13. Write a note on Mannich reaction
14. Use appropriate reagents and discuss the mechanism of the reaction
15. Give the mechanism and stereochemistry of Diels- Alder reaction
16. Write briefly on Lossen rearrangement
17. What are enolates. Compare them with enamines in synthetic applications
18. Discuss the mechanism of Stobbe condensation and its synthetic applications **(6 x 2 = 12)**

Section C

(Answer any **two** questions. Each question carries a weight of 5)

19. What are carbanions? Discuss their formation, structure and stability. What are their importances as reaction intermediates?
20. Give the mechanism of the following reactions.
    1) Wolf rearrangement 2) Michael addition 3) Cannizaro reaction
    4) Darzen condensation
21. What are the different types of pericyclic reactions? Discuss the importances of pericyclic reactions in organic synthesis.
22. i) How can you generate nitrenes?
    ii) Differentiate between SN1 and SN2 reactions.
    iii) Discuss the mechanism of halolactonisation. **(2 x 5 = 10)**

QP Code **Reg. No. …..**

Name ……

M. Sc Degree(C.S.S) Examination, 2019

Second Semester

Faculty of Science-Chemistry

CH01 Chemistry

CH 50 02 03-CHEMICAL BONDING AND COMPUTATIONAL CHEMISTRY

(Common for all branches of Chemistry)

(2019 admissions onwards)

Time: Three hours Max. Weight: 30

Section- A

(Answer any **eight** questions. Each question carries a weight of 1)

1. What are slater determinants?
2. State and Explain Variation theorem
3. State and explain Non crossing rule in quantum mechanics
4. Explain Hellmann-Feynmann theorem.
5. Find out the characters for all the symmetry operations of NH_3 molecule using Cartesian coordinates.
6. What are the group theoretical selection rules for an electronic transition to be allowed?
7. Explain AMBER.
8. What is CHARMM? Explain its use in molecular mechanics.
9. What is Koopman's Theorem?
10. Write a short note on Independent Electron Approximation **(8 x 1 = 8)**

Section B

(Answer any **six** questions. Each question carries a weight of 2)

11. Illustrate variation theorem using the trial wave function x(a-x) for particle in a one dimensional box
12. Explain Huckelmolecular orbital theory of Butadiene and Benzene
13. Explain how group theory helps to predict optical activity
14. Using Direct Product Tables, predict the electronic transitions of C_2v and C_3v molecules.
15. What are the important assumptions used in HFSCF method ?
16. Explain how to build a Z-matrix?
17. Compare MOT and VBT
18. Explain the Kohn-Sham approach used in DFT? **(6 x 2 = 12)**

Section C

(Answer any **two** questions. Each question carries a weight of 5)

19.How GAMESS is input file prepared? Illustrate with reference to water molecule?

20. Using group theory, derive the allowed electronic transitions in formaldehyde.
21. Explain Perturbation Method? Illustrate with Helium as Example
22. Explain molecular orbital theory and derive an expression for energy and wave function of Hydrogen molecule. **(2 x 5 =10)**

QP Code **Reg. No. …..**

Name ……

M. Sc Degree (C.S.S) Examination, ……

Second Semester

Faculty of Science- Chemistry

CH01 Chemistry

CH 50 02 04–MOLECULAR SPECTROSCOPY

(Common for all branches of Chemistry)

(2019 admissions onwards)

Time: Three Hours Maximum Weight: 30

Section A

Answer any eight questions. Each question carries a weight of 1

1. What is FID and FT in NMR spectroscopy?
2. What is Born Oppenheimer approximation? Explain the cases where the Born Oppenheimer approximation breaks down.
3. What is fermi resonance? Give one example.
4. Explain mutual exclusion principle.
5. Which of the following molecules exhibit pure rotational spectra?HF, NH_3 ,H_2O , CO, CH_4 , BF_3 , CO_2 , F_2 .
6. Differentiate between first order and second order NMR spectra
7. What are fine structure and hyperfine structure in ESR spectrum?
8. What is Resonance Raman Spectrum?
9. What is finger print region in IR?
10. Discuss Frank condon principle. **(8 × 1 =8)**

Section B

(Answer any **six** questions. Each question carries a weight of 2

11. Explain the basic principle of NQR spectroscopy.
12. Give the applications of ESR and Mossbauer methods in spectroscopy
13. Explain the terms chemical shift, coupling constant and factors influencing coupling constant in NMR spectroscopy
14. The first line in the rotational spectrum of NO appears at 1.72 cm^{-1} and its force constant is 1608 Nm^{-1}. Calculate the internuclear distance in A^0, vibrational frequency in cm^{-1} and energy in joules required for J = 3 to 4 rotational transition.

15. The first three vibrational energy of HCl were found to be at 2886, 5668 and 10923 cm^{-1}. Calculate the anharmonicity constant, zero point energy and the equilibrium oscillation frequency. Calculate the centrifugal distoration constant if the rotational constant is 21.18 cm^{-1} .
16. Discuss photoelectron spectroscopy.
17. Explain the various relaxation methods in NMR.
18. What is meant by normal mode of vibration? How many normal modes of vibration do the following molecules have? NH_3 , HCN , SO_2 **(6 × 2 = 12)**

Section C

Answer any two questions. Each question carries a weight of 5

19. Explain the following in NMR spectroscopy
    a) Larmor Precision
    b) Chemical shift and its representation
    c) Magic angle spinning
20. Explain the classical theory of Raman spectroscopy.
21. Discuss the theory and applications of NQR Spectroscopy.
22. Write note on:
    a) Resonance fluorescence
    b) Predissociation
    c)Mechanism of Laser action
    d) Polarized and depolarized Raman lines **(5 × 2 = 10)**

QP Code **Reg. No. …..**

Name ……

M. Sc Degree (C.S.S) Examination, ……

Third Semester

Faculty of Science –Chemistry

CH01 Chemistry

CH 50 03 01 -STRUCTURAL INORGANIC CHEMISTRY

(Common for Chemistry/Analytical Chemistry/PolymerChemistry)

(2019 admissions onwards)

Time: Three hours Max. Weight: 30

Section- A

(Answer any **eight** questions. Each question carries a weight of 1)

1. Give an account of wurzite structure.
2. What are Cooper pairs?
3. What are the important applications of poly(ferrocenylsilane)s?
4. How is silica glass prepared?
5. Give an account of the applications of magnetic nanoparticles in MRI.
6. Write a short note on organometallic dendrimers.
7. What are the important medical applications of boron clusters?
8. What are one dimensional conductors?
9. Write a short note on the super conductivity of fullerenes.
10. Give one example each forcatenation and heterocatenation. **(8 x 1 = 8)**

Section B

(Answer any **six** questions. Each question carries a weight of 2)

11. Give an account of spinel and inverse spinal structures.
12. Write a note on free electron theory of solids.
13. Outline the magnetic properties of spinels, ilmenites and perovskites.
14. Write a note on heteropoly acids of Mo and W.
15. Discuss the structure and bonding in sulphur-nitrogen compounds.
16. Give an account of the preparation, structure and bonding in cages and clusters of germanium and tin.
17. Write a note on polymers based on ferrocene. List their applications.
18. Explain different methods for the preparation of thin films. **(6 x 2 = 12)**

Section C

(Answer any **two** questions. Each question carries a weight of 5)

19. Give an account of phase transitions in solids. Discuss different types of phase transitions and kinetics of phase transitions.
20. Explain band theory of solids. Discuss applications of band theory to transition metal compounds and compounds like NaCl, MgO and fullerenes. Outline the mechanism of intrinsic and extrinsic semiconductors.

21. a) Give an account of the synthesis, structure and applications of silicones and zeolites.
    b) Discuss the preparation, properties and structures of cage like structure of phosphorous and cages of boron with aluminium and indium.
22. a) Give an account of the applications of magnetic nanoparticles.
    b) What are type I and type II superconductors? Discuss BCS theory of superconductivity. **(2 x 5 = 10)**

QP Code **Reg. No. …..**

Name ……

M. Sc Degree (C.S.S) Examination,……

Third Semester

Faculty of Science – Chemistry

CH01 Chemistry

CH 50 03 02 - ORGANIC SYNTHESES

(Common for Chemistry/Analytical Chemistry)

(2019 admissions onwards)

Time: 3 hours Max. Weight: 30

Section- A

(Answer any **eight** questions. Each question carries a weight of 1)

1. What are the important uses of (1)DDQ and (2)DCC
2. Define Pauson-Khand reaction with example
3. Give one application of Baker's yeast in organic synthesis
4. Give the importance of amino protection in peptide synthesis
5. What is Passerini reaction? Give its mechanism
6. Give an example for Huisgen 1,3-dipolar addition
7. Give one example for ring closing metathesis using Grubb's catalyst.
8. How oxetanes can be produced photochemically? Explain with example
9. Describe Shi epoxidation? What are its applications?
10. Give an example for Sarrett oxidation with example? **(8 x 1 = 8)**

Section B

(Answer any **six** questions. Each question carries a weight of 2)

11. Explain how Wilkinson's catalyst and Nickel catalyst helps in catalytic hydrogenation ,starting its mechanism of action
12. Explain the following reactions using suitable examples: (a) Nef reaction (b) Tishchenko reaction
13. Give the synthetic utility of Gilmann reagent in organic synthesis
14. Write notes on (a) Cation –Olefin cyclization(b) Radical –Olefin cyclization
15. Briefly explain the retrosynthesis of D-luciferin
16. Discuss the synthetic utility of trialkylstannane in organic synthesis

17. Explain the mechanism of the following reactions(a) Brook rearrangement(b) Ireland-Claisen rearrangement
18. Discuss the relevant protecting groups used in Peptide synthesis with examples

(6 x 2 = 12)

Section C

(Answer any **two** questions. Each question carries a weight of 5.)

19. Give an account of the chemoselectivity in metal hydride reductions with special references to (1) $NaCNBH_3$ (2) DIBAL-H (3) Red-Al (4) LiAlH4
20. How are the following heterocyclic compounds synthesized? (a) Oxazole (b) Imidazole (c) Thiophene (d) Pyrrole
21. Describe the synthetic utility of the following reactions: (a) Moffatt –Pfitzner oxidation
    (b) Hydroboration
    (c) Sarrett oxidation
    (d) TebbeOlefination
22. Write notes on the metal mediated C-C and C-X coupling reactions coupling reactions with special reference to :
    (a) Suzuki-Miyaura coupling
    (b) Sonogashira coupling
    (c)Heck coupling
    (d) Glaser coupling (**2 x 5 = 10**)

QP Code **Reg. No. …..**

Name ……

M. Sc Degree (C.S.S) Examination, ……

Third Semester

Faculty of Science- Chemistry

CH01 Chemistry

CH 50 03 04–SPECTROSCOPIC METHODS IN CHEMISTRY

(Common for all branches of Chemistry)

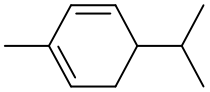
(2019 admissions onwards)

Time: Three hours Max. Weight: 30

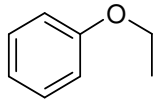
Section- A

(Answer any **eight** questions. Each question carries a weight of 1)

1. Calculate the λ_{max} for the compound



2. Which of the following isomers of pentadiene will show the largest wavelength of UV absorption? Give reason.
   i) CH_2=CH-CH=CH-CH_3 ii) CH_2=CH-CH_2-CH=CH_2
3. 2-Hydroxy-3-nitroacetophenone shows two carbonyl stretching frequencies at 1692 and 1658 cm^{-1}. Explain.
4. C-H stretching frequency increases from alkane → alkene → alkyne. Explain.
5. Show the formation of the peak at m/z = 94 in the mass spectrum of



6. Predict the number of signals and sketch the NMR spectrum of CH_3-O-CH_2-CH_2-Cl.
7. What are shift reagents in NMR spectroscopy? Explain.
8. How NMR spectroscopy is useful in distinguishing cis-stilbene and trans-stilbene?
9. Explain off resonance decoupling.
10. Explain the spin notation A_2X_3 in NMR spectroscopy with example. **(8 × 1 =8)**

Section B

(Answer any **six** questions. Each question carries a weight of 2)

11. Explain the exchange phenomenon in ^{1}H NMR.
12. Discuss the effect of concentration on vibrational stretching frequency of methyl salicylate and ethanol.

13. A compound with molecular formula $C_4H_8O_3$ gave the following spectral data. Deduce the structure.

IR: 1120, 1705 cm^{-1}

^1H NMR: δ 12.1(1H, s), 4.15(2H, s), 3.6(2H, q, J = 7 Hz) and 1.3(3H, t, J = 7 Hz) ppm

14. Write a note on HRMS and MS-MS.

15. Explain McLafferty rearrangement.

16. Discuss the technique - spectral editing based on DEPT.

17. Briefly explain cross polarization and selective population inversion in NMR spectroscopy.

18. A compound 'A' with molecular formula C_5H_{10} on ozonolysis gives 'B', C_4H_8O, as one of the products. The IR spectrum of B showed a band at 1720 cm^{-1} and the NMR spectrum showed three signals at δ values 0.9 (3H, t), 3.4 (2H, q) and 2.2 (3H, s). What are A and B? Explain. **(6 × 2 = 12)**

Section C

(Answer any **two** questions. Each question carries a weight of 5)

19. Describe the following

a) FAB b) MALDI c) Field desorption d) TOF e) Cyclotron

20. Predict the structure of the compound (MF $C_{11}H_{20}O_4$) which gave the following spectral data.

UV – No λ_{max} above 200 nm IR: 1740 cm^{-1}.

^{1}HNMR: δ 4.2 (4H, q), 3.3 (1H, t), 1.9 (2H, q), 1.33 (4H, m), 1.27 (6H, t) and 0.9 (3H, t) ppm.

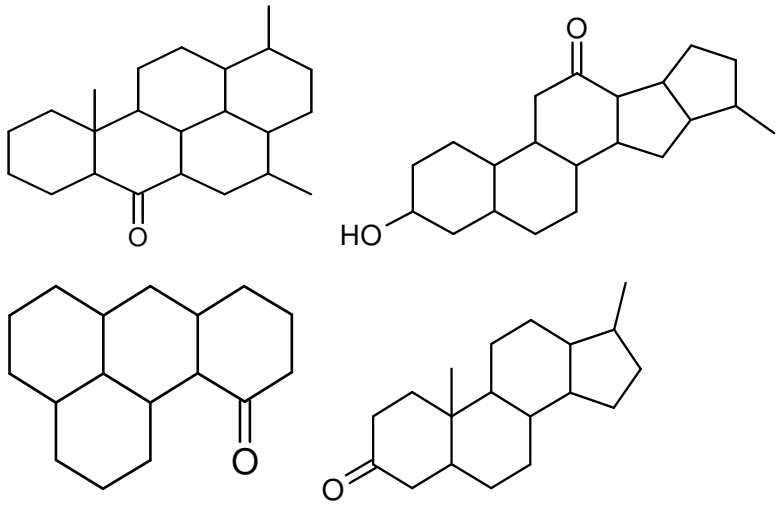
^{13}C NMR: δ 14.10, 13.81, 22.4, 28.5, 29.5, 52.0, 61.1 and 169.3 ppm.

Mass: m/z 216 ($M^{+\cdot}$), 171, 160 (100%), 133 and 115.

21. (a). Explain the magnetic anisotropy in carbonyl compounds and acetylene.

(b). Define spin – spin coupling. Explain spin-spin coupling in the spin systems AX_2, AMX and ABC with examples.

22. Discuss Octant rule. Draw the octants for the following compounds and predict the sign of their optical activity.



(5 × 2 = 10)

QP Code **Reg. No. …..**

Name ……

M. Sc Degree (C.S.S) Examination, ……

Third Semester

Faculty of Science - Chemistry

CH01 Chemistry

CH010303-CHEMICAL KINETICS, SURFACE CHEMISTRY AND CRYSTALLOGRAPHY

(2019 admission onwards)

Time: 3hrs Max. Weight: 30

Section A

(Answer any **eight** questions. Each question carries a weight of 1)

1. What do you mean by branching chain reactions?
2. Distinguish between general and specific H+ ion catalysis
3. What is structure factor? Explain its significance.
4. Define reciprocal lattice. What is its significance?
5. What are Miller Indices? How are they determined?
6. What is potential energy surface? Explain its significance.
7. Define Zeta potential.
8. What are oscillating chemical reactions? Give one example.
9. Explain the principle of SEM.
10. What is steady state approximation? **(8 × 1 = 8)**

Section B

(Answer any **six** questions. Each question carries a weight of 2)

BUNCH 1 (Short Essay Type)

11. Explain the principle of Surface Enhanced Raman Spectroscopy.
12. Explain the Rice Herzfeld mechanism of organic decomposition reactions of acetaldehyde with special reference to Gold finger, Niclause and Letort rule.
13. Explain the Lotka- Volterra mechanism of oscillating chemical reactions.
14. Briefly describe the methods of characterising crystal structure.

BUNCH 2 (Problem Type)

15. 150 ml of N2 (1atm pressure at 0 0C) was required to form a monolayer on the surface of silica gel. Calculate the surface area of the solid. The cross- sectional area of N2 is 0.162 (nm)2 .

16. For the first order isomerisation of an organic compound at 130 0 C, the activation energy is 108.4 KJ/mol and the specific reaction rate is 9.12x 10 -4 sec -1. Calculate the standard entropy of activation and standard enthalpy of activation.

17. The enzyme catalysed conversion of a substance at 25^{o}C has a Michealis constant of 0.042 mol L^{-1}. The rate of reaction is 2.45mol L^{-1} s^{-1} when the substrate concentration is 0.890 mol L^{-1}. What is the maximum velocity of the enzymolysis.

18. For a homogeneous reaction the rate constants are 3.0 x 10 -5 Lmol s-1 and 1.2 x 10 -3 Lmol s-1 at 629K and & 00 K respectively. Calculate the energy of activation and frequency parameter. **(6 × 2 = 12)**

Section C

(Answer any **two** questions. Each question carries a weight of 5)

19. (a) Describe how the limitations of Lindemann theory of unimolecular reaction is overcome by Hinshelwood and RRK modification.

    (b) Compare transition state theory with collision theory.

20. (a) Explain the rotating crystal method for the X-ray diffraction studies of crystals.

    (b) Explain the Eley-Rideal mechanism for the bimolecular reaction on the surface of solids.

21. Derive the BET adsorption isotherm. Show that it approximates to Langmuir adsorption isotherm under limiting conditions.

22. Describe the Semenov-Hinshelwood theory of branching chain reaction. Explain the lower and upper explosion limits with respect to the kinetic expression.

(2 × 5 = 10)

QP code **Reg.No:**

Name:

M.Sc Degree (CSS) Examination....

Fourth Semester

Faculty of Science - Chemistry

CH01 Chemistry

CH 80 04 01- ADVANCED INORGANIC CHEMISTRY

(2019 admission onwards)

Time: 3hrs Max. Weight: 30

Section A

(Answer any **eight** questions. Each question carries a weight of 1)

1. What is photochromism?

2. What are metal complex sensitizers? Give an example.

3. What are the important biological sensing applications of silicon nanoparticles?

4. What are quantum dots?

5. Give two examples for non-silicon semiconductors used as light emitting diodes.

6. List important applications of metal organic frameworks in pharmaceutical industry.

7. Explain the term supramolecular self-assembly.

8. Write a method for the synthesis of gold nanoparticles.

9. What is combinatorial synthesis?

10. Write two applications of inorganic nanotubes. **(8 x 1 = 8)**

Section B

(Answer any **six** questions. Each question carries a weight of 2)

11. Discuss the splitting of d orbitals in different environments using group theoretical considerations.

12. Write a note on the applications of Mössbauer spectroscopy.

13. Discuss photochemical substitution and redox reactions of Cr(III), Co(III), Rh(III) and Ru(II) complexes.

14. Give an account of different types of nanocomposites.

15. Outline mechanical properties and applications of ceramic structures and properties and applications of refractories.

16. What are the different types of metal organic frameworks? Write a note on the design of metal organic frameworks.

17. Discuss supramolecular self-assembly caused by hydrogen bonds and ionic interactions.

18. Explain various synthetic strategies for inorganic material design. **(6 x 2 = 12)**

Section C

(Answer any **two** questions. Each question carries a weight of 5)

19. Construct symmetry adapted linear combination of atomic orbitals for ferrocene. Sketch the MO diagram for ferrocene.

20. What are the applications of EPR spectroscopy? Give an account of EPR of d1 and d9 transition metal ions in cubic and tetragonal ligand fields. Discuss electron-electron interactions and multiple resonance.

21. Discuss various characterisation techniques for Nanomaterials: UV-visible, Raman, XRD, SEM, TEM and AFM techniques.

22. a) What are inorganic supermolecules? Discuss various synthetic strategies for inorganic super molecules and coordination polymers.

    b) Explain the determination of vibrational modes using character tables in tetrahedral complexes.

(2 x 5 = 10)

QP code **Reg.No:**

Name:

M. Sc Degree (C.S.S) Examination, ……

Fourth Semester

Faculty of Science – Chemistry

CH01 Chemistry

CH 80 04 02- ADVANCED ORGANIC CHEMISTRY

(2019 admissions onwards)

Time: Three hours Max. Weight: 30

Section- A

(Answer any **eight** questions. Each question carries a weight of 1)

1. Why microwave energy is used in organic synthesis
2. Define supramolecular chemistry? Which molecular interaction form its basis?
3. Give the structure of PGE2 and PGF2α.
4. How dendrimers are classified
5. Explain Assymetric aldol condensation pioneered by Evans
6. Explain the human genome project
7. Which are the major sections in research paper?
8. What are Rhodopsin?
9. Describe the photochemical reduction of benzophenone to benzopinacol
10. Explain the different sources of chemical literature? **(8 x 1 = 8)**

Section B

(Answer any **six** questions. Each question carries a weight of 2)

11. Explain the Enatioseletive synthesis of Corey lactone
12. Explain the Biomimetic synthesis of progesterone
13. Which are the different types of Research?
14. Write notes on (a) Cyclophanes(b) Cyclodextrin
15. What are the alternative (1) energy sources and (2) reaction media recommended currently on the basis of green chemistry principle?

16. Explain the synthesis of Ibuprofen by Green alternatives

17. Explain the different forces involved in molecular recognition

18. Write a note on the mode of action of (1) Warfarin (2) Chloroquin **(6 x 2 = 12)**

Section C

(Answer any **two** questions. Each question carries a weight of 5)

19. Explain the synthesis of (1) Papaverine (2) βCarotene

20. Explain the significance of 12 principles in green chemistry?

21. Explain the general principle involved in (a) Sonochemical synthesis

    (b) Microwave assisted synthesis, with suitable examples

22. Write notes on

    (a) Antibiotics

    (b) Drugs for cancer

    (c)Replication of DNA

    (d) Transcription and Translation **(2 x 5 = 10)**

QP Code **Reg.No:**

Name:

M.Sc. DEGREE (C.S.S) EXAMINATION.....

Fourth semester

Faculty of Science – Chemistry

CH01 Chemistry

CH 80 04 03-ADVANCED PHYSICAL CHEMISTRY

(2019 admission onwards)

Time: Three hours Max.Weight:30

Section A

(Answer any **eight** questions. Each question carries a weight of **1)**

1. What is the principle of Atomic Absorption Spectroscopy?
2. Explain the role of ATP in bioenergetics.
3. What are Onsager relations? Explain
4. Write down the Wierls equation and explain the terms.
5. What is half wave potential? Explain its significance
6. Define quantum yield. How is it determined?
7. Distinguish between excimers and exciplexes.
8. Write Stern-Volmer equation. Explain its significance.
9. What is the principle of amperometry.
10. What are fuel cells? Explain with an example. **(8 × 1 = 8)**

Section B

(Answer any **six** questions. Each question carries a weight of 2**)**

11. Explain briefly the theory of over voltage.

12. Write a note on Novel fluorephores.

13. What are the advantages of coulometry.

14. Explain Drude –Nernst electrostriction model.

15. Explain the principle and working of solar cells.

16. In an experiment to measure the quantum efficiency of a photochemical reaction, the absorbing substance was exposed to 490nm light from a 100 W source for 45 minutes. The intensity of transmitted light was 40% of the intensity of the incident light. As a result of irradiation, 0.344 mol of the absorbing substance decomposed. Determine the quantum efficiency.

17. In a photochemical reaction $A \rightarrow 2B + C$, the quantum efficiency with 500nm light is 2.1×10^{2} mol Einstein^{-1}. After exposure of 300 m mol of A to the light, 2.28m mol of B was formed. How many photons were absorbed by A.

18. Calculate the mean ionic activity coefficient of 0.01 molal $CaCl_2$ solution."A" value in Debye- Huckel equation is 0.509. **(6 × 2 = 12)**

Section C

(Answer any **two** questions. Each question carries a weight of **5)**

19. Derive Debye- Huckel- Onsager equation. What are its drawbacks?

20. Discuss the polarographic method of chemical analysis.

21. Using the principle of microscopic reversibility show that the cross coefficients are equal.

22. Derive the Butler- Volmer equation. **(2 × 5 = 10)**

DEPARTMENT OF CHEMISTRY

TIME TABLE ODD SEMESTER

MSC CHEMISTRY

1st SEM	1	2	3	4	5
MONDAY	CHEMISTRY (NOUFIYA)	CHEMISTRY (GEORGINA)	CHEMISTRY (JERLY)	CHEMISTRY (VIDYA)	CHEMISTRY (REKHA)
TUESDAY	CHEMISTRY (REKHA)	CHEMISTRY (VIDYA)	CHEMISTRY (JERLY)	CHEMISTRY (NOUFIYA)	CHEMISTRY (GEORGINA)
WEDNESDAY	CHEMISTRY (GEORGINA)	CHEMISTRY (NOUFIYA)	CHEMISTRY (JERLY)	CHEMISTRY (REKHA)	CHEMISTRY (VIDYA)
THURSDAY	CHEMISTRY (JERLY)	CHEMISTRY (JERLY)	CHEMISTRY LAB (VIDYA & GEORGINA)		
FRIDAY	CHEMISTRY (JERLY)	CHEMISTRY (JERLY)	CHEMISTRY LAB (NOUFIYA & REHKA)		
3rd SEM	**1**	**2**	**3**	**4**	**5**
MONDAY	CHEMISTRY (JERLY)	CHEMISTRY (JERLY)		CHEMISTRY LAB (VIDYA & NOUFIYA)	
TUESDAY	CHEMISTRY (JERLY)	CHEMISTRY (JERLY)	CHEMISTRY LAB (GEORGINA & REHKA)		
WEDNESDAY	CHEMISTRY (JERLY)	CHEMISTRY (JERLY)	CHEMISTRY (VIDYA)	CHEMISTRY (NOUFIYA)	CHEMISTRY (GEORGINA)
THURSDAY	CHEMISTRY (NOUFIYA)	CHEMISTRY (GEORGINA)	CHEMISTRY (JERLY)	CHEMISTRY (REKHA)	CHEMISTRY (VIDYA)
FRIDAY	CHEMISTRY (VIDYA)	CHEMISTRY (REKHA)	CHEMISTRY (JERLY)	CHEMISTRY (GEORGINA)	CHEMISTRY (NOUFIYA)

DEPARTMENT OF CHEMISTRY

TIME TABLE EVEN SEMESTER

MSC CHEMISTRY

2nd SEM	1	2	3	4	5
MONDAY	CHEMISTRY (NOUFIYA)	CHEMISTRY (GEORGINA)	CHEMISTRY (JERLY)	CHEMISTRY (VIDYA)	CHEMISTRY (REKHA)
TUESDAY	CHEMISTRY (REKHA)	CHEMISTRY (VIDYA)	CHEMISTRY (JERLY)	CHEMISTRY (NOUFIYA)	CHEMISTRY (GEORGINA)
WEDNESDAY	CHEMISTRY (GEORGINA)	CHEMISTRY (NOUFIYA)	CHEMISTRY (JERLY)	CHEMISTRY (REKHA)	CHEMISTRY (VIDYA)
THURSDAY	CHEMISTRY (JERLY)	CHEMISTRY (JERLY)	CHEMISTRY LAB (VIDYA & GEORGINA)		

FRIDAY	CHEMISTRY (JERLY)	CHEMISTRY (JERLY)	CHEMISTRY LAB (NOUFIYA & REKHA)		
4th SEM	**1**	**2**	**3**	**4**	**5**
MONDAY	CHEMISTRY (JERLY)	CHEMISTRY (JERLY)	CHEMISTRY LAB (VIDYA & NOUFIYA)		
TUESDAY	CHEMISTRY (JERLY)	CHEMISTRY (JERLY)	CHEMISTRY LAB (GEORGINA & REKHA)		
WEDNESDAY	CHEMISTRY (JERLY)	CHEMISTRY (JERLY)	CHEMISTRY (VIDYA)	CHEMISTRY (NOUFIYA)	CHEMISTRY (GEORGINA)
THURSDAY	CHEMISTRY (NOUFIYA)	CHEMISTRY (GEORGINA)	CHEMISTRY (JERLY)	CHEMISTRY (REKHA)	CHEMISTRY (VIDYA)
FRIDAY	CHEMISTRY (VIDYA)	CHEMISTRY (REKHA)	CHEMISTRY (JERLY)	CHEMISTRY (GEORGINA)	CHEMISTRY (NOUFIYA)

Mahatma Gandhi University, Kottayam

PRIYADARSHINI HILLS, KOTTAYAM-686560

B.Sc Chemistry (CBCSS) Syllabus

Prepared by

Board of Studies (UG) in Chemistry

&

Faculty of Science

May 2017

CONTENTS

	Page No.
Introduction	5
Aims and Objectives	6
Programme Structure	11
B.Sc. Chemistry Programme (Model - I)	11
B.Sc. Chemistry - Vocational (Model –II)	13
B.Sc Chemistry – Petrochemicals (Model –III)	15
Syllabus	17
B.Sc. Chemistry Core Courses	18
Chemistry Complementary Courses	62
B.Sc. Chemistry - Vocational (Model –II)	77
B.Sc. Chemistry – Petrochemicals (Model –III)	91
Model Question Papers	
B.Sc. Chemistry Core Courses	
Chemistry Complementary Physical Sciences	
Chemistry Complementary Life Sciences	
B.Sc. Chemistry - Vocational (Model –II)	
B.Sc. Chemistry – Petrochemicals (Model –III)	

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Mahatma Gandhi University, Kottayam

May 2017

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I express my profound gratitude to the Honorable Vice Chancellor, Pro-Vice Chancellor, Registrar, Members of the Syndicate and the Academic Council for their leadership and guidance for making this endeavor a great success. Each of the members of the Faculty of Science, and Board of Studies (UG) in Chemistry of Mahatma Gandhi University has provided me extensive personal and professional support during the work of restructuring this syllabus. I place on record my wholehearted gratitude to all the members of the **Faculty of Science** and **BOS (UG) in Chemistry**. I would like to thank the staff of Mahatma Gandhi University, the Academic Section in particular, for their help and support. With immense pleasure and gratitude I remember the untiring support rendered by the faculty members of Chemistry from various Colleges of Mahatma Gandhi University who worked hard in preparing this restructured syllabus and curriculum for the UG students of Mahatma Gandhi University. I also place on record the help and support given by the academic community and all other stake holders.

Dean, Faculty of Science

Mahatma Gandhi University

Priyadarsini Hills

May 03, 2017

1. INTRODUCTION

Mahatma Gandhi University introduced choice based credit and semester and Grading System in colleges affiliated to the University from the Academic year 2009- 2010, under **Direct Grading System**. Subsequently, the Kerala State Higher Education Council constituted a committee of experts headed by Prof. B. Hridayakumari, to study and make recommendations for the improvement of the working of the Choice Based Credit and Semester System in Colleges affiliated to the Universities in the State. The State Government accepted the recommendations of the Committee and the Syndicate and the Academic Council of the Mahatma Gandhi University have resolved to reform the existing CBCSS regulations. Accordingly, REGULATIONS FOR UNDER GRADUATE PROGRAMMES UNDER CHOICE BASED COURSE-CREDIT-SEMESTER SYSTEM AND GRADING, 2013 was introduced in the University from the Academic year 2013-14 onwards, under **Indirect Grading System.** The University Grants Commission, in order to facilitate student mobility across institutions within and across countries and also to enable potential employers to assess the performance of students, insisted to introduce uniform grading system in the Universities. The Academic Council of the Mahatma Gandhi University at its meeting held on 23rd May 2015 resolved to introduce the UGC Guidelines for Choice Based Credit Semester System from the Academic year 2016-17 onwards and the syndicate of the University at its meeting held on 1st August 2015 approved the resolution of the Academic Council. Meanwhile, the Hon'ble Supreme Court of India has issued orders to include core courses on Environmental Studies and Human Rights in the syllabi and curricula of all UG Progammes of universities all over India. In continuation to this the University Grants Commission has issued circulars regarding the implementation of the above said changes by accepting the directions of the Hon'ble Supreme Court as a National Policy. Hence, the Syndicate of Mahatma Gandhi University has decided to modify the syllabi and curricula of all UG programmes in accordance with the directions of the Hon'ble Supreme Court and the UGC. Further, the Syndicate has decided to implement the new regulations and syllabi with effect from the academic year 2017-2018. In view of this, the BOS – Chemistry (UG) and the Faculty of Science of MG University have prepared the following syllabus for UG programmes in Chemistry.

2. TITLE

B.Sc CHEMISTRY PROGRAMME - Graduate Programmes under Choice Based Credit System, **2017**" (UGCBCSS 2017).

3. SCOPE

3.1 Applicable to all regular Under Graduate Programmes conducted by the University with effect from 2017 admissions, except for Professional and B.Voc programmes. Also applicable to Distance/Private Undergraduate Programmes with suitable modifications. Under Graduate Programmes in Management Studies are included as non-professional programmes. Provided that the existing CBCSS Regulations 2013 shall be applicable to students who were admitted prior to the commencement of these Regulations and who are continuing their studies.

3.2 Examinations of the courses being run under the Distance/Private registration scheme shall be conducted annually.

3.3 The provisions herein supersede all the existing regulations for the Regular/Distance/Private Undergraduate programmes to the extent herein prescribed.

4. AIMS AND OBJECTIVES OF THE PROGRAMME

4.1 AIMS

The Facuty of Science, Mahatma Gandhi University and Board of Studies in Chemistry (UG) recognizes that curriculum, course content and assessment of scholastic achievement play complementary roles in shaping education. The committee is of the view that assessment should support and encourage the broad instructional goals such as basic knowledge of the discipline of Chemistry including theories and techniques, concepts and general principles. This should also support the ability to ask physical questions and to obtain solutions to physical questions by use of qualitative and quantitative reasoning and by experimental investigation. The important student attributes including keen observation, curiosity, creativity and reasoned skepticism and understanding links of Chemistry to other disciplines and to societal issues should be given encouragement. With this in mind, we aim to provide a firm foundation in every aspect of Chemistry and to explain a broad spectrum of modern trends in chemistry and to develop experimental, computational and mathematics skills of students.

The programme also aims to develop the following abilities:

1. Read, understand and interpret chemical information – verbal, mathematical and graphical.
2. Impart skills required to gather information from resources and use them.
3. To give need based education in chemistry of the highest quality at the undergraduate level.
4. Offer courses to the choice of the students.
5. Perform experiments and interpret the results of observation.
6. Provide an intellectually stimulating environment to develop skills and enthusiasms of students to the best of their potential.
7. Use Information Communication Technology to gather knowledge at will.
8. Attract outstanding students from all backgrounds.

4.2 OBJECTIVES

The syllabi are framed in such a way that it bridges the gap between the plus two and post graduate levels of Chemistry by providing a more complete and logical framework in almost all areas of basic Chemistry.

5. COURSE DESIGN

The U.G.programme in Chemistry must include (a) Common courses, (b) Core courses, (c) Complementary Courses, (d) Choice based courses (e) open courses and (f) Project, Industrial Visit (I.V.) and Comprehensive viva - voce. No course shall carry more than 4 credits. The student shall select any one open course in Sem V offered by the Departments which offers the core courses or physical education department, depending on the availability of infrastructure facilities, in the institution. The number of Courses for the restructured programme should contain 12 compulsory core courses,1 open course,1 choice based course from the frontier area of the core courses, 6 core practicals,1 project & I.V. in the area of core,
8 complementary courses, 2 complementary practicals otherwise specified, from the relevant subjects for complementing the core of study. There should be 10 common courses, or otherwise specified, which includes the first and second language of study.

6. B.Sc PROGRAMME IN CHEMISTRY

6.1. PROGRAMME STRUCTURE

(i) MODEL I B.Sc CHEMISTRY

A	**Programme Duration**	**6 Semesters**
B	Total Credits required for successful completion of the Programme	120
C	Credits required from Common Course I	22
D	Credits required from Common Course II	16
E	Credits required from Core course and Complementary courses including Project	79
F	Open Course	3
G	Minimum attendance required	75%

(ii) MODEL II B.Sc CHEMISTRY

A	**Programme Duration**	**6 Semesters**
B	Total Credits required for successful completion of the Programme	120
C	Credits required from Common Course I	16
D	Credits required from Common Course II	8
E	Credits required from Core + Complementary + Vocational Courses including Project	93
F	Open Course	3
G	Minimum attendance required	75%

(iii) MODEL III B.Sc CHEMISTRY

A	**Programme Duration**	**6 Semesters**
B	Total Credits required for successful completion of the Programme	120
C	Credits required from Common Course I	8
D	Credits required from Core + Complementary + Vocational Courses including Project	109
e	Open Course	3
f	Minimum attendance required	75%

6.2. COURSES

There shall be three different types (models) of courses in Chemistry programme. The programme (Model I) consists of common courses with 38 credits, core course, Choice based course, and complementary courses with 79 credits and open course with 3 credits. The programme (Vocational -Model II) consists of common courses with 24 credits, core courses; Choice based courses, and complementary courses with 93 credits and open course with 3 credits. The programme (Model III) consists of common courses with 8 credits, core, Choice based course and complementary courses with 109 credits and open course with 3 credits.

6.3 SCHEME OF COURSES

The different types of courses and its number are as the following:

Model- I		**Model- II**		**Model- III**	
Courses	***No.***	***Courses***	***No.***	***Courses***	***No.***
Common Courses	10	Common Courses	6	Common Courses	2
Core Courses (Theory)	12	Core Courses (Theory)	12	Core Courses (Theory)	12
Project, Industrial Visit. and Comprehensive viva-voce	1	Project, Industrial Visit. and Comprehensive viva-voce	1	Project, Industrial Visit. and Comprehensive viva-voce	1
Core practical	6	Core Practical	6	First Core practical	6
Open Course	1	Open Course	1	Open Course	1
Choice based Course	1	Choice based Course	1	Choice based Course	1
		Vocational courses	6	Second core Courses	6
		Vocational practical	3	Second Core practical	2
		OJT	1	OJT	1
Complementary Courses	10	Complementary Courses	4	Complementary Courses	8
		Complementary practical	2	Complementary practical	2
Total	**41**	**Total**	**43**	**Total**	**42**

6.4. COURSE CODE

Every course in the programme should be coded with an eight digit alphanumeric code according to the following criteria. The first two letters of the code indicates the name of programme i.e. CH for Chemistry. One digit to indicate the semester. ie., CH1 (Chemistry, 1st semester). Two letters form the type of courses such as, CC for common courses, CR for core course, VO for vocational course, CM for Complementary courses, OP for Open Course,

CB for Choice based core, OJ for On the Job Training, OC for Optional Core, PR for project ie.., CH1CR (Chemistry,1st semester Core course). The letter T may be used to denote theory paper and the letter P may be used to denote practical papers. Two digits to indicate the paper's relative position in the programme, i.e., CH5CRT06 (Chemistry, 5th semester, Core course, Theory, sixth paper).

6.5. COURSES WITH CREDITS

Courses with Credits of different courses and scheme of examinations of the programme is the following:

Courses	**Credits**		
	Model I	**Model II**	**Model III**
Core Courses	46	46	46
Open Course	3	3	3
Choice Based Core	3	3	3
Project, I.V. & Viva	2	2	2
Vocational Courses	Nil	24	Nil
OJT	-	2	2
2nd Core Courses	Nil	Nil	24
Total	**54**	**80**	**80**
Complementary Courses I	14	16	16
Complementary Courses II	14	Nil	16
Total	**28**	**16**	**32**
Common Courses	38	24	8
Total	**38**	**24**	**8**
Grand Total	**120**	**120**	**120**

6.6. SCHEME OF DISTRIBUTION OF INSTRUCTIONAL HOURS FOR CORE COURSES

Semester	**Model I**		**Model II**		**Model III**	
	Theory	**Practical**	**Theory**	**Practical**	**Theory**	**Practical**
First	2	2	6	4	6	4
Second	2	2	6	4	6	4
Third	3	2	9	6	10	4
Fourth	3	2	9	6	10	4
Fifth	15	10	15	10	15	10
Sixth	15	10	15	10	15	10

7. DURATION OF COURSE

The duration of U.G. Programmes shall be **6 semesters**.

A student may be permitted to complete the programme, on valid reasons, within a period of 12 continuous semesters from the date of commencement of the first semester of the programme.

Attendance: Students having a minimum of 75% average attendance for all the courses only, can register for the examination.

8. MARKS DISTRIBUTION FOR EXTERNAL EXAMINATION AND INTERNAL EVALUATION

The external theory examination of all semesters shall be conducted by the University at the end of each semester. Internal evaluation is to be done by continuous assessment. For all papers (theory and practical) total percentage of marks of external examination is 80 and total percentage of marks of internal evaluation is 20.

Marks distribution for external and internal assessments and the components for internal evaluation with their marks are shown below:

Components of the internal evaluation and their marks are as below.

8. 1. FOR ALL THEORY PAPERS:

(a) Marks of external Examination : 60

(b) Marks of internal evaluation : 15

All the three components of the internal assessment are mandatory.

Components of theory Internal Evaluation	**MARKS**
Attendance	**5**
Assignment/Seminar/Viva	**2**
Test Paper(s) **(2×4)**	**8**
Total	**15**

8.2 FOR ALL PRACTICAL PAPERS (conducted only at the end of even semesters):

(a) Marks of external Examination : 40

(b) Marks of internal evaluation : 10

All the three components of the internal assessment are mandatory

Components of Practical-internal evaluation	**Marks**
Attendance	**2**
Test Paper (1x4)	**4**
Record*	**4**
Total	**10**

*Marks awarded for Record should be related to number of experiments recorded.

8.3 FOR PROJECTS, INDUSTRIAL VISIT AND COMPREHENSIVE VIVA-VOCE*:

(a) Marks of external Examination : 80

(b) Marks of internal evaluation : 20

Components of Project I.V. and Viva – Evaluation External	**Marks**
Dissertation and I.V. report (External)	50
Comprehensive Viva-voce (External)	30
Total	**80**

* Bonafide reports of the project work and Industrial Visit conducted shall be submitted at the time of examination.

All the four components of the internal assessment are mandatory.

Components of Project & I.V. - Internal Evaluation	Marks
Punctuality	5
Experimentation / Data Collection	5
Knowledge	5
Report	5
Total	**20**

Attendance Evaluation for all papers

% of attendance	Marks
90 and above	5
85–89	4
80-84	3
76-79	2
75	1

(Decimals are to be rounded to the next higher whole number)

8.4 OJT EVALUATION

For On the Job Training there is only internal evaluation.

8.5. ASSIGNMENTS

Assignments are to be done from 1st to 4th Semesters. At least one assignment should be done in each semester for all papers.

8.6 SEMINAR / VIVA

A student shall present a seminar in the 5^{th} semester and appear for Viva- voce in the 6^{th} semester for all papers.

8.7 INTERNAL ASSESSMENT TEST PAPERS

Two internal test- papers are to be attended in each semester for each paper. The evaluations of all components are to be published and are to be acknowledged by the candidates. All documents of internal assessments are to be kept in the college for two years and shall be made available for verification by the University. The responsibility of evaluating the internal assessment is vested on the teacher(s) who teach the paper.

9. CONDUCT OF PRACTICAL EXAMINATIONS

9.1 **PRACTICAL EXAMINATION**

Practical examinations will be conducted only at the end of even semesters for all programmes.

9.2. **PATTERN OF QUESTION PAPERS**

Pattern of questions for external examination of practical papers will decided by the concerned Board of practical examination.

CONSOLIDATED SCHEME FOR I TO VI SEMESTERS
PROGRAMME STRUCTURE

1. B.Sc CHEMISTRY PROGRAMME – (MODEL - I)

Sem	Title with Course code	Course Category	Hours per week	Credits
I	English I	Common	5	4
	English/ Common Course I	Common	4	3
	Second Language I	Common	4	4
	CHICRT01 General and Analytical Chemistry	Core	2	2
	CH2CRP01 Volumetric Analysis	Core	2	-
	Complementary Mathematics	Complementary	4	3
	Complementary Physics	Complementary	2	2
	Complementary Physics Practical	Complementary	2	-
II	English II	Common	5	4
	English/ Common Course II	Common	4	3
	Second Language II	Common	4	4
	CH2CRT02 Theoretical and Inorganic Chemistry	Core	2	2
	CH2CRP01 Volumetric Analysis	Core	2	2
	Complementary Mathematics	Complementary	4	3
	Complementary Physics	Complementary	2	2
	Complementary Physics Practical	Complementary	2	2
III	English III	Common	5	4
	II Lang/Common Course I	Common	5	4
	CH3CRT03 Organic Chemistry-I	Core	3	3
	CH4CRP02 Qualitative Organic Analysis	Core	2	-
	Complementary Mathematics	Complementary	5	4
	Complementary Physics	Complementary	3	3
	Complementary Physics Practical	Complementary	2	-
IV	English IV	Common	5	4
	II Lang/ Common Course II	Common	5	4
	CH4CRT04 Organic Chemistry-II	Core	3	3
	CH4CRP02 Qualitative Organic Analysis	Core	2	2
	Complementary Mathematics	Complementary	5	4
	Complementary Physics	Complementary	3	3
	Complementary Physical Practical	Complementary	2	2
V	CH5CRT05 Environment, Ecology and Human Rights	Core	4	4
	CH5CRT06 Organic Chemistry-III	Core	3	3
	CH5CRT07 Physical Chemistry - I	Core	2	2
	CH5CRT08 Physical Chemistry - II	Core	2	3
	CH5OPT Open course	Open	4	3

	CH6CRP03 Qualitative Inorganic Analysis	Core	3	-
	CH6CRP04 Organic Preparations and Basic Laboratory Techniques	Core	2	-
	CH6CRP05 Physical Chemistry Practical	Core	3	-
	CH6PRP01Project	Core	2	-
VI	CH6CRT09 Inorganic Chemistry	Core	3	3
	CH6CRT10 Organic Chemistry-IV	Core	3	3
	CH6CRT11 Physical Chemistry - III	Core	3	3
	CH6CRT12 Physical Chemistry - IV	Core	3	3
	CH6CBT Choice Based Course	Core	3	3
	CH6CRP03 Qualitative Inorganic Analysis	Core	3	2
	CH6CRP04 Organic Preparations and Basic Laboratory Techniques	Core	2	2
	CH6CRP05 Physical Chemistry Practical	Core	3	2
	CH6CRP06 Gravimetric Analysis	Core	2	2
	CH6PRP01 Project & Industrial visit and comprehensive viva-voce	Core	-	2

OPEN COURSES:

Sl. No.	Semester	Course Code	Course Title
1	V	CH5OPT01	Chemistry in Everyday Life
2	V	CH5OPT02	Nanoscience and Nanotechnology
3	V	CH5OPT03	Forensic Science

CHOICE BASED COURSES:

Sl. No.	Semester	Course Code	Course Title
1	VI	CH6CBT01	Polymer Chemistry
2	VI	CH6CBT02	Nanochemistry and Nanotechnology
3	VI	CH6CBT03	Soil and Agricultural Chemistry

2. B.Sc CHEMISTRY PROGRAMME – (MODEL - II)

Sem	Title with Course code	Course Category	Hours per week	Credits
I	English I	Common	5	4
	Second Language I	Common	5	4
	CHICRT01 General and Analytical Chemistry	Core	2	2
	CH2CRP01 Volumetric Analysis	Core	2	-
	Complementary Mathematics	Complementary	5	3
	CH1VOT01 Industrial Aspects of Inorganic and Organic Chemistry	Core	4	3
	CH2VOP01 Vocational Practical	Core	2	-
II	English I	Common	5	4
	Second Language I	Common	5	4
	CH2CRT02 Theoretical and Inorganic Chemistry	Core	2	2
	CH2CRP01 Volumetric Analysis	Core	2	2
	Complementary Mathematics	Complementary	5	3
	CH2VOT02 Chemical Industries and Industrial Aspects of Physical Chemistry	Core	4	3
	CH2VOP01 Vocational Practical: Industrial Inorganic Chemistry (P)	Core	2	2
III	English III	Common	5	4
	CH3CRT03 Organic Chemistry-I	Core	3	3
	CH4CRP02 Qualitative Organic Analysis	Core	2	-
	Complementary Mathematics	Complementary	5	4
	CH3VOT03 Unit Operations in Chemical Industry	Core	3	4
	CH3VOT04 Unit Processes in Organic Chemicals Manufacture	Core	3	4
	CH2VOP02 Vocational Practical	Core	2	-
	CH2VOP03 Vocational Practical	Core	2	-
IV	English IV	Common	5	4
	CH4CRT04 Organic Chemistry-II	Core	3	3
	CH4CRP02 Qualitative Organic Analysis	Core	2	2
	Complementary Mathematics	Complementary	5	4
	CH4VOT05 Instrumental Methods of Chemical Analysis-I	Core	3	3
	CH4VOT06 Instrumental Methods of Chemical Analysis-II	Core	3	3
	CH2VOP02 Vocational Practical	Core	2	2
	CH2VOP03 Vocational Practical	Core	2	2
V	CH5CRT05 Environment, Ecology and Human Rights	Core	4	4
	CH5CRT06 Organic Chemistry-III	Core	3	3
	CH5CRT07 Physical Chemistry - I	Core	2	2
	CH5CRT08 Physical Chemistry - II	Core	2	3
	CH5OPT Open course	Open	4	3

	CH6CRP03 Qualitative Inorganic Analysis	Core	3	-
	CH6CRP04 Organic Preparations and Basic Laboratory Techniques	Core	2	-
	CH6CRP05 Physical Chemistry Practical	Core	3	-
	CH6PRP01Project	Core	2	-
VI	CH6CRT09 Inorganic Chemistry	Core	3	3
	CH6CRT10 Organic Chemistry-IV	Core	3	3
	CH6CRT11 Physical Chemistry - III	Core	3	3
	CH6CRT12 Physical Chemistry - IV	Core	3	3
	CH6CBT Choice Based Course	Core	3	3
	CH6CRP03 Qualitative Inorganic Analysis	Core	3	2
	CH6CRP04 Organic Preparations and Basic Laboratory Techniques	Core	2	2
	CH6CRP05 Physical Chemistry Practical	Core	3	2
	CH6CRP06 Gravimetric Analysis	Core	2	2
	CH6PRP01 Project, Industrial visit and comprehensive viva - voce	Core	-	2
	CH6OJP01 OJT	Core	-	2

On the Job Training All the students have to undergo on the job training in a chemical industry for a minimum period of 15 days and submit a project report. The period of 15 days need be at a single stretch. The vacation days may be utilized for this purpose. A report of the training should be submitted to the department during the sixth semester for internal evaluation.

OPEN COURSES:

Sl. No.	Semester	Course Code	Course Title
1	V	CH5OPT1.1	Chemistry in Everyday Life
2	V	CH5OPT1.2	Nanoscience and Nanotechnology
3	V	CH5OPT1.3	Forensic Science

CHOICE BASED COURSES:

Sl. No.	Semester	Course Code	Course Title
1	VI	CH6CBT1.1	Polymer Chemistry
2	VI	CH6CBT1.2	Nanochemistry and Nanotechnology
3	VI	CH6CBT1.3	Soil and Agricultural Chemistry

3. B.Sc CHEMISTRY PROGRAMME – (MODEL - III)

Sem	Title with Course code	Course Category	Hours per week	Credits
I	English I	Common	5	4
	CHICRT01 General and Analytical Chemistry	Core	2	2
	CH2CRP01 Volumetric Analysis	Core	2	-
	CH1PCT01 Petroleum Geology	Core	4	3
	CH2PCP01 Practical I	Core	2	-
	Complementary Mathematics	Complementary	5	3
	Complementary Computer Science	Complementary	3	2
	Complementary Practical –I	Complementary	2	-
II	English I	Common	5	4
	CH2CRT02 Theoretical and Inorganic Chemistry	Core	2	2
	CH2CRP01 Volumetric Analysis	Core	2	2
	CH2PCT02 Test Methods and Petroleum Processes	Core	4	3
	CH2PCP01 Practical I	Core	2	2
	Complementary Mathematics	Complementary	5	3
	Complementary Computer Science	Complementary	3	3
	Complementary Practical –I	Complementary	2	2
III	CH3CRT03 Organic Chemistry-I	Core	3	3
	CH4CRP02 Qualitative Organic Analysis	Core	2	-
	CH3PCT03 Production and Application of Compounds from Petroleum	Core	4	4
	CH3PCT04 Manufacture of Petrochemicals-I	Core	3	4
	CH4PCP02 Practical –II	Core	2	-
	Complementary Mathematics	Complementary	5	4
	Complementary Computer Science	Complementary	4	3
	Complementary Practical –II	Complementary	2	-
IV	CH4CRT04 Organic Chemistry-II	Core	3	3
	CH4CRP02 Qualitative Organic Analysis	Core	2	2
	CH4PCT05 Manufacture of Petrochemicals-II	Core	4	4
	CH4PCT06 Petroleum Industries in India	Core	3	4
	CH4PCP02 Practical –II	Complementary	2	2
	Complementary Mathematics	Complementary	6	4
	Complementary Computer Science	Complementary	3	3
	Complementary Practical –II	Core	2	2
V	CH5CRT05 Environment, Ecology and Human Rights	Core	4	4
	CH5CRT06 Organic Chemistry-III	Core	3	3
	CH5CRT07 Physical Chemistry - I	Core	2	2
	CH5CRT08 Physical Chemistry - II	Core	2	3
	CH5OPT Open course	Open	4	3
	CH6CRP03 Qualitative Inorganic Analysis	Core	3	-

	CH6CRP04 Organic Preparations and Basic Laboratory Techniques	Core	2	-
	CH6CRP05 Physical Chemistry Practical	Core	3	-
	CH6PRP01Project	Core	2	-
VI	CH6CRT09 Inorganic Chemistry	Core	3	3
	CH6CRT10 Organic Chemistry-IV	Core	3	3
	CH6CRT11 Physical Chemistry - III	Core	3	3
	CH6CRT12 Physical Chemistry - IV	Core	3	3
	CH6CBT Choice Based Course	Core	3	3
	CH6CRP03 Qualitative Inorganic Analysis	Core	3	2
	CH6CRP04 Organic Preparations and Basic Laboratory Techniques	Core	2	2
	CH6CRP05 Physical Chemistry Practical	Core	3	2
	CH6CRP06 Gravimetric Analysis	Core	2	2
	CH6PRP01 Project, Industrial visit and comprehensive viva-voce	Core	-	2
	CH6OJP01 OJT	Core	-	3

On the Job Training All the students have to undergo on the job training in a chemical industry for a minimum period of 15 days and submit a project report. The period of 15 days need be at a single stretch. The vacation days may be utilized for this purpose. A report of the training should be submitted to the department during the sixth semester for internal evaluation.

OPEN COURSES:

Sl. No.	Semester	Course Code	Course Title
1	V	CH5OPT1.1	Chemistry in Everyday Life
2	V	CH5OPT1.2	Nanoscience and Nanotechnology
3	V	CH5OPT1.3	Forensic Science

CHOICE BASED COURSES:

Sl. No.	Semester	Course Code	Course Title
1	VI	CH6CBT1.1	Polymer Chemistry
2	VI	CH6CBT1.2	Nanochemistry and Nanotechnology
3	VI	CH6CBT1.3	Soil and Agricultural Chemistry

SYLLABUS FOR
CHEMISTRY CORE COURSES

SEMESTER I

CH1CRT01 – GENERAL AND ANALYTICAL CHEMISTRY Credits: 2

(36 Hrs)

Unit 1: Methodology of Chemistry (7 Hrs)

Definition of Science. Scientific methods - observation-posing a question - formulation of hypothesis- experiment – theory - law. Falsification of hypothesis - inductive and deductive reasoning- revision of scientific theories and laws.

Evolution of Chemistry-ancient speculation on the nature of matter. Early form of chemistry-alchemy, origin of modern chemistry. Structure of chemical science: Scope, theory and experiment - branches of chemistry. Role of chemistry as a central science connecting physics, biology and other branches of science. Interdisciplinary areas involving chemistry: Nanotechnology and biotechnology.

Unit 2: Periodic Table and Periodic Properties (5 Hrs)

Modern periodic law – Long form periodic table. Diagonal relationship and anomalous behavior of first element in a group. Periodicity in properties: Atomic and ionic radii - ionization enthalpy - electron affinity (electron gain enthalpy) – electronegativity. Electronegativity scales: Pauling and Mullikan scales. Effective nuclear charge – Slater rule and its applications – polarising power.

Unit 3: Analytical Methods in Chemistry (12 Hrs)

Molecular mass - mole concept – molar volume. Oxidation and reduction – oxidation number and valency – variable valency - equivalent mass.

Qualitative analysis: Applications of solubility product and common ion effect in the precipitation of cations. Principle of intergroup separation of cations. Interfering acid radicals and their elimination (oxalate, fluoride, borate and phosphate).

Titrimetric analysis - fundamental concepts. Methods of expressing concentration: Weight percentage, molality, molarity, normality, mole fraction, ppm. and ppb. Primary and secondary standards, quantitative dilution – problems. Acid base titrations- titration curves – pH indicators. Redox titrations – titration curve –titrations involving MnO_4^- and $Cr_2O_7^{2-}$ - redox indicators. Complexometric titrations – EDTA titrations - titration curves – metal ion indicators. Gravimetric analysis: Unit operations in gravimetric analysis - illustrations using iron and barium estimation. Separation and purification techniques – filtration, crystallization and precipitation – fractional distillation, solvent extraction.

Unit 4: Chromatographic Methods (7 Hrs)

Column Chromatography: Principle, types of adsorbents, preparation of the column, elution, recovery of substances and applications. Thin Layer Chromatography: Principle, choice of adsorbent and solvent, preparation of Chromatoplates, Rf-values, significance of Rf values. Ion exchange chromatography: Principle and experimental techniques. Gas Chromatography: Principle and experimental techniques. High Performance Liquid Chromatography (HPLC): Principle and experimental techniques.

Unit 5: Evaluation of Analytical Data (5 Hrs)

Units, significant digits, rounding, scientific and prefix notation, graphing of data. Precision and accuracy-types of errors – ways of expressing precision – ways to reduce systematic errors - reporting analytical data. Statistical treatment of analytical data – population and samples – Mean and standard deviation – distribution of random errors.

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2. C.N.R.Rao, University General Chemistry, MacMillan India (Ltd.)
3. D.A. Skoog, D.M. West, F.J. Holler and S.R. Crouch, *Fundamentals of Analytical Chemistry*, 8th Edition, Brooks/Cole, Thomson Learning, Inc., USA, 2004.
4. J. D. Lee, Concise Inorganic Chemistry, 5th edn., Blackwell Science, London, 2010.
5. B.R. Puri, L.R. Sharma and K.C. Kalia, *Principles of Inorganic Chemistry*, 31st Edition, Milestone Publishers and Distributors, New Delhi, 2013.
6. Satya Prakash, *Advanced Inorganic Chemistry, Volume 1,* 5th Edition, S. Chand and Sons, New Delhi, 2012.
7. J. Mendham, R.C. Denney, J. D. Barnes and M. Thomas, *Vogel's Text Book of Quantitative Chemical Analysis*, 6th Edition, Pearson Education, Noida, 2013.
8. R. Gopalan, *Inorganic Chemistry for Undergraduates*, Universities Press, Hyderabad, 2009.
9. Vogels Textbook of Quantitative Chemical Analysis, 6thEdn., Pearson Education Ltd.

SEMESTER II

CH2CRT02 – THEORETICAL AND INORGANIC CHEMISTRY

Credits - 2 (36 hrs)

Unit 1: Atomic Structure (6 Hrs)

Introduction based on historical development (Dalton's atomic theory, Thomson's atom model Rutherford's atom model) - failure of classical physics – black body radiation - Planck's quantum hypothesis - photoelectric effect - generalization of quantum theory . Atomic spectra of hydrogen and hydrogen like atoms– Bohr theory of atom – Calculation of Bohr radius, velocity and energy of an electron - explanation of atomic spectra - limitations of Bohr theory

- Sommerfeld modification. Louis de Broglie's matter waves – wave-particle duality - electron diffraction - Heisenberg's uncertainty principle.

Schrödinger wave equation (derivation not expected), wave functions – significance of ψ and ψ^2 – atomic orbitals and concept of quantum numbers - shapes of orbitals (*s, p* and *d*) - Pauli's Exclusion principle - Hund's rule of maximum multiplicity - Aufbau principle – electronic configuration of atoms.

Unit 2: Chemical Bonding – I (9 Hrs)

Introduction – Octet rule and its limitations.

Types of bonds: Ionic bond - factors favouring the formation of ionic bonds - lattice energy of ionic compounds - Born- Lande equation with derivation - solvation enthalpy and solubility of ionic compounds – Born-Haber cycle and its applications – properties of ionic compounds - polarisation of ions – Fajan's rule and its applications.

Covalent Bond: Valence Bond Theory and its limitations. Concept of resonance - resonance structures of borate, carbonate and nitrate ions. Hybridization: Definition and characteristics – shape of molecules ($BeCl_2$, C_2H_2, BF_3, C_2H_4, CH_4, NH_3, H_2O, NH_4^+, H_3O^+, PCl_5, SF_6 and IF_7). VSEPR theory: Postulates - applications - shapes of molecules CCl_4, NH_3, H_2O, ClF_3, XeF_2, SF_6, IF_5, XeF_4, IF_7 and XeF_6.

Properties of covalent compounds - polarity of bonds – percentage of ionic character – dipole moment and molecular structure.

Unit 3: Chemical Bonding – II (9 Hrs)

Covalent Bond: Molecular Orbital Theory – LCAO - bonding and anti-bonding molecular orbitals – bond order and its significance. MO diagrams of homonuclear and heteronuclear diatomic molecules: H_2, He_2, Li_2, Be_2, B_2, C_2, N_2, O_2, F_2, CO and NO – comparison of bond length, magnetic behavior and bond energy of O_2, O_2^+, O_2^{2+}, O_2^- and O_2^{2-} . Metallic Bond: free electron theory, valence bond theory and band theory (qualitative treatment only) - explanation of metallic properties based on these theories.

Intermolecular forces: Hydrogen bond - intra and inter molecular hydrogen bonds – effect on physical properties. Van der Waals forces, ion-dipole, dipole-dipole, ion-induced dipole, dipole-induced dipole and induced dipole-induced dipole interactions

Unit 4: Chemistry of s and p Block Elements (3 Hrs)

Periodicity in s-and p- block elements with respect to electronic configuration, atomic and ionic size, ionization energy and electro negativity. Inert pair effect.

Unit 5: Chemistry of d and f Block Elements (9 Hrs)

Transition Metals: General characteristics: Metallic character, oxidation states, size, density, melting points, boiling points, ionization energy, colour, magnetic properties, reducing properties, catalytic properties, non-stoichiometric compounds, complex formation and alloy formation. Difference between first row and other two rows. Preparation, properties, structure and uses of $KMnO_4$ and $K_2Cr_2O_7$.

Lanthanides: Electronic configuration and general characteristics – Occurrence of lanthanides

Isolation of lanthanides from monazite sand - Separation by ion exchange method.

Lanthanide contraction: Causes and consequences. Industrial importance of lanthanides.

References

1. R.K. Prasad, *Quantum Chemistry*, New Age International, 2001
2. McQuarrie, J. D. Simon, *Physical Chemistry – A molecular Approach*, Viva Books.
3. I. N. Levine, *Physical Chemistry*, Tata McGraw Hill,
4. ManasChanda, *Atomic structure and Chemical bonding in Molecular Spectroscopy"* Tata McGraw Hill.
5. J. D. Lee, Concise Inorganic Chemistry, 5th edn., Blackwell Science, London.
6. B. R. Puri, L. R. Sharma, Kalia, Principles of Inorganic Chemistry, Milestone Publishers, New Delhi.
7. F. A. Cotton, G. Wilkinson and P. L. Gaus, Basic Inorganic Chemistry, 3rd edn., John Wiley.
8. B. Douglas, D. Mc Daniel, J. Alexander, Concepts and models in Inorganic Chemistry.
9. Satya Prakash, *Advanced Inorganic Chemistry, Volume 1,* 5th Edition, S. Chand and Sons, New Delhi, 2012.
10. R. Gopalan, *Inorganic Chemistry for Undergraduates*, Universities Press, Hyderabad, 2009.

SEMESTER I AND II - CORE CHEMISTRY PRACTICALS

CH2CRP01 - VOLUMETRIC ANALYSIS

Credits: 2 (72 Hrs)

A. Acidimetry and Alkalimetry

1. Strong acid-Strong base
2. Strong acid – Weak base
3. Strong base – Weak acid
4. Estimation of $Na_2CO_3$and $NaHCO_3$ in a mixture
5. Estimation of NaOH and Na_2CO_3 in a mixture
6. Estimation of ammonia in ammonium salts by direct and indirect methods

B. Complexometric Titrations Using EDTA

1. Estimation of Zn
2. Estimation of Mg
3. Estimation of Mg and Ca in a mixture
4. Estimation of Ni
5. Determination of hardness of water

C. Oxidation – Reduction Titrations

(i) Permanganometry

1. Estimation of ferrous iron
2. Estimation of oxalic acid
3. Estimation of sodium oxalate
4. Estimation of calcium

(ii) Dichrometry

1. Estimation of ferrous iron using internal indicator
2. Estimation of ferrous iron using external indicator
3. Estimation of ferric iron using internal indicator
4. Estimation of ferric iron using external indicator

(iii) Iodimetry and Iodometry

1. Estimation of copper
2. Estimation of arsenious oxide

References:

1. A. I. Vogel ‘A Text Book of Quantitative Inorganic Analysis Including Elementary Instrumental Analysis’: (Third Ed.) (ELBS)
2. D.A.Skoog, D.M.West and S.R.crouch, Fundamentals of Analytical Chemistry, 8^{th}Edn., Brooks/Cole Nelson.
3. Vogels Textbook of Quantitative Chemical Analysis, 6^{th}Edn., Pearson Education Ltd.

SEMESTER III

CH3CRT03 - ORGANIC CHEMISTRY – I

Credits – 3 (54 Hrs)

(Reaction mechanisms expected only wherever mentioned)

Unit 1: Fundamentals of Organic Chemistry (8 Hrs)

Classification and IUPAC system of nomenclature of common organic compounds (both aliphatic and aromatic).

Line diagram drawing. Factors affecting reaction mechanism. Polarity of bonds.

Electronic displacements: Inductive effect, electromeric effect, mesomeric effect, resonance and hyperconjugation. steric effects.

Cleavage of bonds: Homolysis and heterolysis with suitable examples. curly arrow rules, formal charges.

Types of reagents: Nucleophiles and electrophiles.

Reactive intermediates: Carbocations, carbanions, free radicals and carbenes – types, shape and relative stability.

Types of organic reactions: Addition, elimination, substitution, rearrangement and redox reactions (definition and one example each).

Unit 2: Stereochemistry (15 Hrs)

Stereoisomerism – definition, classification.

Optical isomerism: Optical activity, specific rotation, concept of chirality (upto two carbon atoms). Configuration. Enantiomerism, diastereomerism and meso compounds. Racemic mixture and methods of resolution. Asymmetric synthesis (partial and absolute). Threo and erythro; *d* and *l* designations; Cahn-Ingold-Prelog rules: R/ S notation (for upto 2 chiral carbon atoms).

Geometrical isomerism: cis–trans, *syn-anti* and E/Z nomenclature (for upto two C=C systems) with C.I.P rules. Methods of distinguishing geometrical isomers.

Conformational analysis: Conformational analysis with respect to ethane, butane and cyclohexane. Relative stability and energy diagrams. Inter conversion of Wedge formula, Newman, Sawhorse and Fischer projection formulae. Chair, boat and twist boat forms of cyclohexane with energy diagrams. Conformation of methyl cyclohexane.

Origin of ring strain in cyclic systems. Baeyer's strain theory.

Unit 3: Aliphatic Hydrocarbons and Alkyl Halides (12 Hrs)

Alkanes: Preparation - catalytic hydrogenation, Wurtz reaction, Wurtz-Fittig reaction, from Grignard reagent. Reactions - free radical substitution - halogenation.

Alkenes: Preparation - Elimination reactions - mechanism of E1 and E2 reactions. Dehydration of alkenes and dehydrohalogenation of alkyl halides (Saytzeff's and Hofmann's rules). Reactions - *cis*-addition (alkaline $KMnO_4$) and *trans*-addition (bromine). Addition of HX (Markownikoff's and anti-Markownikoff's addition with mechanisms), Hydration, Ozonolysis.

Alkynes: Preparation - Acetylene from CaC_2 and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal dihalides. Reactions - Acidity of alkynes, formation of metal acetylides, alkylation of terminal alkynes and conversion into higher alkynes, addition of bromine and alkaline $KMnO_4$.

Alkyl Halides: Preparation - From alkenes and alcohols. Reactions - Types of aliphatic nucleophilic substitution reactions - S_N1 and S_N2 mechanisms with stereochemical aspects and effects of substrate structure, solvent, nucleophile and leaving group.

Organometallic compounds of Mg (*Grignard reagents*) – Formation, structure and important reactions/synthetic applications.

Unit 4: Aromatic Hydrocarbons and Aryl Halides (15 Hrs)

Aromaticity : Definition, Hückel's rule - application to benzenoid (benzene, naphthalene and anthracene) and non-benzenoid (cyclopropenyl cation, cyclopentadienyl anion and tropylium cation) compounds.

Benzene: Molecular orbital picture and resonance energy. Preparation - from phenol, by decarboxylation, from acetylene, from aromatic acids. Reactions - Electrophilic aromatic substitution: nitration, halogenation, sulphonation and Friedel-Craft's reaction (alkylation and acylation) with their mechanism. Orientation of aromatic substitution. *ortho, para* and *meta* directing effects of groups. Ring activating and deactivating groups with examples.

Naphthalene and Anthracene: Molecular orbital picture and resonance energy. Preparation - (of Naphthalene): Haworth synthesis

Reactions - Electrophilic substitutions (halogenation, nitration and sulphonation) of naphthalene.

Aryl Halides: Preparation - chloro, bromo and iodo-benzene from phenol, Sandmeyer and Gattermann reactions. Reactions - aromatic nucleophilic substitutions – bimolecular displacement mechanism, elimination-addition (benzyne intermediate) mechanism.

Unit 5: Pericyclic Reactions (4 Hrs)

Classification – electrocyclic reactions, cycloadditions - Diels-Alder reaction and Sigmatropic rearrangements - Claisen rearrangement (with mechanism).

References

1. Morrison, R.T., Boyd, R.N. & Bhattacharjee, S.K. *Organic Chemistry*, 7th ed., Dorling Kindersley (India) Pvt. Ltd (Pearson Education), 2011.
2. Graham Solomon, T.W., Fryhle, C.B. & Snyder, S.A. *Organic Chemistry*, John Wiley & Sons, 2014.
3. McMurry, J. *Organic Chemistry*, 7th ed. Cengage Learning, 2013.
4. Sykes, P. *A Guidebook to Mechanism in Organic Chemistry*, Orient Longman, 1988.
5. Eliel, E.L. & Wilen, S.H. *Stereochemistry of Organic Compounds*, Wiley, 1994.
6. Finar, I.L. *Organic Chemistry* (Vol. 1 & 2), Dorling Kindersley (India) Pvt. Ltd (Pearson Education).
7. Jain, M.K. & Sharma, S.C. *Modern Organic Chemistry*, Vishal Publishing Co. 2010.
8. Bahl, A. & Bahl, B.S. *Advanced Organic Chemistry*, S. Chand, 2010.

9. Kalsi, P. S. *Stereochemistry - Conformation and Mechanism*; New Age International, 2005.
10. Pillai, C.N. *Organic Chemistry*, Universities Press, 2008.
11. Gupta, S.S. *Organic Chemistry*, Oxford University Press, 2014.

SEMESTER IV

CH4CRT04 - ORGANIC CHEMISTRY –II

Credits – 3 (54 Hrs)

(Reaction mechanisms expected only wherever mentioned)

Unit 1: Alcohols, Phenols and Ethers (16 Hrs)

Alcohols

Preparation - 1^{o}, 2^{o} and 3^{o} alcohols using Grignard reagent, ester hydrolysis, reduction of aldehydes, ketones, carboxylic acids and esters (Bouveault-Blanc reduction). Reactions - with sodium, HX (Lucas test), esterification, oxidation (with PCC, alkaline $KMnO_4$, OsO_4, acidic dichromate, conc. HNO_3). Oppenauer oxidation (with mechanism). Ascent and descent of alcohol series.

Diols: Preparation - hydroxylation of alkenes, hydrolysis of epoxides. Reactions - oxidative cleavage of diols using lead tetraacetate and periodic acid. Pinacol - Pinacolone rearrangement (with mechanism).

Phenols: Preparation -cumene hydroperoxide method, from diazonium salts. Reactions - Electrophilic substitution - nitration, halogenation and sulphonation. Reimer- Tiemann reaction and Fries rearrangement (with mechanisms).

Preparation and uses of nitrophenols, picric acid, resorcinol and quinol.

Ethers and Epoxides: Preparation - ethers and epoxides - Williamson's ether synthesis. Reactions of ethers - cleavage with HI. Zeisel's method of estimation of alkoxy groups. Reactions of epoxides - with alcohols, ammonia derivatives and $LiAlH_4$.

Unit 2: Aldehydes and Ketones (20 Hrs)

Preparation, properties and reactions of formaldehye, acetaldehyde, acetone, benzaldehyde and benzophenone.

Preparation - from alcohols, acid chlorides, esters and nitriles.

Reactions - Structure of the carbonyl group and acidity of α-hydrogen. (i) Addition reactions - with HCN, ROH, $NaHSO_3$, Grignard reagents and ammonia derivatives. Aldol, Claisen, Claisen-Schmidt, Knoevenagel and Benzoin condensations (with mechanisms). Cannizzaro reaction, Wittig reaction and Mannich reaction (with mechanisms). Michael addition (with mechanism) (ii) Oxidation reactions - Tollen's and Fehling's tests, Iodoform test, Baeyer-Villiger oxidation (with mechanism) (iii) Reduction reactions - Clemmensen, Wolff-Kishner, Meerwein-Pondorff-Verley, $LiAlH_4$, and $NaBH_4$ reductions (with mechanisms) (iv) Rearrangement reactions - Beckmann, and benzil-benzilic acid rearrangements (with mechanisms).

Unit 3: Carboxylic Acids, Sulphonic Acids and their Derivatives (18 Hrs)

Carboxylic acids (aliphatic and aromatic)

Preparation - Oxidation of alcohols and aldehydes, hydrolysis of nitriles, side chain oxidation and carbonylation of grignard reagents. Acidic and alkaline hydrolysis of esters.

Reactions - structure of carboxylate ion, effect of substituents on acid strength. Ascent and descent of acid series. Reduction and decarboxylation reactions. Reactions with PCl_5, PCl_3

and $SOCl_2$. Reaction with ammonia, esterification and halogentaion. Hell – Volhard - Zelinsky reaction (with mechanism).

Carboxylic acid derivatives (aliphatic):

Preparation - acid chlorides, anhydrides, esters and amides from acids. Reactions - comparative study of nucleophilicity of acyl derivatives. Perkin condensation and Reformatsky reaction (with mechanisms).

Dicarboxylic acids, hydroxy acids and unsaturated acids

Methods of formation, important reactions and uses of dicarboxylic acids, hydroxy acids and unsaturated acids like oxalic acid, malonic acid, adipic acid, phthalic acid, citric acid, salicylic acid, cinnamic acid, anthranilic acid, acrylic acid, maleic acid and fumaric acid.

Sulphonic acids and their derivatives

Preparation, reactions and uses of benzene sulphonic acid, benzene sulphonyl chloride and *ortho*- and *para*- toluene sulphonyl chlorides.

References

1. Morrison, R.T., Boyd, R.N. & Bhattacharjee, S.K. *Organic Chemistry*, 7th ed., Dorling Kindersley (India) Pvt. Ltd (Pearson Education), 2011.
2. Graham Solomon, T.W., Fryhle, C.B. & Snyder, S.A. *Organic Chemistry*, Wiley, 2014.
3. McMurry, J. *Organic Chemistry*, 7th ed. Cengage Learning, 2013.
4. Finar, I.L. *Organic Chemistry* (Vol. 1), Dorling Kindersley (India) Pvt. Ltd (Pearson Education).
5. Carey, F.A., Giuliano, R.M. *Organic Chemistry*, 8th ed., Tata McGraw Hill,.2012
6. Jain, M.K. & Sharma, S.C. *Modern Organic Chemistry*, Vishal Publishing Co. 2010.
7. Bahl, A. & Bahl, B.S. *Advanced Organic Chemistry*, S. Chand, 2010.
8. Tewari, K.S. & Vishnoi, N.K. *Organic Chemistry*, Vikas Publishing House, 2012.
9. Pillai, C.N. *Organic Chemistry*, Universities Press, 2008.
10. Gupta, S.S. *Organic Chemistry*, Oxford University Press,

SEMESTER III AND IV ORGANIC CHEMISTRY

PRACTICALS- I

CH4CRP02 - QUALITATIVE ORGANIC ANALYSIS

Cridit-2 (72 Hrs)

1. Determination of physical constants of solids and liquids – melting and boiling points.
2. Tests for elements: Nitrogen, Halogens and Sulphur
3. Tests for unsaturation.
4. Tests for aromatic character.
5. Study of the reactions of the following functional groups: carboxylic acid, 1,2-dicarboxylic acid, phenol, aldehyde, ketone, ester, reducing and nonreducing sugars, polynuclear hydrocarbon, primary, secondary and tertiary amines, amides, diamide, nitro and halogen compounds.
6. Systematic analysis and preparation of solid derivative of the following organic compounds: carboxylic acid, 1,2-dicarboxylic acid, unsaturated acids, phenol, hydroxy acids, aldehyde, ketone, ester, reducing and nonreducing sugars, polynuclear hydrocarbon, primary, secondary and tertiary amines, amide, diamide, nitro and halogen compounds.
   (Minimum twelve compounds to be analysed)

References

1. Furniss, B.S.; Hannaford, A.J.; Rogers, V. Smith, P.W.G.; Tatchell, A.R. *Vogel's Textbook of Practical Organic Chemistry,* 5th ed., Pearson Education, 2005.
2. Mann,F.G.; Saunders, B.C. *Practical Organic Chemistry*, 4th ed., Pearson Education, 2009.
3. Ahluwalia, V.K.; Dhingra, S. *Comprehensive Practical Organic Chemistry – Qualitative Analysis,* Universities Press, 2000.
4. Vishnoi, N.K. *Advanced Practical Organic Chemistry*, 3rd ed., Vikas Publishing House, New Delhi, 2010.

SEMESTER V

CH5CRT05 - Environment, Ecology and Human Rights

Credits – 4 (72 Hrs)

Environmental Chemistry (54 h)

Objectives: Environmental awareness is to understand the fragility and sensitivity of our environment, in particular the biosphere and the importance of its protection. Promoting environmental awareness is an easy way to become an environmental steward and participate in creating a brighter future for our next generations. The most important goal of this paper is to impart awareness on various environmental aspects, with some glimpses of contemporary issues. This will help them foster a *sense* of responsibility and "*proactive citizenship*".

Module I: Introduction to environmental studies: Natural resources

10 h

Definition, scope and importance of environmental studies for sustainable development, need for public awareness.

Natural Resources: Classification of natural resources; renewable and non-renewable resources:

Natural resources and associated problems;

1.1 Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources.

1.2 Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

1.3 Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

1.4 Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, industrial farming of livestock and effects on global warming, fertilizer-pesticide problems, water logging, salinity. Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, mass production of biodiesel for energy needs and *food security*. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

Module II: Environment: Pollution and Social Issues

18 h

Fundamental ideas of pollution and pollutant. Cause, effects and preventive measures of various types of pollutions including; air, water, soil, marine, noise and thermal pollutions. Nuclear energy as a source of energy and its hazards. Solid waste management; causes, effects and control mechanisms of urban and industrial wastes. Prevention of pollution: role of individual. Disaster management mechanisms; disaster management of; floods, earthquake, cyclone and landslides.

Movement from unsustainable to sustainable development. Urban crisis related to energy. Water conservation, rain water harvesting, watershed management, Environmental ethics: Issues and possible solutions. Introduction to important green house gases (GHGs), sources of the primary greenhouse gases in Earth's atmosphere including water vapor, carbon dioxide, methane. The lesser GHGs- nitrous oxide, ozone and fluorinated gases. Carbon cycle, CO_2 sources, Keeling curve and Natural 'sinks' for CO_2. Green house effect, climate change, global warming, acid rain, ozone layer depletion, role of CFCs in ozone depletion, and

its mechanism, nuclear accidents and holocaust. Wasteland reclamation. Consumerism and waste products. Environment Protection Act (EPA). Air (prevention and control of pollution) Act. Water (prevention and control of pollution) Act, Wildlife Protection Act, Forest Conservation Act. Issues involved in the enforcement of environmental legislation. Introduction to the concept of green chemistry, atom economy (with suitable examples) and the twelve principles of green chemistry.

Module III: Population and Environmental issues

8 h

Human population growth, *Malthusian theory (basic idea) and* theory of evolution by natural selection, *Malthusian* catastrophe. Global challenges, *environmental* problems of population growth, impacts on human health and welfare, variation among nations, population explosion and Family Welfare Programme. Socio- economic, and geo-political dimensions of poverty, absolute and relative poverty, poverty scale, variation among nations, international food crisis. Resettlement and rehabilitation of project affected population. Environmental movements in India: Chipko, Silent valley, Bishnois of Rajasthan etc.

Module IV: Ecological Chemistry

18 h

Definition and scope of ecological chemistry, ecological stress posed upon ecosystems by the presence of chemicals. Origin of chemical toxicants; natural sources, and man-made. Organization of chemicals as xenobiotic, essential or nonessential substances. Release of chemicals in the environment, Transport Processes, Classification of transformation processes, biotic and abiotic. Structure- activity relationships in degradation and biodegradation of organic chemicals. Transformation processes including general, hydrolysis, oxidation, reduction, photochemical degradation, microbial degradation, and phytodegradation, environmental fate determining processes, bioavailability, exposure of species to (bio)available fractions, uptake (accumulation), metabolism, biomagnifications, distribution in organisms, and subsequent toxic effects. Risk assessment of chemicals-assessment of contaminated soils.

Persistent organic pollutants (POPs), natural and anthropogenic origin of POCs and characteristic properties; half-lives, K_{ow}, K_{aw} and K_{oa}. Adverse effects of persistent chemicals. Legislation on the use of POPs and twelve persistent organic pollutants. The sources, the uses, some of the physico-chemical properties, the half-lives in the environmental compartments of air, water and soil. Behaviour of the priority persistent organic pollutants identified by the United Nations Economic Commission for Europe (UNECE) including; polychlorinated biphenyls, dieldrin, aldrin, dichlorodiphenyltrichloroethane (DDT), Mirex, Heptachlor and Polychlorinated furans. Agency for Toxic Substances and Disease Registry (ATSDR) list, **the ATSDR 2017 Substance Priority List,** Restriction of Hazardous Substances (RoHS) directive, Material Safety Data Sheet (MSDN), Toxic Substances Control Act (TSCA) and banned/severely restricted chemicals list.

Suggested reference books

1. S. Manahan, *Fundamentals of environmental chemistry*, CRC-Press, 1993.
2. S. Manahan, *Fundamentals of Environmental and Toxicological Chemistry*: Sustainable Science, CRC Press, 2013
3. R.C. Brunner, *Hazardous Waste Incineration*, McGraw Hill Inc., 1989
4. W.P. Cunningham, T.H. Cooper, E Gorhani, and M.T. Hepworth, *Environmental Encyclopedia*, Jaico Publishing House, Mumbai, 2001.
5. A.K. De, *Environmental Chemistry*, Wiley Eastern Ltd.
6. V. Subramanian, *A Textbook of Environmental Chemistry*, I.K. International Publishing House Pvt. Ltd. 2011.
7. S.K. Tiwari, *Environmental Science: Volume I and II*, Atlantic Publishers and Distributers Pvt. Ltd., 2011.

8. R. M. Harrison (ed.), *Understanding Our Environment An Introduction to Environmental Chemistry and Pollution*, Royal Society of Chemistry, 1999
9. D. E. Newton, *Chemistry of the Environment***,** Facts On File Inc., 2007
10. V. Udai, Modern *Teaching of Population Education*, Anmol Publications Pvt. Ltd., 2005.
11. B. McGuire, Global *Catastrophes: A Very Short Introduction*, Oxford University Press, 2002.
12. A. E. Dessler, E. A. Parson, *The Science and Politics of Global Climate Change*, Cambridge University Press, 2006.
13. J. Firor, J. Jacobsen, *The Crowded and Greenhouse- Population, Climate Change, and Creating a Sustainable World,* Yale University Press, 2002.
14. B. Lomborg, *Cool It: The Skeptical Environmentalist's Guide to Global Warming*, Alfred A. Knopf Publisher- New York, 2007.

Further readings

1. S. V. S. Rana, *Essentials of Ecology and Environmental Science*, 5th Edition, Rupa publications, 2013.
2. V.H. Heywood, and R.T. Waston, *Global Biodiversity Assessment*. Cambridge Univ. Press, 1995.
3. H. Jadhav, V.M. Bhosale, *Environmental Protection and Laws*. Himalaya Pub. House, Delhi, 1995.
4. M.L. Mckinney, and R.M. School, *Environmental Science Systems and Solutions*, Web enhanced edition. 1996.
5. P. H., H. Raven, D.M. Hassenzahl, and L. R. Berg, *Environment*, 8th Edn. John Wiley & Sons, 2012.
6. A. Wreford, D. Moran, N. Adger , *Climate Change and Agriculture: impacts, adaptation and mitigation*, OECD publications, 2010.
7. R.S. Boethling D. Mackay, *Handbook of Property Estimation Methods for Chemicals.* Boca Raton, FL, USA: Lewis Publishers, 2000.
8. J.L.M. Hermens C. J. Van Leeuwen *Risk Assessment of Chemicals: An Introduction, Dordrecht,* The Netherlands, Kluwer Academic Press, 1995.
9. D. Mackay, W.Y.,Shiu, K.C. Ma *Physical-Chemical Properties and Environmental Fate, Degradation Handbook.* (CD-ROM), Boca Raton, FL, USA, Chapman & Hall CRC netBASE, CRC, 1999.
10. W. J. G. M. Peijnenburg, *Ecological Chemistry, Environmental and Ecological Chemistry- Vol. III, Encyclopedia of Life Support Systems* (EOLSS).
11. M. Ali, *Climate Change Impacts on Plant Biomass Growth*, Springer Dordrecht Heidelberg, 2013

Special Notes and Suggestions:

The purpose of the paper is to create general awareness on various dimensions of environmental sciences with a special focus on contemporary issues. The BoS in Chemistry recommend case studies or sample surveys (maybe in groups) rather than seminars. Students can undertake an assignment based on any of the following highly relevant and current topic;

- Edutainment film *"Samaksham",* produced by Mahatma Gandhi University, Kottayam.
- Case Studies on the *important natural resources* of Kerala.
- Case Studies on the Indian *mining scams and consequent environmental* damages of; illegal mining in the *Aravali Ranges, Goa, Ganges river bed, Bellary* etc.
- Case Studies on the *disaster management mechanisms* of floods, landslides, earthquake, cyclone etc.
- Case Studies on the water conservation, rain water harvesting, watershed management in a local contest.
- Case studies on environmental movements like Narmada Bachao Andolan, Appiko Movement, Save Ganga Movement etc.

Module - V (18 h)

V.I Human Rights

An Introduction to Human Rights, meaning, concept and development –History of Human Rights- Different Generations of Human Rights- Universality of Human Rights- Basic International Human Rights Documents - UDHR, ICCPR, ICESCR.-Value dimensions of Human Rights

V-II Human Rights and United Nations

Human Rights co-ordination within UN system- Role of UN secretariat- The Economic and Social Council-The Commission (of) Human Rights?-The Security Council and Human rights- The Committee on the Elimination of Racial Discrimination- The Committee on the Elimination of Discrimination Against Women- the Committee on Economic, Social and Cultural Rights- The Human Rights Committee- Critical Appraisal of UN Human Rights Regime.

V-III Human Rights National Perspective

Human Rights in Indian Constitution – Fundamental Rights- The Constitutional Context of Human Rights- directive Principles of State Policy and Human Rights- Human Rights of Women-children –minorities- Prisoners- Science Technology and Human Rights- National Human Rights Commission- State Human Rights Commission- Human Rights Awareness in Education.

References and suggested readings

1. H.O. Agarwal, *Implementation of Human Rights Covenants with Special Reference to India*,
2. P. Alston, *The United Nations and Human Rights*, Clarendon Press, London, 1995.
3. Amnesty International, *Political Kings by Governments*, Amnesty International, London, 1983.
4. Bajwa, G.S. and D.K. Bajwa, *Human Rights in India: Implementation and Violations* , D.K. Publishers, New Delhi, 1996.
5. UNESCO, Yearbook on Human Rights.
6. NHRC, Annual Reports since 1993.
7. V.K. Bansal, *Right to Life and Personal Liberty*, Deep and Deep, New Delhi, 1986.
8. M. Banton, *International Action against Racial Discrimination* Clarendon Press, Oxford, 1996.
9. D.D. Basu, Human Rights in Constitutional Law, Prentice Hall, New Delhi, 1994.
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12. UN Centre for Human Rights, *Discrimination against Women*, World Campaign for Human Rights, Geneva, 1994.
13. UN Centre for Human Rights, Minority Rights, World Campaign for Human Rights, Geneva, , 1998.
14. UN Centre for Human Rights, *Human Rights Machinery*, World Campaign for Human Rights, Geneva, 1987.
15. Ian Brownlie, *Basic Documents Human Rights*
16. Jack Donelli, *Universal Human Rights in Theory and practice*
17. Upendra Baxi, *Future of Human Rights*
18. O P Dhiman, *Understanding Human Rights-An Overview*
19. D P Khanna, *Reforming Human Rights*
20. Chiranjivi J Nirmal, *Human Rights in India-Historical, social and political perspectives*

21. *Human Rights in Post-Colonial India,* Edited by Om Prakash Dwivedi and V G Julie Rajan

CH5CRT06 - ORGANIC CHEMISTRY - III

(Reaction mechanisms expected only wherever mentioned)

Credits – 3 (54 Hrs)

Unit 1: Nitrogen Containing Compounds (15 Hrs)

Nitro compounds (aliphatic and aromatic):

Preparation: Methods of preparation of nitroalkanes and aromatic nitro compounds**.**

Reactions: Tautomerism of nitromethane. Reduction products of nitrobenzene in acidic, neutral and alkaline media. Electrolytic reduction and selective reduction of polynitro compounds. Formation of charge transfer complexes. **Amines** (aliphatic and aromatic):

Preparation: From alkyl halides, Reduction of nitro compounds and nitriles, Reductive amination of aldehydes and ketones, Gabriel's phthalimide synthesis, Hofmann bromamide reaction (with mechanism).

Reactions: Hofmann vs. Saytzeff elimination, Carbylamine test, Hinsberg test, with HNO_2. Separation of a mixture of 1°, 2° and 3° amines using Hinsberg reagent. Stereochemistry of amines. Structural features affecting basicity of aliphatic and aromatic amines. Comparative study of aliphatic and aromatic amines. Schotten – Baumann Reaction (with mechanism). Electrophilic substitution reactions of aniline: Halogenation, nitration and sulphonation. Quaternary amine salts as phase-transfer catalysts.

Diazonium salts:

Preparation: From aromatic amines.

Reactions: Structure and stability of benzene diazonium salts. Conversion to benzene, phenol, chloro, bromo, iodo and fluoro benzenes, nitro benzene and azo dyes. Mechanisms of Sandmeyer and Gatterman reactions. Schiemann and Gomberg reactions. Preparation, structure and uses of Phenyl hydrazine, Diazomethane and Diazoacetic ester. Arndt –Eistert synthesis – Mechanism of Wolff rearrangement.

Unit 2: Heterocyclic Compounds (8 Hrs)

Classification and nomenclature. Structure and aromaticity of 5-numbered and 6-membered rings containing one heteroatom. Synthesis and reactions of: Furan, Thiophene, Pyrrole (Paal-Knorr synthesis and Knorr pyrrole synthesis), Pyridine (Hantzsch synthesis), Indole (Fischer's indole synthesis), Quinoline (Skraup synthesis and Friedlander's synthesis) and Isoquinoline (Bischler-Napieralski reaction).

Unit 3: Active Methylene Compounds (5 Hrs)

Preparation: Ethyl acetoacetate by Claisen ester condensation.

Reactions: Keto-enol tautomerism. Synthetic uses of ethylacetoacetate, diethyl malonate and ethyl cyanoacetate (preparation of non-heteromolecules only). Alkylation of carbonyl compounds *via* enamines.

Unit 4: Carbohydrates (11 Hrs)

Classification of carbohydrates. Reducing and non-reducing sugars. General Properties of Glucose and Fructose, their open chain structure. Epimers, mutarotation and anomers. Determination of configuration of Glucose (Fischer proof). Cyclic structure of glucose. Haworth projections. Cyclic structure of fructose. Chain lengthening and chain shortening of aldoses - Kiliani-Fischer synthesis and Wohl degradation. Interconversion of aldoses and ketoses.Linkage between monosaccharides. Structure of the disaccharides sucrose, maltose and cellobiose (excluding their structure elucidation). Reactions and uses of sucrose. Artificial sugars (sweeteners) – sucralose. Structure of the polysaccharides starch and cellulose (excluding their structure elucidation). Industrial applications of cellulose.

Unit 5: Drugs (5 Hrs)

Classification of drugs. Structure, therapeutic uses and mode of action (synthesis not required) of Antibiotics: Ampicillin and Chloramphenicaol, Sulpha drugs: Sulphanilamide, Antipyretics: Paracetamol, Analgesics: Aspirin and Ibuprofen, Antimalarials: Chloroquine, Antacids: Ranitidine, Anti- cancer drugs: Chlorambucil and Anti-HIV agents: Azidothymidine (Zidovudine). Psychotropic drugs: Tranquilizers, antidepressants and stimulants with examples. Drug addiction and abuse. Prevention and treatment.

Unit 6: Dyes (4 Hrs)

Theories of colour and chemical constitution. Classification of dyes – according to chemical constitution and method of application. Natural and synthetic dyes. Synthesis and applications of: Azo dyes – Methyl orange; Triphenyl methane dyes - Malachite green and Rosaniline; Phthalein dyes – Phenolphthalein and Fluorescein; Indigoid dyes - Indigotin; Anthraquinoid dyes – Alizarin. Edible dyes (Food colours) with examples.

Unit 7: Polymers (6 Hrs)

Introduction and classification. Polymerisation reactions - Addition and condensation - Mechanism of cationic, anionic and free radical addition polymerization; Metallocene-based Ziegler-Natta polymerisation of alkenes. Preparation and applications of plastics – thermosetting (Phenol-formaldehyde, Urea-formaldehyde, Polyurethane) and thermosoftening (Polythene, PVC); Fibres (acrylic, polyamide, polyester). Synthetic rubbers – SBR, Nitrile rubber and Neoprene. Introduction to conducting polymers with examples. Environmental hazards and biodegradability of polymers. Recycling of plastics.

References

1. Morrison, R.T., Boyd, R.N. & Bhattacharjee, S.K. *Organic Chemistry*, 7th ed., Dorling Kindersley (India) Pvt. Ltd (Pearson Education), 2011.
2. Graham Solomon, T.W., Fryhle, C.B. & Snyder, S.A. *Organic Chemistry*, Wiley, 2014.
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7. John R. Dyer: *Applications of Absorption Spectroscopy of Organic Compounds,* Prentice Hall.
8. R.M. Silverstein, G.C. Bassler & T.C. Morrill*: Spectroscopic Identification of Organic Compounds*, Wiley.
9. Pillai, C.N. *Organic Chemistry*, Universities Press, 2008.
10. Gupta, S.S. *Organic Chemistry*, Oxford University Press, 2014.

CH5CRT07 – PHYSICAL CHEMISTRY - I

Credits – 2 (36 Hrs)

Unit 1: Gaseous State (12 Hrs) Postulates of Kinetic Theory of Gases and derivation of the kinetic gas equation.

Deviation of real gases from ideal behaviour, compressibility factor, causes of deviation. van der Waals equation of state for real gases. Boyle temperature (derivation not required). Critical phenomena and Andrews isotherms of CO_2, critical constants and their calculation from van der Waals equation. Virial equation of state, van der Waals equation expressed in virial form.

Maxwell Boltzmann distribution laws of molecular velocities and molecular energies (graphical representation – derivation not required) and their importance. Temperature dependence of these distributions. Most probable, average and root mean square velocities (no derivation).

Collision properties: Collision cross section, collision number, collision frequency, collision diameter and mean free path of molecules. Relation between mean free path and coefficient of viscosity.

Unit 2: Liquid State (3 Hrs) Intermolecular forces in liquids (qualitative idea only). Surface tension and its

measurement by stalagmometer method, factors affecting Surface tension, Viscosity, Poisuelle's equation, Determination of viscosity by Ostwald's viscometer..

Unit 3: Solid State (12 Hrs)

The nature of the solid state – anisotropy –Forms of solids. Unit cells, crystal systems, Bravais lattice types and identification of lattice planes. Laws of Crystallography – Law of constancy of interfacial angles, Law of rational indices. Miller indices. X–Ray diffraction by crystals, Bragg's law. Bragg's X-ray diffractometer method and powder pattern method. Analysis of powder diffraction patterns of NaCl and KCl, density of cubic crystals.

Structure of ionic compounds of the type AX (NaCl, CsCl, ZnS) and AX2 (CaF2, Na2O) Defects in crystals – stoichiometric and non-stoichiometric defects, extrinsic and intrinsic defects. Electrical conductivity, semiconductors, n-type, p-type, Superconductivity – An introduction.

Liquid crystals and its thermographic behaviour. Classification, structure of nematic and cholestric phases.

Unit 4: Surface Chemistry and Colloidal State (9 Hrs)

Adsorption – types, adsorption of gases by solids – factors influencing adsorption – Freundlich adsorption isotherm – Langmuir adsorption isotherm –derivation of Langmuir adsorption isotherm. The BET theory (no derivation) – use of BET equation for the determination of surface area.

Types of solutions – true, colloid and suspensions, Purification of colloids – Ultra filtration and electrodialysis, optical and electrical properties of colloids. Electrical double

layer and zeta potential. Coagulation of colloids, Hardy-Schulz rule. Micelles and critical micelle concentration, sedimentation and streaming potential.

References

1. R P W Atkins, *"Physical Chemistry"*, Oxford University Press
2. R J Silby and R A Alberty, *"Physical Chemistry"*, John Wiley & Sons
3. F Daniels and A Alberty, *"Physical Chemistry"*, Wiley Eastern
4. Puri, Sharma and Pathania, *"Principles of Physical Chemistry"*, Millennium Edition, Vishal Publishing Co
5. Barrow, G.M. "*Physical Chemistry*",Tata McGraw-Hill (2007).
6. Castellan, G.W. "*Physical Chemistry"*,4th Ed. Narosa (2004).
7. K. L. Kapoor, "*A Textbook of Physical chemistry"*, Volume 1, Macmillan India Ltd.,
8. B. R. Puri, L. R. Sharma, M. S. Pathania, "*Elements of Physical chemistry"*, Vishal Pub. Co.,
9. L V Azaroff, *"Introduction to Solids"*, McGraw Hill.
10. N B Hannay, *"Solid State Chemistry"*, Prentice Hall.
11. A. McQuarrie, J. D. Simon, *"Physical Chemistry – A molecular Approach"*, Viva Books Pvt. Ltd.
12. Anthony R. West, *"Solid State Chemistry and its Applications"*, Wiley Eastern.

CH5CRT08 – PHYSICAL CHEMISTRY – II
Credits - 3 (36 Hrs)

Unit 1: Quantum Mechanics (14 Hrs)

Classical mechanics: Concepts, Radiation phenomena –Blackbody radiation, Photoelectric effect, Compton effect and Atomic spectra. Plank's quantum theory and explanation of the radiation phenomena.de Broglie hypothesis, dual nature of electrons – Davisson and Germer's experiment. Heisensberg's uncertainty principle and its significance.

Postulates of quantum mechanics: Schrodinger wave equation – significance of Ψ, well behaved wave functions, Concept of operators- Operator algebra – Linear and Hermitian operators - Laplacian and Hamiltonian operators – Eigen functions and Eigen values of an operator.

Application of quantum mechanics to simple systems – Particle in 1-D box, normalization of wave function, application to linear conjugated polyene (butadiene). Introductory treatment of Schrödinger equation for hydrogen atom.– The wave equation in spherical polar coordinates (derivation not required) - Separation of wave equation - Radial and angular functions (derivation not required) – Orbitals. Quantum numbers and their importance, hydrogen like wave functions – radial and angular wave functions, radial distribution curves.

Molecular orbital theory: basic ideas – criteria for forming MO from AOs, construction of molecular orbital by LCAO method for H_2^+ion (elementary idea only), physical picture of bonding and antibonding wave functions, concept of σ, σ*, π, π* orbitals and their characteristics.

Unit 2: Molecular Spectroscopy-I (12 Hrs)

Introduction: electromagnetic radiation, regions of the spectrum, interaction ofelectromagnetic radiation with molecules, various types of molecular spectroscopic techniques, Born-Oppenheimer approximation.

Rotation spectroscopy: Introduction to rotational spectroscopy, Rotational energy levels, Selection rules.

Vibrational spectroscopy: Introduction, Selection Rules, Classical equation of vibration, calculation of force constant, concept of anharmonicity, Morse potential, dissociation energies, fundamental frequencies, overtones, hot bands. Degrees of freedom for polyatomic molecules, modes of vibration (H_2O and CO_2 as examples), finger print region, Fermi resonance.

Raman spectroscopy: Introduction, Classical and quantum treatment of Raman effect, Qualitative treatment of Rotational Raman effect; Vibrational Raman spectra, Stokes and anti-Stokes lines: their intensity difference, rule of mutual exclusion.

Unit 3: Molecular Spectroscopy-II (10 Hrs)

Electronic spectroscopy: Introduction, selection rule, Franck-Condon principle, electronic transitions, singlet and triplet states, dissociation and predissociation. Polyatomic molecules – qualitative description of σ, π and n- molecular orbitals, their energy levels and the respective transitions. Lambert-Beer's law.

Nuclear Magnetic Resonance (NMR) spectroscopy: Principles of NMR spectroscopy, Larmor precession, chemical shift and low resolution spectra, different scales, spin-spin coupling.

Electron Spin Resonance (ESR) spectroscopy: Principle, hyperfine structure, ESR of simple radical - methyl radical.

References

1. R.K. Prasad, *Quantum Chemistry*, New Age International, 2001
2. Mc Quarrie, J. D. Simon, *Physical Chemistry – A molecular Approach*, Viva Books.
3. I. N. Levine, *Physical Chemistry*, Tata McGraw Hill,
4. Banwell, C. N. &Mc Cash, E. M. *Fundamentals of Molecular Spectroscopy*,4th Ed. Tata McGraw-Hill: New Delhi (2006).
5. Manas Chanda, *Atomic structure and Chemical bonding in Molecular Spectroscopy"* Tata McGraw Hill.
6. D. L. Pavia, G. M. Lampman, G. S. Kriz, *Introduction to spectroscopy*, 3rd edn, ThomsonBrooks/Cole, 2001.
7. D. N. Satyanarayana, *Electronic absorption spectroscopy and related techniques*, Universities Press.
8. D.N. Sathyanarayana, Introduction To Magnetic Resonance Spectroscopy ESR, NMR, NQR, IK International, 2009.
9. Lowe, J. P. & Peterson, K. *Quantum Chemistry*, Academic Press (2005).
10. GurdeepRaj, *Photochemistry*, 6thEdn, Goel Publishing House, 2014
11. Rohatgi-Mukherjee, *Fundamentals of Photochemistry*, New Age International (P) Ltd.
12. Puri, Sharma &Pathania, *Priniciples of Physical Chemistry*, Vishal Publishing Co.
13. N. J. Turro, *Modern Molecular Photochemistry*, 4th Edition University Science Books,Sausalito, 1991.
14. Gurdeep Raj, *"Advanced Physical Chemistry"*, Goel Publishing House

CH5OPT – OPEN COURSE

Mahatma Gandhi University, Kottayam

CH5OPT02 - NANOSCIENCE AND NANOTECHNOLOGY

Credits – 3 (72 Hrs)

Unit 1: Hitory of Nanotchnology (18 Hrs)

Historical landmarks- terminology-scales. Top-down and bottom-up paths in nanoscience. Feynman's hypothesis-Moore's law -Types of nanomaterials: fullerene- its discovery-production-contribution to nanotechnology-unusual properties of fullerene. Nanotubes:carbon nanotubes- synthesis- properties and applications.

Unit 2: Nanoscience: Its Social, Economic and Ethical Perspectives (18 Hrs)

Existing laws and regulations of nanotechnology- regulatory agencies- intellectual property policy of nanotechnology. Energy challenges-environmental impacts of nanotechnology - green nanotechnology- technology business: nano economics- entrepreneurs in the technological ecosystem- nanoethics - future of nanotechnology.

Unit 3: Seeing the Nanoworld (18 Hrs)

Fundamental particles-elctromagnetic radiation- its components- impact on matter-the Planck's equation- de Broglie relation- matter-wave concept of radiation- concept of colour and vision-Auxochromes and chromophores- spectroscopic methods and radiation-elementary ideas of UV-visible, XPES and UPES techniques, SEM, TEM, SPL, and SIMS - their use in the studies of nanosystems (theory is not expected).

Unit 4: Applications of Nanotechnology (18 Hrs)

Nanobiology and its applications- Nanomedicines- immuno targeted drug delivery--nanoparticle drug systems for oral, nasal, and ocular administration- nanomaterials in medical diagnosis - therapeutic applications. Nanosensors- smart dusts. Destructive applications of nanotechnology.

References

1. T. Pradeep, Nano: The Essentials, Mc Graw Hill Publishing Company, New Delhi (2007).
2. V. S. Muraleedharan and A. Subramania, Nanosciece and nanotechnology, Ane Books Pvt. Ltd. New Delhi, 2009.
3. C. N. R. Rao and A.Govindraj, Nanotubes and Nanowires, Royal Society of Chemistry (2005).
4. J. M. M. Duart, R. J. M. Palma and F.A. Rueda,Nanotechnology and Microelectronics and optoelectronics, Elsevier (2002).
5. R. Booker and , E. Boysen, Nanotechnology, Wiley India Pvt Ltd, 2008.
6. K. J. Klabunde, Nanoscale materials in chemistry, John Wiley and Sons.
7. C. P. Poole Jr and F J Owens, Introduction to nanotechnology, Wiley IndiaPvt Ltd 2009.
8. L. E. Foster, Nanotechnology: Science, Innovation and Opportunity, Pearson Education (2008).
9. http://www.zyvex.com/nanotech/feynman.html

SEMESTER VI

CH6CRT09 - INORGANIC CHEMISTRY

Credits - 3 (54 Hrs)

Unit 1: Coordination Chemistry - I (7 Hrs)

Introduction of coordination compounds, Types of ligands – Anionic, cationic and neutral – IUPAC Nomenclature, Isomerism in coordination compounds –Structural isomerism and stereo isomerism . Chelates, chelate effect-Stability of complexes: Inert and labile complexes - Factors influencing stability. Review of Werner's theory and Sidgwick's concept of coordination – EAN rule.

Unit 2: Coordination Chemistry - II (14 Hrs)

Bonding theories: Valence bond theory - Geometries of coordination numbers 4 and 6 – Inner orbital and outer orbital complexes- Limitations of VBT. Crystal filed theory - Splitting of *d*-orbitals in octahedral, tetrahedral, tetragonal and square planar complexes - Jahn Teller Effect– Jahn –Teller distortion in Cu(II) complexes. Factors affecting crystal field splitting - CFSE of low spin and high spin octahedral complexes. Spectrochemical series - Explanation of geometry, magnetism and spectral properties - Merits and demerits of Crystal field theory. Molecular orbital theory – evidence for metal ligand covalency- MO diagram for octahedral complexes (with sigma bonds only).

Unit 3: Cooridnation Chemistry III (6 Hrs)

Spectral and magnetic properties of complexes – electronic absorption spectrum of $[Ti(H_2O)_6]^{3+}$, Calculation of magnetic moments – spin only formula. Reactivity of complexes – Ligand substitution reactions- SN_1 and SN_2 substitution reactions of square plananr complexs- Trans effect and its applications. Application of coordination chemistry in qualitative and quantitative analysis of metal ions such as Cu^{2+}, Zn^{2+}, Ni^{2+} and Mg^{2+}.

Unit 4: Organometallic Compounds (12 Hrs)

Definition – Classification based on the nature of metal-carbon bond and on the basis of hapticity. Naming of organometallic compounds. The 18- electron rule and stability – Ferrocene: Preparation, properties and bonding (VBT only). Metal-alkene complexes- – Zeise's salt. Catalytic properties of organometallic compounds - Zeigler Natta catalyst in the polymerization of alkene and Wilkinson catalyst in the hydrogenation of alkene (mechanism not expected). Preparation and properties of mononuclear carbonyls - Structures of $Mo(CO)_6$, $Fe(CO)_5$ and $Ni(CO)_4$. Polynuclear carbonyls, bridged carbonyls and bonding in carbonyls – $Mn_2(CO)_{10}$ and $Fe_2(CO)_9$. EAN of metals in metal carbonys – indication of metal-metal bonding. - Quadruple bond – structure of $Re_2CI_8^{2-}$.

Unit 5: Bioinorganic Chemistry (6 Hrs)

Essential and trace elements in biological systems – Structure and functions of haemoglobin and myoglobin, Vitamin B12 (structure not expected). Electron carriers – cytochromes. Chlorophyll and photosynthesis (mechanism not expected).

Role of alkali and alkaline earth metals in biological systems, Na/K pump. Importance of Ca and Mg. Biological functions and toxicity of metals – Fe, Cu, Zn, Cr, Mn, Ni, Co, Cd, Hg and Pb. Metalloenzymes of zinc and copper, nitrogenase. Treatment of metal toxicity by chelation therapy. Anti cancer drugs – cis platin and carboplatin– Structure and significance.

Unit 6: Boron Compounds (3 Hrs)

Preparation, properties and structure of diborane, borazine, boric acid, boron nitride.

Unit 7: Inter-halogen and Noble Gas Compounds (6 Hrs)

Interhalogens - classification- general preparation- structures of AB, AB_3, AB_5 and AB_7 types. Reactivity (ClF, ICl_3, ClF_3, IF_5 and IF_7). Comparison of pseudohalogens with halogens. Electropositive character of iodine. Separation of noble gases (charcoal adsorption method). Compounds of noble gases.

References

1. F.A. Cotton and G. Wilkinson, *Advanced Inorganic Chemistry*, 6th Edition, Wiley India Pvt. Ltd., New Delhi, 2009 (Reprint).
2. J.E. Huheey, E.A. Keitler and R.L. Keitler, *Inorganic Chemistry–Principles ofStructure and Reactivity*, 4th Edition, Pearson Education, New Delhi, 2013.
3. D.F. Shriver and P. Atkins, *Inorganic Chemistry*, 5th Edition, Oxford University Press, New York, 2010.
4. B.R. Puri, L.R. Sharma and K.C. Kalia, *Principles of Inorganic Chemistry*, 31st Edition, Milestone Publishers and Distributors, New Delhi, 2013.
5. P.L. Soni and Mohan Katyal, *Textbook of Inorganic Chemistry*, 20th Edition, S. Chand and Sons, New Delhi, 2013.
6. Satya Prakash, *Advanced Inorganic Chemistry, Volume 2,* S. Chand and Sons, New Delhi, 2005.
7. J.D. Lee, *Concise Inorganic Chemistry*, 5th Edition, Oxford University Press, New Delhi 2008.
8. R. Gopalan and V. Ramalingam, *Concise Coordination Chemistry,* 1st Edition, Vikas Publishing House, New Delhi, 2001.
9. Wahid U. Malik, G D. Tuli and R.D. Madan, Selected Topics in Inorganic Chemistry, S. Chand and Co., New Delhi, 2010 (Reprint).

SEMESTER VI

CH6CRT10 - ORGANIC CHEMISTRY - IV

Credits - 3 (54 Hrs)

Unit 1: Natural Products (6 Hrs)

Terpenoids

Terpenoids – Classification. Isoprene rule. Structure elucidation and uses of citral and geraniol. Natural rubber - structure, latex processing methods, vulcanisation, rubber compounding, mastication and uses.

Alkaloids

Alkaloids - General methods of isolation. Classification. Physiological action and medicinal importance. Structure elucidation and synthesis of coniine, nicotine and piperine.

Unit 2: Lipids (6 Hrs)

Introduction to lipids. Classification.

Oils and fats: Biological functions. Extraction and refining. Common fatty acids present in oils and fats. Omega fatty acids. Trans fats and their effect. Hydrogenation, Rancidity. Acid value, Saponification value, Iodine value and RM value.

Biological functions of waxes, phospholipids and glycolipids.

Soaps - Types of soaps. Cleansing action of soaps.

Synthetic detergents - Classification. Detergent additives. Comparison between soaps and detergents. Environmental aspects. ABS and LAS detergents.

Unit 3: Vitamins, Steroids and Hormones (6 Hrs)

Vitamins

Vitamins – Classification. Structure, biological functions and deficiency diseases of vitamins A, B_1, B_2, B_3, B_5, B_6, C and D.

Steroids

Steroids – Introduction. Diels' hydrocarbon. Structure and functions of cholesterol.

Elementary idea of HDL and LDL.

Hormones

Hormones – Introduction. Examples and biological functions of steroid hormones, peptide hormones and amine hormones (structure not required). Artificial hormones.

Unit 4: Amino Acids, Peptides and Proteins (8 Hrs)

Classification of amino acids. Synthesis, ionic properties and reactions of α-amino acids. Zwitterion structure and Isoelectric point.

Polypeptides. Synthesis of simple peptides (upto tripeptides) by N-protecting (benzyloxycarbonyl and *t*-butyloxycarbonyl) & C-activating groups. DCC method. Merrifield's solid phase peptide synthesis.

Classification of proteins. Overview of Primary, Secondary, Tertiary and Quaternary structure of proteins. Determination of primary structure of proteins. Determination of N-

terminal amino acid (by FDNB and Edman method) and C–terminal amino acid (by hydrazinolysis and with carboxypeptidase enzyme). Helical and sheet structures. Denaturation of proteins.

Unit 5: Nucleic Acids (4 Hrs)

Components of Nucleic acids: Adenine, guanine, cytosine, thymine and uracil (structure only), other components of nucleic acids. Nucleosides and nucleotides (nomenclature), Structure of polynucleotides; Structure of DNA (Watson - Crick Model) and RNA. Biological functions of DNA and RNA - Replication and protein biosynthesis. Transcription and Translation. Genetic code.

Unit 6: Enzymes (3 Hrs)

Introduction, classification and characteristics of enzymes. Salient features of active site of enzymes.

Mechanism of enzyme action, factors affecting enzyme action, Coenzymes and cofactors and their role in biological reactions, Specificity of enzyme action (Including stereospecificity). Enzyme inhibitors and their importance. Uses of enzymes.

Unit 7: Supramolecular Chemistry (3 Hrs) Introduction. Molecular recognition. Host-guest interactions. Types of non-covalent

interactions and molecular receptors. Role of molecular recognition in biopolymer (DNA and protein) structure organisation (elementary idea only).

Unit 8: Organic Photochemistry (4 Hrs)

Introduction. Photochemical versus Thermal reactions. Electronic excitation and fate of excited molecules. Jablonski diagram. Fluorescence and phosphorescence. Photosensitisation. Photochemical reactions: Norrish type I and II reactions of acyclic ketones, Paterno-Buchi reaction and Photo-Fries reaction (with mechanisms).

Unit 9: Organic Spectroscopy (14 Hrs)

UV Spectroscopy: Types of electronic transitions, λmax, Chromophores and Auxochromes, Bathochromic and Hypsochromic shifts, Intensity of absorption; Application of Woodward Rules for calculation of λ_{max} for the following systems: α,β-unsaturated aldehydes, ketones, carboxylic acids and esters; Conjugated dienes: alicyclic, homoannular and heteroannular; Extended conjugated systems (aldehydes, ketones and dienes); distinction between *cis* and *trans* isomers.

IR Spectroscopy: Fundamental and non-fundamental molecular vibrations; IR absorption positions of O and N containing functional groups; Effect of H-bonding, conjugation, resonance and ring size on IR absorptions; Fingerprint region and its significance; application in functional group analysis.

NMR Spectroscopy: Basic principles of Proton Magnetic Resonance, chemical shift and factors influencing it; Spin – Spin coupling and coupling constant; Anisotropic effects in

alkene, alkyne, aldehydes and aromatics, Interpretation of NMR spectra of simple compounds.

Applications of IR, UV and NMR for identification of simple organic molecules.

Mass Spectrometry: Introduction. EI ionisation. Determination of molecular mass by MS (elementary idea only – fragmentation study not required).

References

1. Finar, I. L. *Organic Chemistry* (*Volume 2)*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
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3. Nelson, D. L. & Cox, M. M. *Lehninger's Principles of Biochemistry,* 7th ed., W. H. Freeman.
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10. Gowariker, V.R., Viswanathan, N.V. & Sreedhar J. *Polymer Science*, 2nd ed., New Age, 2015
11. Steed, J. W. & Atwood, J.L. *Supramolecular Chemistry*, 2nd ed., Wiley, 2009.
12. Dodziuk, H. *Introduction to Supramolecular Chemistry*, Springer, 2002.

CH6CRT11 – PHYSICAL CHEMISTRY – III

Credits – 3 (54 Hrs)

Unit 1: Thermodynamics-I (15 Hrs)

Basic concepts- system, surroundings, types of systems. Extensive and intensive properties, macroscopic properties. State functions and path functions. Types of Processes, Zeroth law of thermodynamics. Definition of internal energy and enthalpy. Heat capacities at constant volume (C_v) and at constant pressure (C_p), relationship between C_p and C_v.

First law of thermodynamics –Mathematical statement of first law. Reversible process and maximum work. Calculation of work, heat, internal energy change and enthalpy change for the expansion of an ideal gas under reversible isothermal and adiabatic condition.

The Joule-Thomson effect – derivation of the expression for Joule-Thomson coefficient. Sign and magnitude of Joule-Thomson coefficient, inversion temperature. Liquefaction of gases.

Thermochemistry – standard states. Enthalpies of formation, combustion and neutralization. Integral and differential enthalpies of solution. Hess's law and its applications. Kirchoff's equation.

Unit 2: Thermodynamics-II (12 Hrs)

Second law: Limitations of first law – Different statements of II^{nd} law, Thermodynamic scale of temperature. Carnot cycle and its efficiency, Carnot theorem.

Concept of entropy – Definition and physical significance. Entropy as a function of volume and temperature, Entropy as a function of pressure and temperature. Entropy as a criteria of spontaneity and equilibrium.

Gibbs and Helmholtz free energies and their significances- criteria of equilibrium and spontaneity. Gibbs-Helmholtz equation, dependence of Gibbs free energy change on temperature, volume and pressure. Third law of thermodynamics-statement and determination of absolute entropies of substances.

Unit 3: Chemical Equilibria (3 Hrs) Law of mass action-equilibrium constant – Relation between Kp, Kc and Kx –

Thermodynamic treatment of the law of mass action – Vant Hoff reaction isotherm – Temperature dependence of the equilibrium constant – The Van't Hoffs equation –Pressure dependence of the equilibrium constant Kp.

Unit 4: Ionic Equilibria (8 Hrs) Introduction – Concepts of acids and bases, relative strength of acid-base pairs,

influence of solvents, Dissociation constants – acids, bases, and polyprotic acids. Ostwald's dilution law.

Degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water-pH. Effects of solvents on ionic strength..

Buffer solutions – Mechanism of buffer action, Henderson equation. Hydrolysis of salts – degree of hydrolysis and hydrolysis constant, determination of degree of hydrolysis, pH of salt solutions.

Unit 5: Phase equilibria (6 Hrs)

The phase rule-derivation, equilibrium between phases – conditions. One component system – water system, sulphur system. Two component systems – solid-liquid equilibrium – Simple Eutectic, Lead- Silver system, Formation of compounds with Congruent Melting Point; Ferric chloride–Water system, Formation of compounds with Incongruent Melting Point Sodium sulphate–Water system.

Unit 6: Chemical Kinetics (10 Hrs)

Rate of reaction, rate equation, order and molecularity of reactions, determination of order of a reaction. Integrated rate expressions for first and second order reactions ($2A \rightarrow P$ and $A + B \rightarrow P$). Zero order reactions, pseudo order reactions, half life.

Theories of chemical kinetics: Effect of temperature on the rate of reaction: Arrhenius equation, concept of activation energy, Collision theory, Transition state theory. Thermodynamic parameters for activation – Eyring equation (no derivation needed),enthalpy and entropy of activation. Theory of unimolecular reactions – Lindemann Theory.

Kinetics of complex (composite) reactions: Opposing reactions, consecutive reactions, and parallel (simultaneous) reactions. Chain reactions – steady state treatment, Hydrogen– Bromine reaction- derivation of rate expression.

Catalysis: Homogeneous catalysis, enzyme catalysis – Michaelis–Menten equation (no derivation needed). Heterogeneous catalysis – Surface catalysis, Elementary idea about Autocatalysis.

References

1. R. P. Rastogi, R. R. Misra, *An Introduction to Chemical Thermodynamics*, 6th edn., Vikas Pub. Pvt. Ltd. (2003).
2. P. Atkins and J Paula, *The elements of Physical chemistry*, 7thedn., Oxford University Press.
3. K.K. Sharma, L.K. Sharma, *A Textbook of Physical Chemistry*, 4thedn, Vikas publishing House.
4. B. R. Puri, L. R. Sharma, M. S. Pathania, *Elements of Physical chemistry*, Vishal Pub. Co. Jalandhar
5. J. Rajaram and J. C. Kuriakose, *Thermodynamics*, ShobanLalNagin Chand & Co (1986).
6. D. A. McQuarrie, J. D. Simon, *Physical Chemistry – A molecular* Approach, Viva Books Pvt. Ltd.
7. F. A. Alberty and R. J .Silby, *Physical Chemistry*, John Wiley.
8. F Daniels and R A Alberty, *Physical Chemistry*, Wiley Eastern.
9. Gurdeep Raj, *Advanced Physical Chemistry*, Goel Publishing House.
10. S. Glasstone, *Thermodynamics for Chemists*, Affiliated East West Publishers.
11. G.S. Rush Brooke, *Statistical Mechanics*, Oxford University Press.
12. K. L. Kapoor, A *Textbook of Physical chemistry, Volumes 3*, Macmillan India Ltd.
13. Gurdeep Raj, *Chemical Kinetics*, Krishna's Educational Publishers (2014).
14. K. J. Laidler, *Chemical kinetics*, 3rdedn, Pearson education, 2004.

CH6CRT12– PHYSICAL CHEMISTRY – IV

Credits – 3 (54 Hrs)

Unit 1: Solutions (12 Hrs)

Introduction – Binary liquid solutions – Raoult's law- ideal and non-ideal solutions– OG_{mix}, OV_{mix}, and OS_{mix} for ideal solutions. Vapour pressure – composition and temperature– composition curves of ideal and non-ideal binary liquid solutions. Fractional distillation of binary liquid-liquid solutions – distillation of immiscible liquids, partially miscible liquid-liquid systems. Critical solution temperature (CST).

Solubility of gases in liquids – Henry's law. Distribution of a solute between two solvents– Nernst distribution law.

Partial molar quantities – Chemical potential – Gibbs–Duhem equation. Colligative properties of dilute solutions – vapour pressure lowering, Boiling point elevation and freezing point depression (thermodynamic derivation).Molar mass determination-related problems – Osmotic pressure –laws of osmotic pressure – Reverse osmosis – purification of sea water. Abnormal molecular masses – van't Hoff factor – Degree of association and Degree of dissociation.

Unit 2: Electrical Conductance (12 Hrs)

Introduction- Faraday's laws of electrolysis, electrochemical equivalent& chemical equivalent. Electrolytic conductivity, molar conductivity – Variation of molar conductivity with concentration. Kohlrausch's law – Applications.

Ionic mobility – relation with ion conductivity, influence of temperature on ion conductivity, ion conductivity and viscosity – Walden's rule. Abnormal ion conductivity of hydrogen and hydroxyl ions.

Transference number and its experimental determination using Hittorf and Moving boundary methods.

Debye-Hückel theory of strong electrolytes – the concept of ionic atmosphere, Asymmetry and electrophoretic effect, Debye- Hückel-Onsager equation (no derivation). Activity, mean ionic activity and mean ionic activity coefficients of electrolytes. Ionic strength of a solution, Debye-Hückel limiting law (no derivation).

Applications of conductance measurements – Determinations of degree of dissociation of weak electrolytes, determination of solubility and solubility products of sparingly soluble salts, conductometric titrations involving strong acid- strong base, weak acid- strong base, mixture of a strong acid and weak acid against strong base and precipitation titrations.

Unit 3: Electromotive Force (15 Hrs)

Introduction –Electrochemical cells and electrolytic cells, Galvanic cells, characteristics of reversible cells. Reversible electrodes – Different types, Reference electrodes – Standard Hydrogen Electrode, Calomel electrode, Electrode potential – Electrochemical series. Representation of cells, Electrode reactions and cell reactions

Derivation of Nernst equation for electrode potential and cell potential, Gibb's Helmholtz equation and EMF of a cell, calculation of OG, OH and OS from EMF data. Calculation of equilibrium constant from EMF data.

Concentration cells – Electrode concentration cell and electrolyte concentration cells. Types of electrolyte concentration cells – with transference and without transference, liquid junction potential and salt bridge. Fuel cells – the hydrogen-oxygen fuel cell.

Applications of emf measurements – determination of solubility product, determination of pH using hydrogen electrode, quinhydrone electrode and glass electrode.

Potentiometric titrations of acid-base and redox reaction, oxidation reduction indicators. Irreversible electrode processes – overvoltage.

Corrosion of metals – forms of corrosion, corrosion monitoring and prevention methods.

Unit 4: Photochemistry (6 Hrs)

Laws of photochemistry-Grothus-Draper law, Stark-Einstein law. Jablonsky diagram-qualitative description of fluorescence, phosphorescence, non-radiative processes (internal conversion, intersystem crossing). Quenching of fluorescence.

Quantum yield, examples of low and high quantum yields, photochemical reactions (decomposition of HBr, isomerisation of maleic acid to fumaric acid), photosensitised reactions (photosynthesis, isomerization of 2-butene), chemiluminescence, bioluminescence..

Unit 5: Group Theory (9 Hrs)

Elements of symmetry – Proper and improper axis of symmetry, plane of symmetry, centre of symmetry and identity element. Combination of symmetry elements, Schoenflies symbol, Point groups, C_2V, C_3V and D_3h, Group multiplication table of C_2V, Determination of point groups of simple molecules like H_2O, NH_3 and BF_3.

References

1. B. R. Puri, L. R. Sharma, M. S. Pathania, *Elements of Physical chemistry*, VishalPub. Co. Jalandhar.
2. K. L. Kapoor, *A Textbook of Physical chemistry*, *Volume 4*, Macmillan India Ltd.
3. Barrow, G.M. *Physical Chemistry*,Tata McGraw-Hill (2007).
4. Castellan, G.W. *Physical Chemistry*,4th Ed. Narosa (2004).
5. Kotz, J.C., Treichel, P.M. & Townsend, J.R., *General Chemistry*, Cengage Learning India Pvt. Ltd. New Delhi (2009).
6. Mahan, B.H. *University Chemistry*, 3rd Ed. Narosa (1998).
7. K. L. Kapoor, *A Textbook of Physical chemistry*, *Volumes 1*, Macmillan India Ltd,
8. Glasstone S, *An Introduction to Electrochemistry*, East-West Press (Pvt.) Ltd. (2006).
9. Gurdeep Raj, *Advanced Physical Chemistry*, Goel publishing house.
10. Glasstone and Lewis, *Elements of Physical Chemistry*, Macmillan

11. K. L. Kapoor, *A Textbook of Physical chemistry*, *Volumes 3*, Macmillan IndiaLtd.
12. I.N. Levine, *Physical Chemistry*, Tata McGraw Hill
13. F A Alberty and R J Silby, *Physical Chemistry*, John Wiley.
14. P. W. Atkins,*The elements of Physical chemistry*, 8thedn, Oxford UniversityPress.
15. D. A. McQuarrie, J. D. Simon, *Physical Chemistry – A molecular Approach*, Viva Books Pvt.Ltd.
16. S. H. Marron and J. B. Lando, *Fundamentals of Physical Chemistry*, MacmillanLtd.
17. G. K. Vemulapalli, *Physical Chemistry*, Prentice-Hall of India Pvt. Ltd. (1997) V Ramakrishnan and M S Gopinathan, *"Group Theory in Chemistry"*, Vishal Publishing.

PRACTICALS
SEMESTER V & VI

CH6CRP03 - QUALITATIVE INORGANIC ANALYSIS

Credit – 3 (108 Hrs)

1. Study of the reactions of the following radicals with a view to their identification and confirmation. Ag^{+} , Hg^{2+}, Pb^{2+}, Cu^{2+}, Bi^{2+}, Cd^{2+}, As^{3+}, Sn^{2+}, Sb^{3+}, Fe^{2+}, Fe^{3+}, Al^{3+}, Cr^{3+}, Zn^{2+} , Mn^{2+}, Co^{2+}, Ni^{2+}, Ca^{2+}, Sr^{2+}, Ba^{2+}, Mg^{2+}, Li^{+} , Na^{+} , K^{+} , $NH4^{+}$. $CO3^{2-}$, $S2^{-}$, $SO4^{2-}$, NO3', F^{-}, Cl^{-}, Br^{-} , $BO2^{-}$, $C2O4^{2-}$, $C4H4O6^{2-}$, $CH3COO^{-}$, $PO4^{3-}$, $AsO3^{3-}$, $AsO4^{3-}$ and $CrO4^{2}$-
2. Systematic qualitative analysis of mixtures containing two acid and two basic radicals from the above list without interfering radical and with one interfering radical by Semi-micro method only. (Minimum of 10 mixtures to be analysed)

References

1. Vogel 'A Text Book of Quantitative Inorganic Analysis Including Elementary Instrumental Analysis': (Third Ed.) (ELBS)
2. G. Svehla, Text Book of Vogel's Macro and Semi-micro Inorganic Analysis, revised, Orient Longman.
3. V. V. Ramanujam, 'Inorganic Semi micro Qualitative Analysis', The National Publishing Co., Chennai,
4. W. G. Palmer 'Experimental Inorganic Chemistry', Cambridge.

CH6CRP04 - ORGANIC PREPARATIONS AND LABORATORY TECHNIQUES

Crdits-2 (72 Hrs)

A. Basic Laboratory Techniques

1. Crystallisation – Any four compounds using ethyl acetate, ethanol, and water - Record the yield of recovery.
2. Distillation - Purification of water and ethyl acetate-Record the yield of recovery.
3. Solvent extraction – aniline from water - methyl benzoate from water - using ether-
4. Record the yield of recovery. (*Any two experiments shall be done*).

B. Organic Preparations

1. Oxidation (benzaldehyde to benzoic acid).
2. Hydrolysis (methyl salicylate or ethyl benzoate to the acid).
3. Nitration (*m*-dinitrobenzene and picric acid).

4. Halogenation (*p*-bromoacetanilide from acetanilide).
5. Acylation (Benzoylation of aniline, phenol, β-naphthol).
6. Esterification (benzoic acid ester).
7. Iodoform from acetone or ethyl methyl ketone.
8. Side chain oxidation (benzyl chloride to benzoic acid).
9. Claisen – Schmidt reaction: Dibenzal acetone from benzaldyde.

C. Chromatography

1. TLC - Separation and identification- Determination of Rf value of *o*-and *p*-nitroanilines,
   o- and *p*-chloroanilines, *p*-chlorophenol and *p*-nitrophenol, *p*-chloroaniline and *p*–nitroaniline, benzil and *o*-nitroaniline or any two amino acids.
2. Column Chromatography – Purification of *o*-nitro aniline, o-nitrophenol, benzil, m-dinitro benzene, benzene azo –β-naphthol (*non–evaluative*).

References

1. Furniss, B.S.; Hannaford, A.J.; Rogers, V. Smith, P.W.G.; Tatchell, A.R. *Vogel's Textbook of Practical Organic Chemistry,* 5th ed., Pearson Education, 2005.
2. Mann,F.G.; Saunders, B.C. *Practical Organic Chemistry*, 4th ed., Pearson Education, 2009.
3. Ahluwalia, V.K.; Aggarwal, R. *Comprehensive Practical Organic Chemistry – Preparation and Quantitative Analysis*, Universities Press, 2000.
4. Vishnoi, N.K. *Advanced Practical Organic Chemistry*, 3rd ed., Vikas Publishing House, New Delhi, 2010.

CH6CRP05 - PHYSICAL CHEMISTRY PRACTICALS

Credits 3 (108 hrs)

1. Viscosity – percentage composition of a mixture.
2. Heat of solution – KNO3, NH4Cl
3. Heat of neutralization
4. Determination of equivalent conductance of an electrolyte
5. Conductometric titration – strong acid *vs.* strong base, weak acid-strong base
6. Transition temperature of salt hydrates. (Sodium thiosulphate, sodium acetate)
7. Determination of the surface tension of a liquid(Drop number method or Drop weight method)
8. Critical solution temperature of phenol-water system.
9. Effect of electrolytes on the CST of phenol-water system.
10. Molecular weight determination by Rast's method. (using naphthalene,camphor or biphenyl as solvent and acetanilide, p-dichlorobenzene etc. assolute.)
11. Kinetics of simple reactions eg. Acid hydrolysis of methyl acetate.
12. Potentiometric titration – Fe^{2+} *vs.* $Cr_2O_7^{2-}$, I^- *vs.* MnO^{4-}
13. Data analysis of kinetic experiments using spreadsheet program (determination of rate constant)

14. Determination of equivalence point of potentiometric and conductometric titrationsusing spreadsheet program.

References

1. W. G. Palmer: 'Experimental physical chemistry', Cambridge University Press.
2. J.B. Yadav: Advanced Practical Physical Chemistry Goel Publishing House.
3. R.C. Das and B. Behra; 'Experiments in Physical Chemistry', Tata McGraw hill.
4. K.K. Sharma : 'An Introduction of Practical Chemistry': Vikas Publishing House, New Delhi
5. Khosla, B. D.; Garg, V. C. &Gulati, A. *Senior Practical Physical Chemistry,*R. Chand & Co.: New Delhi (2011).

CH6CRP06 GRAVIMETRIC ANALYSIS

2 Credits (36 Hrs) – Semester VI only

1. Estimation of Barium as barium sulphate
2. Estimation of iron as Fe_2O_3
3. Estimation of sulphate as barium sulphate
4. Estimation of copper as cuprous thiocynate
5. Estimation of nickel as nickel dimethyl glyoxime.

References

1. J. Mendham. R.C. Denney, J.D. Barnes and M. Thomas, *Vogel's Textbook of Quantitative Chemical Analysis*, 6th Edition, Pearson Education, Noida, 2013.
2. D.A. Skoog, D.M. West, F.J. Holler and S.R. Crouch, *Fundamentals of Analytical Chemistry*, 8th Edition, Brooks/Cole, Thomson Learning, Inc., USA, 2004.
3. G. D. Christian, Analytical Chemistry, JohnWiley and Sons.
4. R. D. Day, A. L. Uderwood, Quantitative analysis,

Semester VI

CHOICE BASED COURSES

CH6CBT01 - POLYMER CHEMISTRY

Credits – 3 (54 Hrs)

Unit 1: Introduction and History of Polymeric Materials (4 Hrs)

History of Polymers. Terminology. Different schemes of classification of polymers. Polymer nomenclature.

Unit 2: Mechanisms of Polymerization (6 Hrs)

Classification of polymerization processes. Mechanism of step growth, radical chain growth, ionic chain (both cationic and anionic) and coordination polymerizations. Mechanism of copolymerization. Mechanism of ring opening and group transfer polymerisations.

Unit 3: Polymerisation Techniques (4 Hrs)

Polymerisation techniques: Bulk, solution, suspension and emulsion polymerisations. Melt, solution and interfacial polycondensation techniques.

Unit 4: Physical Properties of Polymers (14 Hrs)

Structure-Property relationships of polymers.

Crystallization and Crystallinity: Determination of crystalline melting point and degree of crystallinity, Morphology of crystalline polymers, Factors affecting crystalline melting point. ***Molecular weight of polymers:*** Determination of Molecular Weight of Polymers (M_n, M_w, etc) by end group analysis, viscometry, light scattering and osmotic pressure methods. Molecular weight distribution and its significance. Polydispersity index.

Glass Transition Temperature (T_g): Definition. Factors influencing glass transition temperature (T_g). T_g and molecular weight. T_g and melting point. Importance of T_g.

Unit 5: Reactions of Polymers (4 Hrs)

Hydrolysis, hydrogenation, addition, substitution, crosslinking, vulcanisation and cyclisation reactions.

Unit 6: Polymer Degradation (4 Hrs)

Types of degradation. Thermal, mechanical, photo and oxidative degradations of polymers.

Unit 7: Polymer Processing (4 Hrs)

Polymer processing techniques: Compression moulding, Injection moulding, Blow moulding, Extrusion moulding, Thermoforming, Die casting, Film casting, Rotational casting, Calendering and Spinning.

Unit 8: Chemistry of Commercial Polymers **(8 Hrs)**

Brief introduction to the preparation, structure, properties and applications of the following polymers: polyolefins (LDPE, HDPE and PP), poly(vinyl chloride), polystyrene, poly(vinyl acetate), acrylic polymers (PAN and PMMA), fluoro polymers (PTFE), aliphatic polyamides (Nylon 6,6 and Nylon 6), aromatic polyamides (Kevlar), polyesters (PET), formaldehyde resins (PF, UF and MF), polyurethanes, polycarbonates, epoxy resins.

Unit 9: Specialty Polymers **(6 Hrs)**

High temperature resistant and flame retardant polymers. Biomedical applications of polymers. Controlled drug delivery systems. Conducting polymers - polyacetylene, polyaniline, poly(p-phenylene sulphide), polypyrrole, polythiophene. Conduction mechanism and applications. Carbon nanotubes. Synthesis and applications (elementary idea only).

References

1. Carraher, C.E. *Seymour/Carraher's Polymer Chemistry,* 6th ed., Marcel Dekker, New York, 2003.
2. Odian, G. *Principles of Polymerization*, 4th ed., Wiley, 2004.
3. Billmeyer, F.W. *Textbook of Polymer Science*, 3rd ed., Wiley-Blackwell, 1984.
4. Gowariker, V.R., Viswanathan, N.V.; Sreedhar J. *Polymer Science*, 2nd ed., New Age, 2015.
5. Ghosh, P. *Polymer Science & Technology*, 2nd ed., Tata McGraw-Hill, New Delhi, 2002.
6. Lenz, R.W. *Organic Chemistry of Synthetic High Polymers.* Interscience Publishers, New York, 1967.
7. Bahadur, R., Sastry, N.V. *Principles of Polymer Science*, Narosa, New Delhi, 2003.

Mahatma Gandhi University, Kottayam

SYLLABUS FOR B.Sc. CHEMISTRY (COMPLEMENTARY)

SEMESTER I

CH1CMT01 - BASIC THEORETICAL AND ANALYTICAL CHEMISTRY

(Common for students who have opted Life Sciences, Family & Community Science, Physical Sciences and Geology as core)

Credits - 2 (36 Hrs)

Unit 1: Atomic Structure and Chemical Bonding (9 Hrs)

Atomic Structure: Bohr atom model and its limitations, Dual nature of matter and radiation. Photoelectric effect, de Broglie equation, Heisenberg's uncertainty principle, Concept of orbital, Quantum numbers, shapes of orbitals (*s, p, d*), Electronic configuration of atoms - Aufbau principle, Hund's rule of maximum multiplicity, Pauli's exclusion principle.

Chemical Bonding: Introduction – Type of bonds. Ionic bond: Factors favouring the formation of ionic bonds - Lattice energy of ionic compounds and its applications. Covalent bond: Lewis theory - Valence bond theory – Coordinate bond. VSEPR theory and examples. Hybridisation: - sp^3, sp^2 and *sp* (ethane, ethene, ethyne). Intermolecular forces - Hydrogen bonding in H_2O - Dipole-dipole interactions.

Unit 2: Fundamental Concepts in Chemistry (9 hrs)

Periodic Properties: Modern periodic law – Long form of periodic table. Periodicity in properties: Atomic radii, ionic radii, ionization enthalpy, electron affinity (electron gain enthalpy) and electronegativity (Pauling scale). Atomic mass - Molecular mass - Mole concept – Molar volume - Oxidation and reduction – Oxidation number and valency - Equivalent mass. Methods of expressing concentration: Weight percentage, molality, molarity, normality, mole fraction, ppm and millimoles.

Concept of Equilibrium: Acids and Bases - Arrhenius, Lowry-Bronsted and Lewis theories. Ionic product of water - pH and pOH, Strengths of acids and bases - K_a and K_b, pK_a and pK_b. Buffer solution. Preparation of buffer solution having a known pH. Solvation, solubility, solubility product, common ion effect and their applications.

Unit 3: Basic Principles of Analytical Chemistry (9 Hrs)

Laboratory Operations (*Non-evaluative*): Laboratory safety and first aid. Use of different glassware like pipette, burette, standard measuring flask, distillation apparatus; heating methods, filtration techniques, weighing principle in chemical balance, weighing in electronic balance.

Methods of Analysis: Volumetric method of analysis - General principles. Primary and secondary standards, criteria for primary standards, preparation of standard solutions, standardization of solutions, end point. Acid base, redox and complexometric titrations and corresponding indicators. Double burette method of titration: Principle and advantages. Microanalysis and its advantages. Gravimetric method of analysis: General principles.

Reporting of Analytical Data: Units, significant digits, rounding, scientific and prefix notation, graphing of data - Precision and accuracy – Types of errors – Ways of expressing precision – Methods to reduce systematic errors.

Separation and Purification Techniques: Recrystallisation, use of drying agents, sublimation. General principles of distillation, fractional distillation, distillation under reduced pressure. Solvent extraction.

Unit 4: Chromatographic Techniques (9 Hrs)

Chromatography - Principle of differential migration. Classification of chromatographic methods. Basic principle and uses of Thin layer chromatography (TLC), Paper chromatography (PC), R_f value, Column chromatography, Gas chromatography(GC), High performance Liquid chromatography (HPLC), Ion Exchange chromatography (IEC).

References

1. B. R. Puri, L. R. Sharma, M.S. Pathania, *Elements of Physical Chemistry*, 3rd edn. Vishal Pub. Co., 2008.
2. C. N. R. Rao, *University General Chemistry*, Macmillan, 2009.
3. Manas Chanda, *Atomic Structure and Molecular Spectroscopy.*
4. P. L. Soni, *Inorganic Chemistry* .
5. R. A. Day Junior, A.L. Underwood, *Quantitative Analysis*, 5th edn. Prentice Hall of India Pvt. Ltd. New Delhi, 1988.
6. J. Mendham, R. C. Denney, J.D. Barnes, M. Thomas, *Vogel's Text Book of Quantitative Chemical Analysis*, 6th edn. Pearson Education (2003).
7. R. Gopalan, *Analytical Chemistry*, S. Chand and Co., New Delhi.

SEMESTER II
CH2CMT02 - BASIC ORGANIC CHEMISTRY

(Common for students who have opted Life Sciences, Family & Community Science, Physical Sciences and Geology as core)

Credits – 2 (36 Hrs)

Unit 1: Fundamental Concepts of Organic Chemistry (9 Hrs)

Introduction: Origin of organic chemistry – Uniqueness of carbon – Homologous series. IUPAC nomenclature of alkyl halides, alcohols, aldehydes, ketones, carboxylic acids and amines. Structural isomerism: Chain isomerism, position isomerism, functional isomerism, metamerism and tautomerism. Arrow formalism in organic chemistry. Bond fission - homolytic and heterolytic fission. Types of reagents - Electrophiles and nucleophiles. Polarity of bonds. Reaction Intermediates: Carbocations, carbanions and free radicals (preparation, structure, hybridization and stability). Types of organic reactions: Addition, Elimination, Substitution, Rearrangement and Redox reactions (definition and one example each).

Unit 2: Mechanisms of Organic Reactions (9 Hrs)

Meaning of reaction mechanism. Polarity of bonds. Electron Displacement Effects: Inductive effect - Definition - Characteristics - +I and -I groups. Applications: Explanation of substituent effect on the acidity of aliphatic carboxylic acids. Mesomeric effect: Definition – Characteristics - +M and -M groups. Applications: Comparison of electron density in benzene, nitrobenzene and phenol. Hyperconjugation: Definition – Characteristics. Applications: Baker-Nathan effect, Comparison of stability of 2-methyl-1-butene & 2-methyl-2-butene. Steric effect (causes and simple examples).

Substitution reactions: nucleophilic substitution of alkyl halides- S_N1 and S_N2 mechanisms. Electrophilic substitutions in benzene - reaction mechanism. Addition reactions: electrophilic addition to alkene sand alkynes - Markwonikoff's rule, Peroxide effect. Elimination reactions: E1 and E2 mechanisms.

Unit 3: Stereochemistry of Organic Compounds (9 Hrs)

Stereosiomerism – definition, classification.

Geometrical Isomerism: Definition – Condition – Geometrical isomerism in but-2-ene and but-2-ene-1,4-dioic acid. cis and trans, *E* and *Z* configurations. Methods of distinguishing and interconversion of geometrical isomers.

Optical Isomerism: Optical activity – Chirality – Enantiomers - Meso compounds - Diastereoisomers – Optical isomerism in lactic acid and tartaric acid - Racemisation and resolution (elementary idea only).

Conformations: Newman projection, Saw-horse projection. Conformations of ethane, n-butane, and cyclohexane - Relative stability and energy diagrams. Conformation of methyl cyclohexane.

Unit 4: Natural and Synthetic Polymers (9 Hrs)

Introduction. Classification of polymers: Natural, synthetic; linear, cross-linked and network; plastics, elastomers, fibres; homopolymers and copolymers. Polymerization reactions. Typical examples: Polyethylene, polypropylene, PVC, phenol-formaldehyde and melamine-formaldehyde resins, polyamides (nylons) and polyesters. Natural rubber: structure, latex processing methods, vulcanization and uses. Synthetic rubbers: SBR, nitrile rubber and neoprene. Biodegradability of polymers, environmental hazards. Recycling of plastics.

References

1. I. L. Finar, Organic Chemistry Vol. I , 6th edn. Pearson.
2. M.K. Jain, S.C. Sharma, *Modern Organic Chemistry*, Vishal Publishing Co. 2010.
3. S. M. Mukherji, S. P Singh, R. P Kapoor, Organic Chemistry Vol.1, New Age International Pvt. Ltd, 2006.
4. S. Sengupta, *Basic Stereochemisty of Organic Molecules,* 2014.
5. E. L. Eliel, S.H. Wilen, *Sterechemistry of Organic Compounds,* Wiley, 1994.
6. Peter Sykes, *A Guide Book to Mechanism in Organic Chemistry*, 6th edn. Orient Longman, 1988.
7. S. M. Mukherji, S.P Singh, *Reaction Mechanism in Organic Chemistry*, Macmillan, 3rd edn., 2003.
8. V.R. Gowarikar, N.V. Viswanathan, J. Sreedhar, *Polymer Science*, 2nd edn., New Age International Pvt. Ltd., 2015.

SEMESTER-III

CH3CMT03 - PHYSICAL CHEMISTRY – I

(For students who have opted Physical Sciences and Geology as Main)

Credits-3 (54 Hrs)

Unit 1: Solids and Crystalline State (18 Hrs)

Classification of solids: amorphous, crystalline – differences. Lattice, lattice energy (general idea), unit cell, examples of simple cubic, bcc and fcc lattices, calculation of number of atoms in a unit cell, calculation of lattice parameters of cubic unit cell. Theories of Solid: band theory, conductors, semiconductors and insulators, mention of super conductors. Magnetic Properties: classification - diamagnetic, paramagnetic, antiferromagnetic, ferro and ferrimagnetic, permanent and temporary magnets.

Symmetry of molecules-symmetry elements and symmetry operations – centre of symmetry, plane of symmetry, proper and improper axes of symmetry, crystallographic point groups, Schoenflies symbol. Symmetry elements in crystals - The seven crystal systems – Weiss and Miller indices - Bravais lattices – Bragg's equation (derivation required) and its applications (mention only), structure determination of NaCl by X-ray diffraction.

Unit 2: Liquid State and Solutions (12 Hrs)

Liquids: Intermolecular forces, liquids compared with gases and solids (qualitative idea only), viscosity, surface tension (method of determination not expected), structure of liquids (a qualitative description). Liquid crystals – the intermediate phase between solid and normal liquid phases, thermographic behaviour, classification, structure of nematic and cholesteric phases.

Solutions: Kinds of solutions - Solubility of gases in liquids – Henry's law and its applications - Colligative properties - Osmotic pressure - Reverse osmosis and its applications - Determination of molecular mass using colligative properties.

Unit 3: Gaseous State (9hrs)

Gaseous State: Introduction - Kinetic molecular model of gases – Maxwell distribution of velocities and its use in calculating molecular velocities – Average velocity, RMS velocity and most probable velocity (derivations not required) – Boyle's law – Charles's law – Ideal gas equation – Behaviour of real gases – Deviation from ideal behaviour - Van der Waals equation (derivation not required).

Unit 4: Surface Chemistry and Colloids (9 Hrs)

Adsorption – types of adsorption of gases by solids, factors influencing adsorption, Freundlich adsorption isotherm – Langmuir adsorption isotherm (derivation not required).rue solution, colloidal solution and suspension. Classification of colloids: Lyophilic, lyophobic, macromolecular, multimolecular and associated colloids with examples. Purification of colloids by electrodialysis and ultrafiltration. Properties of colloids: Brownian movement – Tyndall effect – Electrophoresis. Origin of charge and stability of colloids – Zeta potential – Coagulation - Hardy Schulze rule – Protective colloids - Gold number. Emulsions. Applications of colloids: Delta formation, medicines, emulsification, cleaning action of detergents and soaps.

Unit 5: Phase Equilibrium (6Hrs)

The phase rule, definition, equilibrium between phases, one component system – water system, two component systems: solid- liquid equilibrium – simple eutectic, lead-silver system, solid solution. Distribution law, partition coefficient, applications.

References

1. B.R. Puri, L.R. Sharma, M.S. Pathania, *Elements of Physical Chemistry*, 40thedn. Vishal Pub. Co. Jalandhar (2013)
2. B. R. Puri, L.R. Sharma and K.C. kalia, *Principles of Inorganic Chemistry*, Milestone Publishers New Delhi. 2013.
3. J.A. K. Tareen and T.R. N. Kutty, *A basic course in Crystallography*, University Press, 2000.
4. Anthony R West, Solid State Chemistry and its Applications", Wiley Eastern
5. V.Ramakrishnan and M.S.Gopinathan, "Group Theory in Chemistry", Vishal Publishing Co.
6. Gurdeep Raj, "Advanced Physical Chemistry", Goel Publishing House.
7. Walter J. Moore, Physical Chemistry, 4thEdn. Longmans Green and Co. Ltd.
8. P. W Atkins, "Physical Chemistry", Oxford University Press.
9. R. J Silby and R.A Alberty, "Physical Chemistry", John Wiley & Sons.

SEMESTER III

CH3CMT04: INORGANIC AND ORGANIC CHEMISTRY

(For students who have opted Life Sciences and Family & Community Science as core)

Credits - 3 (54 Hrs)

Unit 1: Nuclear Chemistry (12 Hrs)

Nuclear Stability - Mass defect, Binding energy, Nuclear forces, Magic number, Packing fraction, n/p ratio. Natural and induced radioactivity, radioactivity – detection, Units of radioactivity. Modes of decay – Group displacement law. Isotopes, isobars and isotones with examples. Nuclear fission - Atom bomb – Nuclear fusion – Hydrogen bomb - Nuclear reactors - Nuclear reactors in India. Application of radioactive isotopes – ^{14}C dating – Rock dating – Isotopes as tracers – Radio diagnosis and radiotherapy.

Unit 2: Bioinorganic Chemistry (6 Hrs)

Thermodynamics of Living cell- Exergonic and endergonic reactions, coupled reactions. Metal ions in biological systems - Biochemistry of iron – Metalloporphyrins - Haemoglobin and myoglobin, pH of blood, cytochromes, Ferredoxine - Mechanism of O_2 and CO_2 transportation - Chlorophyll and photosynthesis (mechanism not expected) elementary idea of photophosphorylation. Photosynthesis and respiration – comparison. – Elementary idea of structure and mechanism of action of sodium potassium pump. Biochemistry of zinc and cobalt.

Unit 3: Chemistry and Agriculture (12 Hrs)

Fertilizers: NPK, superphosphates, triple super phosphate, uses of mixed fertilizers, micronutrients and their role, bio-fertilizers, plant growth hormones.

Pesticides: Classifications with simple examples, Biopesticides. Insecticides – stomach poisons, contact insecticides, fumigants. Method of preparation and use of DDT, BHC, pyrethrin. Herbicides - structure and function of 2, 4,-D and 2,4,5 –T, Fungicides- inorganic and organic- Bordeaux mixture. Excessive use of pesticides – environmental hazards.

Unit 4: Heterocyclic Compounds (12 Hrs)

Aromaticity – Huckel's rule, preparation (any one method), properties, structure and aromaticity of furan, pyrrole, pyridine and indole. Pyrimidines & purines - adenine, guanine, thymine, cytosine and uracil.

Unit 5: Drugs (6 Hrs)

Classification of drugs. Structure, therapeutic uses and mode of action (synthesis not required) of Antibiotics: Ampicillin, Sulpha drugs: Sulphanilamide, Antipyretics: Paracetamol, Analgesics: Aspirin, Antacids: Ranitidine, Antimalarials: Chloroquine and Anti-cancer drugs: Chlorambucil. Psychotropic drugs: Tranquilizers, antidepressants and stimulants with examples. Drug addiction and abuse. Prevention and treatment.

Unit 6: Food Additives and Cosmetics (6 Hrs)

Food Additives: Food preservatives, artificial sweeteners, flavours, emulsifying agents, antioxidants, leavening agents and flavour enhancers (definition and examples, structures not required) – Structure of BHT, BHA and MSG - Commonly used permitted and non-permitted food colours (structures not required) - Fast foods and junk foods & their health effects – Soft drinks and their health effects.

Cosmetics: Introduction, classification. Dental cosmetics, Shampoos, Hair dyes, Skin products, Shaving cream, Talcum powder, Perfumes and Deodorants (composition and health effects).

References

1. H.J. Arnikar, *Essentials of Nuclear Chemistry* (Revised IV edn.),New Age, 1995.
2. B. R. Puri, L. R. Sharma, M.S. Pathania, *Elements of Physical Chemistry*, 3rd edn. Vishal Pub Co., 2008.
3. I. L. Finar, *Organic Chemistry* Vol. 1 & 2, 6th edn., Pearson, 2002.
4. C.N. R. Rao, *University General Chemistry*, Macmillan 2009.
5. B. R. Puri, L.R. Sharma and K.C. Kalia, *Principles of Inorganic Chemistry*, Milestone Publishers New Delhi. 2013.
6. G. R. Chatwal, *Synthetic Drugs*, Himalaya Publishing House, Bombay, 1995.
7. J.Ghosh, *A Textbook of Pharmaceutical Chemistry*, S. Chand & Co Ltd., 1997
8. B. Sreelakshmi, *Food Science*, New Age International Pvt. Ltd, New Delhi, 2015.
9. J.W. Hill, T.W. McCreary, D.K. Kolb, *Chemistry for Changing Times*, Prentice Hall, 12^{th} edn., 2010.

SEMESTER-IV

CH4CMT05 - PHYSICAL CHEMISTRY – II

(For students who have opted Physical Sciences and Geology as Main)

Credits-3 (54 Hrs)

Unit 1: Introduction to Spectroscopy (9 Hrs)

Interaction of electromagnetic radiation with matter, electromagnetic spectrum, quantization of energy, electronic, vibrational and rotational energy levels, Boltzmann distribution of energy (formula only), population of levels.

UV- Visible Spectroscopy: Beer Lambert's law, molar extinction coefficient and its importance, UV spectrum, max, chromophore, auxochrome, red shift, blue shift, types of transition.

Infra-red spectroscopy: vibrational degrees of freedom, types of vibrations – symmetric and asymmetric stretching and bending, calculation of force constant, concept of group frequencies-frequencies of common functional groups in organic compounds, Fingerprint region in IR spectra.

Rotational Spectroscopy: diatomic molecules, determination of bond length.

Unit 2: Nano Chemistry (9 Hrs)

Terminology- scales of nanosystems- nanoparticles. Nanomaterials – synthesis – chemical precipitation, mechano-chemical method, micro emulsion method, reduction technique, chemical vapour deposition and sol-gel method (brief study).Properties and applications of fullerenes and carbon nanotubes. Nanochemical devices- optoelectronic devices- photodetectors- LEDs and lasers.

Unit 3: Kinetics, Catalysis & Photochemistry (18 Hrs)

Kinetics: Rates of reactions - Factors influencing rate of reactions - Order and molecularity - Zero, first, second and third order reactions - Derivation of integrated rate equations for first order and second order reactions (single reactant only) - Half-life period for first order reaction - Units of rate constants - Influence of temperature on reaction rates - Arrhenius equation - Calculation of Arrhenius parameters - Collision theory of reaction rate, Activated complex theory-basic concepts-no derivation required.

Catalysis: Types of catalysis – Homogeneous and heterogeneous catalysis. Theories of catalysis: Outline of intermediate compound formation theory and adsorption theory.

Laws of photochemistry, Grothus Draper law, Stark-Einsten's Law, Beer Lambert's Law. Photochemical equivalence and quantum explanation for low and high quantum yields. Photosensitization, Jablonski diagram- Fluorescence and phosphorescence, flash photolysis and chemiluminescence.

Unit 4: Electrochemistry (18 Hrs)

Introduction- Faraday's laws of electrolysis, electrochemical equivalent and chemical equivalent, Specific conductance, equivalent conductance and molar conductance – Variation of conductance with dilution - Kohlrausch's law - Degree of ionization of weak electrolytes - Application of conductance measurements –Determination of degree of dissociation of weak electrolytes, conductometric titrations involving strong acid- strong base, strong acid-weak base, weak acid- strong base, and precipitation titration.

Galvanic cells - Cell and electrode potentials - IUPAC sign convention, Types of electrodes: Reference electrodes – Standard hydrogen electrode and calomel electrode, Indicator electrodes-metal-metal ion electrodes, Quinhydron electrode and Redox electrodes. Standard electrode potential - Nernst equation, electro chemical series. Gibb's Helmholtz equation and EMF of a cell.

Fuel cells- H2-O2 fuel cell. Potentiometric titrations of acid-base and redox reactions-precipitation reactions.

References

1. Banwell, C. N. &Mc Cash, E. M. *Fundamentals of Molecular Spectroscopy* 4th Ed. Tata McGraw-Hill: New Delhi (2006).
2. D. L. Pavia, G. M. Lampman, G. S. Kriz, Introduction to spectroscopy 3rd edn, Thomson Brooks/Cole, 2001.
3. V. S. Muraleedharan and A. Subramania, *Nanosciece and nanotechnology*, Ane Books Pvt. Ltd. New Delhi, 2009
4. T. Pradeep, *Nano: The Essentials*, McGraw-Hill education, New Delhi,2006.
5. K.K. Sharma and L.K. Sharma, *A Textbook of Physical Chemistry*, 5th Edition, Vikas Publishing House, New Delhi, 2012.
6. B. R. Puri, L.R. Sharma, M. S. Pathania, *Elements of Physical Chemistry*, 40th edn. Vishal Pub. Co. Jalandhar (2003).
7. G. M. Barrow, *Physical Chemistry*, 5th Edition, Tata McGraw Hill Education, New Delhi, 2006.
8. G. K. Vemulapalli, Physical Chemistry, Prentice-Hall of India Pvt. Ltd. (1997)
9. Gurdeep Raj, Photochemistry, 6th Edn, Goel Publishing House, 2014.

SEMESTER IV

CH4CMT06 ADVANCED BIO-ORGANIC CHEMISTRY

(For students who have opted Life Sciences and Family & Community Science as core)

Credits - 3 (54 Hrs)

Unit 1: Natural Products (6 Hrs)

Terpenoids: Classification with examples – Isoprene rule – Isolation of essential oils by steam distillation – Uses of lemongrass oil, eucalyptus oil and sandalwood oil - Source, structure and uses of citral and geraniol.

Alkaloids: Classification – Isolation, general properties. Source, structure and physiological activity of nicotine, coniine and piperine.

Unit 2: Lipids (6 Hrs)

Lipids: Classification – Oils, fats and waxes (definition, structure, biological functions and examples). Hydrogenation and Rancidity - Acid value, Saponification value and Iodine value –. Biological functions of phospholipids and glycolipids

Soaps and Detergents: Soaps – Types of soaps. Cleansing action of soaps. Synthetic detergents - Classification. Comparison between soaps and detergents. Environmental aspects.

Unit 3: Amino Acids and Proteins (12 Hrs)

Amino acids: Classification – Zwitter ion formation and isoelectric point- Synthesis of glycine, alanine, and phenyl alanine (any one method). Peptides: Peptide bond. Synthesis of peptides (upto dipeptides). Proteins: Classification of proteins – Primary, secondary and tertiary structure of proteins -– Denaturation of proteins – Tests for proteins.

Unit 4: Enzymes and Nucleic Acids (9 Hrs)

Enzymes: Nomenclature, classification and characteristics. Mechanism of enzyme action. Theory of enzyme catalysis – Michaelis-Menten theory. Cofactors and coenzymes. Enzyme inhibitors. Uses of enzymes.

Nucleic acids: Structure of pentose sugar, nitrogenous base, nucleoside and nucleotide – Double-helical structure of DNA – Differences between DNA and RNA. Biological Functions – Replication and protein biosynthesis. Transcription and Translation. Genetic code. Energy rich molecules: Elementary structure of ATP, ADP and AMP.

Unit 5: Carbohydrates (12 Hrs)

Carbohydrates: Classification with examples. Preparation and properties of glucose, fructose and sucrose. Cyclic structures and Haworth projections of glucose, fructose, maltose and sucrose (ring size determination not expected). – Mutarotation. Conversion of glucose to fructose and vice versa. – Structure of starch and cellulose (structure elucidation not expected). Industrial applications of cellulose.

Unit 6: Vitamins, Steroids and Hormones (9 Hrs)

Vitamins: Classification. Structure, biological functions and deficiency diseases of vitamins A, B_1, B_2, B_3, B_5, B_6, B_{12} (structure not required), C and D.

Steroids: Introduction. Structure and functions of cholesterol. Elementary idea of HDL and LDL. Bile acids.

Hormones: Introduction. Steroid hormones, peptide hormones and amine hormones (examples, endocrine gland and biological functions, structure not required). Artificial hormones (elementary study only).

References

1. Maya Shankar Singh, L.G.Wade, *Organic Chemistry*, 6th Edition, Pearson Education, New Delhi, 2013.
2. P.Y. Bruice, *Essential Organic Chemistry*, 1st Edition, Pearson Education, New Delhi, 2013.
3. I.L. Finar, *Organic Chemistry Vol. I & II*, 5th Edition, Pearson Education, New Delhi, 2013.
4. M.K. Jain, S.C. Sharma, *Modern Organic Chemistry*, Vishal Publishing Co. 2010.
5. K.S. Tewari, N.K. Vishnoi and S.N. Mehrotra, *A Textbook of Organic Chemistry*, 2nd Edition, Vikas Publishing House (P) Ltd., New Delhi, 2004.
6. A. Bahl and B.S. Bahl, *Advanced Organic Chemistry*, 1st Multicolour Edition, S. Chand & Company, New Delhi, 2010.
7. A.C. Deb, *Fundamentals of Biochemistry*, 9th Edn. New Central Book Agency,2001.
8. Rastogi, *Biochemistry*, Tata Mc Graw –Hill Publication ,1996.
9. Bhat S.V., Nagasampagi, B.A. & Sivakumar M. *Chemistry of Natural Products*, Narosa, 2005.

PRACTICAL-I

(Semester I and II)
(Common to Physical sciences, Life sciences, Geology and Family & Community sciences)

CH2CMP01 - VOLUMETRIC ANALYSIS

Credit – 2 (72 Hrs)

Standard solution must be prepared by the student.

1. Acidimetry and Alkalimetry

1. Standardization of HCl with standard Na_2CO_3 solution
2. Standardization of NaOH with standard oxalic acid solution
3. Estimation of any acid using standard NaOH
4. Estimation of any alkali using standard HCl.

2. Permanganometry

1. Standardization of $KMnO_4$ using (i) oxalic acid (ii) Mohr's salt
2. Estimation of Fe^{2+} in Mohr's salt and crystalline Ferrous Sulphate using standard $KMnO_4$.

3. Dichrometry

1. Estimation of Ferrous ions (external indicator)
2. Estimation of Ferrous ions (internal indicator)
3. Estimation of $FeSO_4$. 7 H_2O (external indicator)

4. Iodimetry and Iodometry

1. Standardization of Iodine solution
2. Standardization of Sodium thiosulphate
3. Estimation of $KMnO_4$
4. Estimation of Copper

References

1. D. A. Skoog, D. M. West, and S. R. Crouch, *Fundamentals of Analytical Chemistry* 8th edn, Brooks/Cole Nelson
2. *Vogel's Textbook of Quantitative Chemical Analysis* 6th edn., Pearson Education. Ltd.
3. G. D. Christian, *Analytical Chemistry*, JohnWiley and Sons
4. R.D Day, A.L. Underwood, *Quantitative Analysis*, 6th Edn., Prentice Hall of India Pvt. Ltd.

PRACTICAL – II
(Semesters III and IV)

CH4CMP02 - PHYSICAL CHEMISTRY PRACTICALS

(For students who have opted Physical Sciences and Geology as Main)

Credit – 2 (72 Hrs)

1. Viscosity-percentage composition of sucrose solution.
2. Determination of Partition coefficient of a non-volatile solute
3. Transition temperature of salt hydrates, eg. Sodium thiosulphate Sodium acetate etc.
4. Critical solution temperature of phenol water system
5. Phase diagram of two component systems

7. Heat of neutralization
8. Determination of equivalent conductance of an electrolyte 9

. Conductometric titration of strong acid Vs. strong base

10. Potentiometric titrations : Fe^{2+} Vs. $Cr_2O_7^{2-}$ and Fe^{2+} Vs. $KMnO_4$
11. Determination of molecular weight by Rast's method. (Using naphthalene, or biphenyl as solvent and acetanilide, p–dichlorobenzene etc.as solute)
12. Kinetics of simple reactions, e.g. Acid hydrolysis of methyl acetate

References

1. W. G. Palmer: 'Experimental physical chemistry', Cambridge University Press.
2. J. B. Yadav: Advanced Practical Physical Chemistry Goel Publishing House.
3. R. C. Das and B. Behra; 'Experiments in Physical Chemistry' , Tata McGraw hill.
4. K. K. Sharma : 'An Introduction of Practical Chemistry': Vikas Publishing House, New Delhi

CH4CMP03 - ORGANIC CHEMISTRY PRACTICALS

(For students who have opted Life Sciences and Family & Community Science as Core)

Credit – 2 (72 Hrs)

1. Tests for elements: Nitrogen, Halogen and Sulphur
2. Determination of physical constants
3. Study of reactions of common functional groups.
4. Qualitative analysis with a view to characterization of functional groups and identification of the following compounds: Naphthalene, anthracene, chlorobenzene, benzyl chloride, p-dichlorobenzene, benzyl alcohol, phenol, o-, m- and p- cresols, α-naphthol, β-naphthol, resorcinol, benzaldehyde, acetophenone, benzophenone: benzoic acid, phthalic acid, cinnamic acid, salicylic acid, ethyl benzoate, methyl salicylate, benzamide, urea, aniline, o-, m- and p- toluidines, dimethyl aniline, nitrobenzene, o-nitrotoluene, m-dinitrobenzene and glucose. (minimum of ten compounds to be analysed).
5. Organic preparation involving halogenation, nitration, oxidation, reduction, acetylation, benozylation, hydrolysis, diazotization.
6. Isolation of an organic compound from a natural source.

References:

1. A. I Vogel, *A Text Book of Practical Organic Chemistry*, Longman.
2. F. G. Mann and B.C. Saunders, *Practical Organic Chemistry*, 4th Edn., Pearson Education.
3. V. K. Ahluwalia and S. Dhingra, *Comprehensive Practical Organic Chemistry*, Universities Press.

N. B: These complementary courses are applicable to relevant Model-II and other course

DEPARTMENT OF CHEMISTRY

TIME TABLE FOR THE YEAR 2021-2022

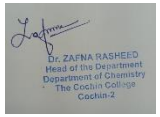
	I	II	III	IV	V
MONDAY	**I ZOO (Z)** **III CHEM (V)**	**II ZOO (P)** **III CHEM (V)**	**O C (P)**	**….. II CHEM** **III CHEM (S)**	**PRAC (Z, P)…..** **III CHEM (S)**
TUESDAY	**III CHEM (Z)**	**III CHEM (P)**	**I CHEM (V)** **II CHEM (P)** **O C (Z)**	**…….III CHEM** **II ZOO (V)**	**PRAC (Z, S) ……**
WEDNESDAY	**II CHEM (P)** **…….. III CHEM**	**I ZOO (S)** **II ZOO (P)** **PRAC (V, Z)……**	**O C (S)**	**……. I CHEM** **III CHEM (P)**	**PRAC (V, S)……..** **III CHEM (Z)**
THURSDAY	**……. II ZOOL** **III CHEM (S)**	**PRAC (P, Z)……** **...III CHEM (V,S)….**	**O C (S)**	**….. III CHEM**	**PRACT (V, P)….**
FRIDAY	**……. I ZOOL** **III CHEM (V)**	**PRAC (Z,S)……** **III CHEM (V)**	**II CHEM (Z)** **…….. III CHEM**	**I CHEM (Z)** **PRAC (V,P) ……**	**…….**

Z – Zafna Rasheed

V – Veena R Nair

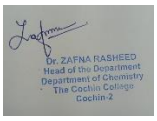
P – Priya M

S – Saumya Jose



THE COCHIN COLLEGE, COCHIN-2
DEPARTMENT OF CHEMISTRY
TIME TABLE 2021-22

DAY	CLASS	I	II	III	IV	V
DAY 1	I B.Sc Chemistry					
	II B.Sc. Chemistry				**V, Z**	**V, Z**
	III B.Sc. Chemistry	**P**	**P**	**Z**	**S**	**S**
	I B.Sc. Zoology	**V**				
	II B.Sc. Zoology		**Z**			
DAY 2	I B.Sc Chemistry			**P**		
	II B.Sc. Chemistry			**Z**		
	III B.Sc. Chemistry	**V**	**Z**	**V**	**V, S**	**V, S**
	I B.Sc. Zoology					
	II B.Sc. Zoology				**P**	
DAY 3	I B.Sc Chemistry				**P, S**	**P, S**
	II B.Sc. Chemistry	**Z**				
	III B.Sc. Chemistry	**V, P**	**V, P**	**S**	**Z**	**V**
	I B.Sc. Zoology		**S**			
	II B.Sc. Zoology		**Z**			
DAY 4	I B.Sc Chemistry					
	II B.Sc. Chemistry					
	III B.Sc. Chemistry	**S**	**P, S**	**S**	**Z, P**	**Z, P**
	I B.Sc. Zoology					
	II B.Sc. Zoology	**V, U**	**V, U**			
DAY 5	I B.Sc Chemistry				**V**	
	II B.Sc. Chemistry			**V**		
	III B.Sc. Chemistry	**P**	**P**	**Z, P**	**Z, P**	**Z, P**
	I B.Sc. Zoology	**V, S**	**V, S**			
	II B.Sc. Zoology					



Z – Zafna Rasheed

V - Veena G Nair

P - Priya M

S – Saumya Jose

I B.Sc. Chemistry

Total number of theory hours – 2

Total number of practical hours – 4

II B.Sc. Chemistry

Total number of theory hours – 3

Total number of practical hours - 4

III B.Sc. Chemistry

Total number of theory hours – 15

Total number of practical hours - 20

I B.Sc. Zoology (complimentary)

Total number of theory hours – 2

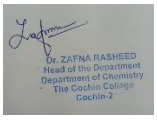
Total number of practical hours - 4

II B.Sc. Zoology (complimentary)

Total number of theory hours – 3

Total number of practical hours - 4

TOTAL NO. OF HOURS – 61



DEPARTMENT OF COMMERCE					
TIME TABLE					
B.COM F & T					
1st SEM	1	2	3	4	5
MONDAY	ANN	H/M	NIKISHA	FEBIN	ATHIRA
TUESDAY	ROHINI	ANN	NIKISHA	H/M	FEBIN
WEDNESDAY	THAMANNA	FEBIN	NIKISHA	ANN	ANN
THURSDAY	JAYASHREE	H/M	ROHINI	NIKISHA	ANN
FRIDAY	NIKISHA	ROHINI	FEBIN	H/M	THAMANNA
3rd SEM	1	2	3	4	5
MONDAY	ROHINI	ROHINI	FEBIN	NIKISHA	ANN
TUESDAY	ANN	JAYASHREE	NIKISHA	FEBIN	ROHINI
WEDNESDAY	ROHINI	ROHINI	ANN	NIKISHA	FEBIN
THURSDAY	ROHINI	ANN	NIKISHA	FEBIN	JAYASHREE
FRIDAY	ATHIRA	FEBIN	NIKISHA	ROHINI	ANN
5th SEM	1	2	3	4	5
MONDAY	VIJAYAKUMAR	NIKISHA	ROHINI	ANN	FEBIN
TUESDAY	FEBIN	NIKISHA	ROHINI	VIJAYAKUMAR	ANNA
WEDNESDAY	VIJAYAKUMAR	ANNA	ROHINI	FEBIN	NIKISHA
THURSDAY	FEBIN	NIKISHA	ROHINI	ANN	VIJAYAKUMAR
FRIDAY	FEBIN	NIKISHA	ANN	VIJAYAKUMAR	VIJAYAKUMAR
DEPARTMENT OF COMMERCE					
TIME TABLE EVEN SEMESTER					

B.COM F & T					
2nd SEM	1	2	3	4	5
MONDAY	ANNA	H/M	NIKISHA	FEBIN	ATHIRA
TUESDAY	ROHINI	ANN	JAYASHREE	H/M	FEBIN
WEDNESDAY	THAMANNA	ANN	NIKISHA	ANN	ROHINI
THURSDAY	JAYASHREE	H/M	ROHINI	NIKISHA	ANNA
FRIDAY	ROHINI	NIKISHA	FEBIN	H/M	THAMANNA
4th SEM	1	2	3	4	5
MONDAY	NIKISHA	ANN	FEBIN	ROHINI	ROHINI
TUESDAY	ANN	JAYASHREE	FEBIN	NIKISHA	ROHINI
WEDNESDAY	ROHINI	NIKISHA	FEBIN	ROHINI	FEBIN
THURSDAY	ANN	ROHINI	NIKISHA	FEBIN	JAYASHREE
FRIDAY	ATHIRA	FEBIN	ANN	NIKISHA	ANN
6th SEM	1	2	3	4	5
MONDAY	VIJAYAKUMA	NIKISHA	ROHINI	ANN	FEBIN
TUESDAY	FEBIN	NIKISHA	ANN	ROHINI	VIJAYAKUMAR
WEDNESDAY	VIJAYAKUMA	ROHINI	ANN	FEBIN	NIKISHA
THURSDAY	NIKISHA	FEBIN	ANN	ROHINI	VIJAYAKUMAR
FRIDAY	VIJAYAKUMA	ROHINI	NIKISHA	FEBIN	VIJAYAKUMAR

TIME TABLE					
B.COM CA					
1st SEM	1	2	3	4	5
MONDAY	FA1(AYSHA)	ENGLISH(A)	H/M	BANKING (Ma	CRA(Jemma)
TUESDAY	ENGLISH (J)	CRA(Mariya)	CRA (Jemma)	FA1(AYSHA)	H/M
WEDNESDAY	ENGLISH (A)	CRA(Mariya)	FA1(AYSHA(	DMBS(Jemma)	H/M

THURSDAY	BANKING(Ma	ENGLISH(J)	FA1(AYSHA)	H/M	DMBS(Jemma)
FRIDAY	ENGLISH(J)	H/M	FA1(AYSHA)	BANKING(Ma	DMBS(Jemma)
3rd SEM	1	2	3	4	5
MONDAY	QT(Mariya	ENGLISH (J)	IT(RAHIYANA	CORP(Jemma)	MKT(AYSHA)
TUESDAY	FMO(AYSHA)	ENGLISH (A)	IT(RAHIYANA	CORP(Jemma)	CORP(Jemma)
WEDNESDAY	IT(RAHIYANA	CORP(Jemma)	ENGLISH (J)	FMO(AYSHA)	QT(Mariya)
THURSDAY	FMO(AYSHA)	FMO(Jemma)	ENGLISH (A)	IT(RAHIYANA	QT(Mariya)
FRIDAY	IT(RAHIYANA	FMO(Jemma)	ENGLISH (A)	MKT(AYSHA)	QT(Mariya)
5th SEM	1	2	3	4	5
MONDAY	C(HRIDYA)	COST(VIJAYA	OC	COM(AYSHA)	EMHR(Mariya)
TUESDAY	COST(VIJAYA	COST(Jemma)	OC	C(HRIDYA)	EMHR(Mariya)
WEDNESDAY	COST(VIJAYA	C(HRIDYA)	OC	COM(Mariya)	EMHR(Jemma)
THURSDAY	COST(VIJAYA	EMHR(Mariya	OC	C(HRIDYA)	COM(AYSHA)
FRIDAY	COST(VIJAYA	COM(Mariya)	EMHR(Jemma	C(HRIDYA).	COM(AYSHA)

DEPARTMENT OF COMMERCE					
TIME TABLE EVEN SEMESTER					
B.COM CA					
2nd SEM	1	2	3	4	5
MONDAY	FA2(AYSHA)	ENGLISH (A)	H/M	BUSINESS (M	BRF(Jemma)
TUESDAY	ENGLISH (J)	BRF(Jemma)	BUSINESS (M	FA2(AYSHA)	H/M
WEDNESDAY	ENGLISH (A)	BRF(Mariya)	FA2(AYSHA)	PBD (Jemma)	H/M

THURSDAY	BM(Mariya)	ENGLISH(J)	FA2(AYSHA)	H/M	PBD(Jemma)	
FRIDAY	ENGLISH(J)	H/M	FA2(AYSHA)	PBD(Jemma)	BRF (Mariya)	
4th SEM	1	2	3	4	5	
MONDAY	QT(Mariya ()	ENGLISH (J)	IT(HRIDYA)	EDPM(AYSHA	QT(Mariya)	
TUESDAY	EDPM(AYSHA	ENGLISH (A)	IT(HRIDYA)	CORP ACC(Jer	CORP ACC(Jemma)	
WEDNESDAY	IT(HRIDYA)	CORP ACC(Jer	ENGLISH (J)	QT(Mariya)	EDPM(AYSHA)	
THURSDAY	CORP ACC(Jer	QT(Mariya)	ENGLISH (A)	IT(HRIDYA)	EDPM(AYSHA)	
FRIDAY	IT(HRIDYA)	EDPM(AYSHA	ENGLISH (A)	QT(Mariya)	CORP(Jemma)	
6th SEM	1	2	3	4	5	
MONDAY	SBR(BCA)	COST ACC(VK	MGT ACC(Jem	DBMS	MGT(AYSHA)	
TUESDAY	ADV(Jemma)	COST ACC(VK	DBMS	SBR(BCA)	ADV(Mariya)	
WEDNESDAY	COST ACC(VK	COST ACC(VK	ADV(Mariya)	MGT ACC(AY	DBMS	
THURSDAY	MGT(AYSHA)	DBMS	COST ACC(VK	SBR(MATHS)	ADV(Mariya)	
FRIDAY	MGT(Jemma)	COST ACC(VK	SBR(MATHS)	DBMS	SBR(MATHS)	

RESTRUCTURED CURRICULUM AND SYLLABI FOR THE B.COM DEGREE PROGRAMME (MODEL I) UNDER THE CHOICE BASED CREDIT AND SEMESTER SYSTEM



MAHATMA GANDHI UNIVERSITY
PRIYADARSHINI HILLS P O
KOTTAYAM, KERALA

2017

(Effective from 2017-18 admissions)

ACKNOWLEDGEMENT

There are many pro-active, sapient people whose relentless support and guidance made this syllabus restructuring 2017 a success. I take this opportunity to express my sincere appreciation to all those who were part of this endeavour for restructuring the syllabus U G course in Commerce under Mahatma Gandhi University, Kottayam.

I express profound gratitude to the Honourable Vice-Chancellor, Pro-Vice Chancellor, Registrar, Members of the Syndicate and Academic Council for their sincere co-operation and guidance for completion of this work. My thanks and appreciation also goes to the members of Faculty of Commerce and Board of Studies for their untiring efforts. I also appreciate the efforts of members of University Academic Section and other staff. .

Furthermore, I would also like to acknowledge with much appreciation the crucial role of all teachers who participated in the workshops organised by the University for restructuring the syllabus. I also place on record my gratitude to all professionals, academicians and other stakeholders who gave valuable suggestions in this regard.

Dean- Faculty of Commerce
Mahatma Gandhi University
Kottayam

Courses and Duration of Examinations

Total credits: **120**
Semesters- 6
Working Days per Semester: **90**
Working Hours per Semester: **450**
Examination- External Evaluation: 80% and Internal evaluation- 20%

MODEL-I

B.Com Degree Programme Model-I Course Structure

Common Courses

Sl No	Course Name	Credit	Hours per week
1	Language- English-I	4	5
2	Second Language-I	4	4
3	Language- English-II	4	5
4	Second Language-II	4	4
5	Language- English- III	3	3
6	Language- English -IV	3	3
	TOTAL – Common Course 1 – 14 credits and Common Course 2- 8 credits	**22**	**-**

Complementary Courses

Sl No	Course Name	Credit	Hours per week
1	Banking and Insurance	3	4
2	Principles of Business Decisions	3	4
	TOTAL	**6**	

Core Courses

Sl No	Course Name	Credit	Hours per week
1	Dimensions and Methodology of Business Studies	**2**	**3**

2	Financial Accounting I	**4**	**5**
3	Corporate Regulations and Administration	**3**	**4**
4	Financial Accounting II	**4**	**5**
5	Business Regulatory Framework	**3**	**4**
6	Business Management	**3**	**3**
7	Corporate Accounts I	**4**	**5**
8	Quantitative Techniques for Business- 1	**4**	**5**
9	Financial Markets and Operations	**3**	**4**
10	Marketing Management	**3**	**3**
11	Optional - 1	**4**	**5**
12	Corporate Accounts II	**4**	**6**
13	Quantitative Techniques for Business- II	**4**	**6**
14	Entrepreneurship Development and Project Management	**4**	**5**
15	Optional - 2 -	**4**	**5**
16	Cost Accounting - 1	**4**	**6**
17	Environment Management and Human Rights	**4**	**5**
18	Financial Management	**4**	**5**
19	Optional - 3	**4**	**5**
20	Cost Accounting - 2	**4**	**6**
21	Advertisement and Sales Management	**3**	**4**
22	Auditing and Assurance	**4**	**5**
23	Management Accounting	**4**	**5**
24	Optional - 4	**4**	**5**
25	**Project and Viva**	1	-
	TOTAL	**89**	

Details of Optional Courses

Sl No	Course Name	Credit	Hours per week
FINANCE AND TAXATION			
1	Goods and Services Tax	4	5
2	Financial Services	4	5
3	Income Tax- I	4	5
4	Income Tax - II	4	5
COMPUTER APPLICATIONS			
1	Information Technology for Business	4	5
2	Information Technology for Office	4	5
3	Computerized Accounting	4	5

4	Software for Business and Research	4	5

CO-OPERATION			
1	Basics of Co-operation	4	5
2	Management of Co-operative Enterprises	4	5
3	Co-operative Legal System	4	5
4	Accounting for Co-operative Societies	4	5
TRAVEL AND TOURISM			
1	Fundamentals of Tourism	4	5
2	Travel and Tourism Infrastructure	4	5
3	Hospitality Management	4	5
4	Tourism and Cultural Heritage of India	4	5
MARKETING			
1	Customer Relationship Management	4	5
2	Services Marketing	4	5
3	Marketing Research	4	5
4	International Marketing	4	5

OPEN COURSES OFFERED

Sl No	Course Name	Credit	Hours per week
1	**CO5OP01**- Fundamentals of Banking and Insurance	3	4
2	**CO5OP02**- Capital Market and Investment Management	3	4
3	**CO5OP03**- Fundamentals of Accounting	3	4
	TOTAL	**3**	

Semester-wise details

Semester- 1

Sl No	Course Code	Course Name	Credit	Hours per week
1		Language- English-I	4	5
2		Second Language-I	4	4
3	CO1CRT01	Dimensions and Methodology of Business Studies	**2**	**3**
4	CO1CRT02	Financial Accounting I	**4**	**5**
5	CO1CRT03	Corporate Regulations and Administration	**3**	**4**
6	CO1CMT01	Banking and Insurance	3	4
		TOTAL	**20**	**25**

Semester- 2

Sl No	Course Code	Course Name	Credit	Hours per week
1		Language- English-I	4	5
2		Second Language-I	4	4
3	CO2CRT04	Financial Accounting II	**4**	**5**
4	CO2CRT05	Business Regulatory Framework	**3**	**4**
5	CO2CRT06	Business Management	**3**	**3**
6	CO2CMT02	Principles of Business Decisions	3	4
		TOTAL	**21**	**25**

Semester 3

Sl No	Course Code	Course Name	Credit	Hours per week
1		Language- English-I	3	3
2	CO3CRT07	Corporate Accounts I	**4**	**5**
3	CO3CRT08	Quantitative Techniques for Business- 1	**4**	**5**
4	CO3CRT09	Financial Markets and Operations	**3**	**4**
5	CO3CRT10	Marketing Management	**3**	**3**
6		Optional - 1		
	CO3OCT01	Finance and Taxation-Goods and Services Tax	**4**	**5**
	CO3OCT02	Computer Application- Information Technology for Business (Theory)	**3**	**3**
		Information Technology for Business (Practical)- ***Exam in semester 4 only***	**-**	**2**
	CO3OCT03	Co-operation- Basics of Co-operation	**4**	**5**
	CO3OCT04	Travel and Tourism - Fundamentals of Tourism	**4**	**5**
	CO3OCT05	Marketing- Customer Relationship Management	**4**	**5**
		TOTAL for streams other than Computer Applications	**21**	**25**
		TOTAL for Computer Application Stream	**20**	**25**

Semester- 4

Sl No	Course Code	Course Name	Credit	Hours per week
1		Language- English-I	3	3
2	CO4CRT11	Corporate Accounts II	**4**	**6**
3	CO4CRT12	Quantitative Techniques for Business- II	**4**	**6**
4	CO4CRT13	Entrepreneurship Development and Project Management	**4**	**5**
5	CO4	Optional - 2 -	**4**	**5**
	CO4OCT01	Finance and Taxation- Financial Services	**4**	**5**
	CO4OCT02	Computer Application- Information Technology for Office (Theory)	**3**	**3**
		Information Technology for Office (Practical)	**-**	**2**
	CO34OCP01	***Computer Application Practical Examination*** for Information Technology for Office and Information technology for Business	**2**	**NA**
	CO4OCT03	Co-operation- Management of Co-operative Enterprises	**4**	**5**
	CO4OCT04	Travel and Tourism- Travel and Tourism Infrastructure	**4**	**5**
	CO4OCT05	Marketing- Services Marketing	**4**	**5**
		TOTAL for streams other than Computer Application	**19**	**25**
		TOTAL for Computer Application Stream	**20**	**25**

Semester- 5

Sl No	Course Code	Course Name	Credit	Hours per week
1	CO5CRT14	Cost Accounting - 1	**4**	**6**
2	CO5CRT15	Environment Management and Human Rights	**4**	**5**
3	CO5CRT16	Financial Management	**4**	**5**
4		Optional - 3		
	CO5OCT01	Finance and Taxation- Income Tax- I	**4**	**5**
	CO5OCT02	Computer Application-	**3**	**3**

		Computerised Accounting(Theory)		
		Computerised Accounting (Practical)- **Examination in 6th Semester only**	**-**	**2**
	CO5OCT03	Co-operation- Co-operative Legal System	**4**	**5**
	CO5OCT04	Travel and Tourism- Hospitality Management	**4**	**5**
	CO5OCT05	Marketing- Marketing Research	**4**	**5**
5		Open Course	**3**	**4**
		TOTAL for streams other than Computer Application	**19**	**25**
		TOTAL for Computer Application stream	**18**	**25**

Semester- 6

Sl No	Course Code	Course Name	Credit	Hours per week
1	CO6CRT17	Cost Accounting - 2	**4**	**6**
2	CO6CRT18	Advertisement and Sales Management	**3**	**4**
3	CO6CRT19	Auditing and Assurance	**4**	**5**
4	CO6CRT20	Management Accounting	**4**	**5**
5	CO6OCT	Optional - 4	**4**	**5**
	CO6OCT01	Finance and Taxation- Income Tax- II	**4**	**5**
	CO6OCT02	Computer Application- Software for Business and Research (Theory)	**3**	**3**
		Software for Business and Research(Practical)	**-**	**2**
	CO56OCP01	**Computer Application-** Practical Examination – Computerised Accounting and Software for Business and Research	**2**	**NA**
	CO6OCT03	Co-operation- Accounting for Co-operative Societies	**4**	**5**
	CO6OCT04	Travel and Tourism- Tourism and Cultural Heritage of India	**4**	**5**
	CO6OCT05	Marketing- International Marketing	**4**	**5**
6	**CO6PR01**	**Project and Viva**	**1**	**-**
		TOTAL for streams other than Computer Application	**20**	**25**
		TOTAL for Computer Application	**21**	**25**

		Stream		

SEMESTER 1

Core Course -1: DIMENSIONS AND METHODOLOGY OF BUSINESS STUDIES

Instructional Hours: 54 **Credit: 2**

Objectives

- *To understand business and its role in society*
- *To have an understanding of Business ethics and CSR*
- *To comprehend the business environment and various dimensions*
- *To familiarise Technology integration in business*
- *To introduce the importance and fundamentals of business research*

Module 1

Business and Environment Business- Functions - Scope - Significance of business - Objectives of business - Business and development - Forms of business organisations- Stake holders of business- Business Environment – Definition - Features- Importance - Components of business environment- Internal environment and external environment - Micro environment and macro environment- Global business environment **(10 Hours)**

Module 2

Business in India- Stages and developments of business in the Indian economy since independence - Role of public, private, co-operative sectors - Liberalisation, Privatisation and Globalization – Disinvestment – Outsourcing –Recent economic initiatives - Niti Ayog - Make in India initiative **(10 Hours)**

Module 3

Technology integration in business- E Commerce- Meaning- Functions - Operation of E-commerce - Types of E-Commerce -B2C-B2B-C2C- C2B- B2E- B2G- P2P- E-Commerce and E-Business – M-Commerce- Meaning- Advantages- Challenges – E-Payment systems (brief study) Debit/Credit card payment, Net banking, Digital wallet, e-cheque, e-cash – Payment gateway. **(14 Hours)**

Module 4

Business Ethics – Importance - Principles of business ethics - Factors influencing Business Ethics - Arguments in favour and against business ethics - Social responsibility of business – objectives and principles - Arguments in favour and against social responsibility. Corporate Governance – Meaning and importance – Objectives – Principles **(10 Hours)**

Module 5

Business Research – Research**-** Meaning and Definition- Importance of research- Quantitative and qualitative approach to research-Inductive and deductive reasoning- Major Types of Research (Pure-Applied - Exploratory- Descriptive- Empirical- Analytical) - Business Research- Elements of Business Research-Management Research- -Objectives- Research Methods vs Research Methodology -Research Process(brief outline only) –Research report **(10 Hours)**

Suggested Readings

1. Keith Davis and William C.Frederick*: Business and Society Management, Public Policy, Ethics.*
2. Peter F. Drucker*: Management Tasks, Responsibilities, Practices.*
3. Peter F Drucker*: The Practice of Management.*
4. P.T.Joseph, S.J*, E-Commerce: An Indian Perspective , Prentice Hall of India*
5. Kamalesh K Bajaj and Debjani Nag: *E-Commerce, the Cutting Edge of Business:, Tata McGraw Hill.*
6. Schneider: *E-Commerce:, Thomson Publication*
7. CSV Murthy*, Business Ethics, Himalaya Publishing House, Mumbai*
8. C R Kothari *Research Methodology, New Age Publishers*
9. O R Krishnaswamy: *Research Methodology- Himalaya Publications*
10.N V Badi and R.V. Badi: *Business Ethics: Vrinda Publications*
11. Cherunilam, Fransis, Business environment, *Himalaya Publishing House, Mumbai.*
12. Fernando, A, C,. Business Environment, *Pearson, New Delhi*
13 Francis, Ronald & Mishra, Muktha, Business Ethics: An Indian Perspective, *Tata McGraw Hill Pvt Ltd, New Delhi*
14 Sharma, J.P., Corporate Governance, Business Ethics, and CSR, *Ane Books Pvt Ltd, New Delhi.*
15. Ghosh, B.N., Business Ethics and Corporate Governance, *Tata McGraw Hill Pvt Ltd, Delhi.*

Core Course -2: FINANCIAL ACCOUNTING– I

Instructional Hours: 90 **Credit: 4**

Objective: *To equip the students with the skill of preparing accounts and financial statements of various types of business units other than corporate undertakings*

Module – I

Preparation of Financial Statements –Conceptual framework- Accounting Principles - Accounting Concepts - Accounting Conventions- - Capital and Revenue Expenditure - Capital and Revenue Receipts - Capital and Revenue Losses - Deferred Revenue Expenditure–Accounting Standards- Objectives -Final Accounts of Sole Trader - Trading Account - Manufacturing Account - Profit and Loss Account - Balance Sheet - Adjusting entries - Closing Entries- Practical Problems with all Adjustments.

(26 Hours)

Module -II

Accounting of Incomplete Records - Single Entry System - Features - Advantages - Disadvantages - Distinction between Single Entry and Double Entry System- Ascertainment of Profit/loss - Statement of Affairs Method - Conversion Method - Steps for Conversion of Single Entry into Double Entry - Preparation of Trading and Profit and Loss Account and Balance Sheet.

(20 Hours)

Module - III

Royalty Accounts – Meaning – Minimum Rent – Short Working – Recovery– Journal Entries in the books of Lessor and Lessee – Preparation of Minimum Rent Account – Short Working Account – Royalty Account (Excluding Sublease)– Special Circumstances :Adjustment of Minimum Rent in the event of Strike and Lock - outs - Govt. Subsidy in case of Strikes/Lockouts

(18 Hours.)

Module - IV

Accounting for Consignment - Meaning – Important Terms – Journal Entries in the books of Consignor and Consignee – Preparation of Consignment Account – Consignee's Account – Goods Sent at Cost or Invoice Price Delcredre commission- Valuation of Stock – Normal and Abnormal Loss

(18 Hours)

Module – V

Farm Accounts- Meaning- Characteristics- Objectives and advantages- Recording of farm transactions- Preparation of farm account, crop account, dairy account, livestock account etc- Preparation of final accounts of farming activities- **(8 Hours)**

Suggested Readings

1. Jain, S.P., & Narang, K.L., Advanced Accountancy, *Kalyani Publishers*, *New Delhi*
2. Maheshwari, S.N., & Maheswari, S.K., Advanced Accountancy, *Vikas Publishing House*, *New Delhi.*
3. Shukla, M.C., & Grewal, T.S., Advanced Accountancy, *S Chand and Company (Pvt.) Ltd*, *New Delhi.*
4. Ashok, Sehgal, & Deepak Sehgal, Financial Accounting *Taxmann Allied Service (Pvt.) Ltd*, *New Delhi.*
5. MA Arulanandam and KS Raman, *Advanced Accountancy, Himalaya Publications, Mumbai.*
6. Paul, S. K., & Chandrani, Paul, Advanced Accountancy, *New Central Book Agency*, *New Delhi.*
7. Raman B S, *Financial Accounting- United Publishers*
8. The Chartered Accountant(Journal), Institute of Chartered Accountants of India, New Delhi.

Core Course -3:

CORPORATE REGULATIONS AND ADMINISTRATION

Instructional Hours: 72 **Credit: 3**

Objective: *To familiarise the students with the management and administration of joint stock companies in India as per Companies Act, 2013*

Module 1

Company - Definition – Characteristics – Classifications –History and framework of Company Law in India - Companies Act 2013 - one person company, small company, associate company, dormant company, producer company; association not for profit; illegal association **(Instructional Hours - 10)**

Module 2

Promotion and formation of a company- Body Corporate - promoter- legal position-duties-remuneration - Memorandum of Association – Articles of Association - Contents and alteration - Incorporation of Company - On-line registration of a company – CIN - Companies With Charitable Objects - Doctrines of Indoor Management, Constructive Notice, Ultra-vires - Lifting up of Corporate veil - Conversion of Companies **(Instructional Hours - 12)**

Module 3

Share Capital – Types - Public Offer - Private Placement - Prospectus - Contents of Prospectus – Types of prospectus – Deemed prospectus - Shelf Prospectus - Red Herring Prospectus - Abridged prospectus- Liability for Misstatements in Prospectus – Issue and Allotment of Securities – Types - Voting Rights –

DVR- Application of Premiums - Sweat Equity Shares - Issue and Redemption of Preference Shares- Transfer and Transmission of Securities- Punishment for impersonation of Shareholder - Further Issue of Share Capital- Bonus Shares- Debenture Issue - **(Instructional Hours - 15)**

Module 4

Membership in company and meetings- modes of acquiring membership-rights and liabilities of members- cessation of membership- Register of Members - Company meetings – Annual General Meeting - Extraordinary General Meeting- Notice Of Meeting - Quorum - Chairman - Proxies - Voting - Show of Hands – E-Voting - Poll- Postal Ballot- Motions - Resolutions - Types - Minutes - Books of accounts - Annual Return- Directors - Types - legal position – Appointment - Duties - Disqualifications - DIN - Vacation of Office - Resignation - Removal - Meetings of Board - Resolutions and Proceedings - Powers of Board - Key Managerial Personnel- CEO- CFO - Audit and Audit Committee - related party- transactions - Corporate Social Responsibility.

(Instructional Hours - 20)

Module 5

Winding up - Contributory – Modes of winding up - Winding Up by Tribunal - Petition for Winding Up - Powers of Tribunal- Liquidators - Appointments- Submission of Report - Powers and Duties - Effect of Winding Up Order- Voluntary Winding Up - Circumstances - Declaration Of Solvency - Meeting of Creditors- Commencement of Voluntary Winding Up- Appointment of Company Liquidator- Final Meeting and Dissolution of Company Official Liquidators –Appointment -Powers - Functions - Winding up of unregistered companies. **(Instructional Hours - 15)**

Suggested Readings

1. Shukla, M.C., & Gulshan, Principles of Company Law, *S.Chand, New Delhi*.
2. Venkataramana, K., Corporate Administration, *Seven Hills Books Publications.*
3. Kapoor,N.D., Company Law and Secretarial Practice, Sultan Chand,*New Delhi.*
4. Bansal C.L., Business and Corporate Law, *Vikas Publishers, New Delhi.*
5. Bhandari, M.C., Guide to Company Law Procedures, Wadhwa Publication.
6. S.N. Maheswari and S.K. Maheswari, Elements of Corporate Law, Himalaya Publications,
7. Kuchal, S.C., Company Law and Secretarial Practice, *Vikas Publishers, New Delhi*
8. Chartered Secretary, *The Institute of Company Secretaries of India.*

Complementary Course 1: BANKING AND INSURANCE

Instructional Hours: 72 **Credit: 3**

Objective: *To familiarize the students with the basic concepts and practice of banking and the principles of Insurance*

Module I

Introduction to Banking- Origin and Evolution of Banks - Meaning and Definition-Classification of Banks – Functions of Commercial Banks- Primary and Secondary- Credit Creation-Reserve Bank of India-Functions of RBI-Banking Ombudsman Scheme. **(15 Hours)**

Module II

Innovations and Reforms in Banking – E-banking – ATM – CDM - telephone/ Mobile Banking –ECS – EFT – NEFT – RTGS – SWIFT - CORE Banking - Cheque Truncation System - Credit and Debit Cards

– CIBIL – KYC - Banking Sector Reforms-Prudential Norms- Capital Adequacy Norms - NPA – NBA - Basel norms - Small Finance Banks - Payment Banks - Financial Inclusion - PMJDY.

(18 Hours)

Module III

Banker and Customer- Meaning and Definition- Relationship- General and Special- Different Types of Accounts- Cheque- dishonour of cheque – payment in due course – Crossing - Endorsement.

(15 Hours)

Module IV

Insurance - Introduction- Concept of Risk**-** Insurance - Need and Importance - Principles of Insurance contract Insurance Industry in India**-** IRDA - Insurance Sector Reforms – Bancassurance.

(9 Hours)

Module V

Types of insurance - Life Insurance– Features - Classification of Policies - Policy Conditions - Application and Acceptance- Assignments - Nomination - -Surrender-Foreclosure- Marine Insurance – Features- Policy Conditions - Clauses - Fire Insurance- Motor vehicle insurance - Health Insurance- Burglary insurance-personal accident insurance- Re-Insurance- Group insurance.

(15 Hours)

Suggested Readings

1. Shekhar, K.C, Banking Theory and Practice, *Vikas Publishing House*, *New Delhi*
2. Maheswari, S.N., Banking Law and Practice, *Kalyani Publishers*, *New Delhi*
3. Sundharam,Varshney, Banking Theory Law & Practice, *Sulthan Chand & Sons*, *New Delhi.*
4. Agarwal, O.P., Banking and Insurance*, Himalya Publishing House, Mumbai*
5. Saxena, G.S., Legal Aspects of Banking Operations*, Sultan Chand and Sons, New Delhi*
6. Agarwal, O.P., Banking and Insurance*, Himalya Publishing House, Mumbai*
7. Tripati, Nalini & Prabil Pal., Insurance: Theory and Practice, *PHI Pvt Ltd, New Delhi*
8. Gupta, P.K., Insurance and Risk Management, *Himalaya Publishing House, Mumbai*
9. Mishra, M.N., Principles and Practices of Insurance, *S. Chand and Sons, New Delhi*

SEMESTER 2

Core Course -4 FINANCIAL ACCOUNTING – II

Instructional Hours: 90 **Credit: 4**

Objective**:** *To acquaint the students with the preparation of books of accounts of various types of business activities and application of important accounting standards*

Module I

Accounting for Hire Purchase – Meaning and Features of Hire Purchase System – Hire purchase Agreement –Hire purchase and Sale - Hire Purchase and Installment – Interest Calculation – Recording Transactions in the Books of both the Parties – Default and Repossession- Complete repossession- Partial repossession- **(25 Hours)**

Module II

Branch Accounts – Objectives- Features – Types – Accounting for Branches keeping full system of accounting – Debtors System – Stock and Debtors System – Independent Branches and Incorporation of Branch Accounts in the Books of H.O – Cash in Transit and Goods in Transit – Consolidated Balance Sheet.(accounting for foreign branches excluded) **(20 Hours)**

Module III

Departmental Accounts – Meaning – Objectives – Advantages – Distinction between branch and department- Accounting Procedure – Allocation of Expenses and Income- Inter Departmental Transfers – Provision for Unrealized Profits. (**10 Hours)**

Module IV

Accounting for Dissolution of partnership firm- Dissolution of a firm- Settlement of Accounts on dissolution- - Insolvency of a partner-Application of decision of Garner Vs Murray Case - Settlement of accounts when all partners are insolvent- Piecemeal distribution- Highest Relative Capital Method- Maximum Possible Loss method **(25 Hours)**

Module V

Accounting Standards- Importance- Accounting Standards Board- Applicability of Accounting Standards – Brief learning of AS1, AS2, AS9, AS10 and AS 19(Theory only) (**10 Hours)**

Suggested Readings

1. Jain S.P & Narang K.L., Advanced Accountancy, *Kalyani Publishers*, *New Delhi*
2. Maheshwari, S.N., & Maheswari, S.K., Advanced Accountancy, *Vikas Publishing House*, *New Delhi.*
3. Shukla, M.C., & Grewal, T.S., Advanced Accountancy, *S Chand and Company Pvt.Ltd*, *New Delhi.*
4. Ashok Sehgal & Deepak Sehgal, Financial Accounting *Taxmann Allied Service (Pvt) Ltd*, *New Delhi.*
5. Paul, S. K., & Chandrani Paul, Advanced Accountancy, *New Central Book Agency*, *New Delhi.*
6. MA Arulanandam and KS Raman*, Advanced Accountancy,Himalaya Publications, Mumbai.*
7. Raman B S*, Financial Accounting United Publishers*
8. The Chartered Accountant (Journal), Institute of Chartered Accountants of India, New Delhi.

Core Course -5 BUSINESS REGULATORY FRAMEWORK

Instructional Hours: 72 **Credit: 3**

Objective: *The course is intended to familiarise the students with the legal framework influencing business decisions***.**

Module I

Introduction to Mercantile Law -Law of Contract - Definition - Kinds of Contracts - Valid – Void - Voidable - Contingent and Quasi Contract - E-Contract - Essentials of a Valid Contract - Offer and Acceptance - Communication of Offer - Acceptance and its Revocation - Agreement - Consideration - Capacity to Contract - Free Consent - Legality of Object and Consideration - Performance of Contract - Discharge of Contract -Breach of Contract - Remedies for Breach of Contract. **(25 Hours)**

Module II

Special Contract I-Bailor and Bailee - Finder of Lost Goods - Pledge - Essentials - Rights and Duties of Pawner and Pawnee **(15 Hours)**

Module III

Special Contract II- Indemnity and Guarantee- Indemnity - Meaning and Definition - Contract of Guarantee - Kinds of Guarantee - Rights and Liabilities of Surety - Discharge of Surety.

(10 hours)

Module IV

Law of Agency - Essentials, kinds of agents, rights and duties of agent and principal, creation of agency, termination of agency-Sub agents and substituted agents- Relationship **(12 Hours)**

Module V

Sale of Goods Act, 1930 -Essentials of Contract of Sale Goods - Classification of Goods - Condition and Warranties - Transfer of Property in Goods - Right of Unpaid Seller - Buyer's Right Against Seller - Auction Sale. **(10 Hours)**

Suggested Readings

1. Aswathappa, K., Business Laws, *Himalaya Publishing House*, *Bengaluru.*
2. Kapoor,N.D., Business Laws, *Sultan Chand publications* New Delhi.
3. Sharma,S.C., Business Law, *International Publishers,Bengaluru*
4. Tulsian, Business Law, *McGraw-Hill Education Mumbai.*
5. Indian Contract Act No. IX, 1972
6. Indian Sale of Goods Act, 1930

Journals

1. The Indian Journal of Law and Technology, National Law School of India University, Bangalore.
2. E bulletin of Students Company Secretary

Core Course -6: BUSINESS MANAGEMENT

Instructional Hours: 54 **Credit: 3**

Objectives: *To familiarise the students with concepts and principles of management.*

Module 1

Introduction to Management - Meaning , Nature, Scope and Functional Areas of Management - Management as a Science, Art and Profession - Management & Administration - Principles of Management- Managerial roles: Mintzberg Model - Functions of Management - Contributions of F.W.Taylor and Henry Fayol.

(12 Hours)

Module II

Planning - Planning - Meaning - Nature - Importance - Types of Plans - Planning Process- Barriers to Effective Planning - M.B.O - Features – Steps - Coordination - Meaning and Importance - Techniques for Effective Coordination

(10 Hours)

Module III

Organizing - Meaning - Nature - Importance - Principles of Organisation - Types of Organisation - Organisation Chart - Organisation Manual - Centralization – Decentralization- Authority - Delegation of Authority -Responsibility and Accountability.

(10 Hours)

Module IV **Direction and Control** – Principles of direction- Leadership: Concept and Styles; Trait and Situational Theory of Leadership,Managerial Grid by Blake and Mouton , Likert's Four System Model - Motivation: Concept and Importance; Maslow's Need Hierarchy Theory; Herzberg's Two Factors Theory. Control: Concept and Process-Control Techniques.

(12 Hours)

Module V

Management Techniques – (Brief Study) Quality circle-Total Quality Management - Business Process Reengineering (BPR)- Six sigma-Kaizen

(10 Hours)

Suggested Readings

1. Koontz, O Donnell, Management, *McGraw-Hill*
2. Appaniah, Reddy, Essentials of Management, *Himalaya Publishing House*.
3. Prasad, L. M., Principles of management, *Sultan Chand and Sons*.
4. Srinivasan, Chunawalla, Management Principles and Practice, *Himalaya Publishing House.*
5. Tulsian, P.C., & Pandey, Vishal, Business Organization and Management, Pearson Education

Complementary Course -2 – PRINCIPLES OF BUSINESS DECISIONS

Instructional Hours: 72 **Credit: 3**

Objective: *The course is intended to familiarise the students with the economic concepts and principles underlying business decision making*

Module I

Introduction –Decision making- Definition of decision and decision making- Importance of decision making- Steps in decision making- Types of decisions- Decision making environment- Elements of a decision- Application of economic theories in decision making- Areas where economic theories can be applied for business decision making - Important Economic concepts and theories applied in decision making- – Incremental Reasoning – Time Perspective – Discounting Principle – Opportunity Cost – Equi- marginal Principle **(10 Hours)**

Module II

Demand Theory –Demand**–**Meaning- Law of Demand – Reasons for Law of demand – Exceptions to the Law –Demand determinants- Movements Vs Shift in Demand- Demand distinctions- Elasticity of Demand – Price elasticity- Importance of price elasticity- Income elasticity-Advertisement elasticity – Cross elasticity – Measurement of elasticity - Demand Forecasting –Short Term and Long Term Forecasting – Methods of Forecasting(theory only) -Forecasting demand for new products- Characteristics of a good forecasting technique. **(20 Hours)**

Module III

Production Analysis– Production- Production Function –Assumptions and uses of production function- Cobb Douglas Production Function – Laws of Production – Law of Diminishing Returns or variable proportions- –Law of Returns to Scale – Economies And Diseconomies of Scale – Isoquant Curve-Isocost Curve – Optimum Combination of Inputs **(12 Hours)**

Module IV

Cost Analysis-Cost concepts- Determinants of cost- Cost output relationship in the short run and long run- Optimum firm **(8 Hours)**

Module V

Pricing in Different Markets –Price theory and price mechanism- objectives of pricing- Various market forms and pricing- Perfect Competition –Features- Price determination- Equilibrium of a firm under perfect competition- Monopoly- Features and kinds of monopoly- Price and output determination- Price Discrimination- Types- conditions- degree of price discrimination- Monopolistic competition- features- Price-output determination- - Oligopoly—features- Kinked Demand Curve- Price Leadership – Pricing under Collusion **(22 Hours)**

Suggested Readings

1. Dean, Joel Managerial economics- *Prentice Hall of India*
2. Varshney, R.L., & Maheshwari, K.L., Managerial Economics, *Sultan Chand & Sons Private Ltd.*, *New Delhi*
3. Kasi Reddy M., & Saraswathi, S., Managerial Economics and Financial Accounting, *PHI Learning, New Delhi.*
4. Mehta, P. L., Managerial Economics, *Sultan & Chand, New Delhi*
5. *DM Mithani, Managerial economics, Himalaya Publishing House Mumbai.*
6. Trivedi, M.L., Managerial Economics Theory and Applications, *McGraw Hill Education Private Ltd, New Delhi.*
7. Dwivedi, D. N., Managerial Economics, *Vikas Publishing House Private Limited, New Delhi.*
8. Chopra P.N., Principles of Business Decisions, *Kalyani Publishers*

SEMESTER 3

Core Course -7 CORPORATE ACCOUNTS - I

Instructional Hours: 90 **Credit: 4**

Objective: *To make the students familiarise with corporate accounting procedures and to understand the accounting for banking companies.*

Module 1

Accounting for Shares– Redemption of Preference Shares– ESOP-Rights Issue – Bonus Issue – Buyback of Shares **(20 Hours)**

Module II

Underwriting of Shares and Debentures – Marked and Unmarked Applications – Firm Underwriting– Determining the Liability of Underwriters in respect of an Underwriting Contract – Complete Underwriting – Partial Underwriting – Firm Underwriting **(10 Hours)**

Module III

Final Accounts of Joint Stock Companies (Vertical form- As per provisions of Companies Act 2013) – Preparation of Company Final Accounts including Balance Sheet – Calculation of Managerial Remuneration- Profit (Loss) Prior to Incorporation **(30 Hours)**

Module IV

Investment Account – Cum-interest- Ex-interest- Cum-dividend- Ex-dividend- Accounting entries- Preparation of Investment Accounts- Treatment of Bonus Share and Right Shares – Preparation of Investment Accounts **(15 Hours)**

Module V

Insurance claims- Loss of stock- computation of claim for loss of stock- Application of average clause- elimination of abnormal/defective items – Loss of profit policy- Calculation of claim- **(15 Hours)**

Suggested Readings

1. Jain, S.P., & Narang, K.L. , Advanced Accountancy, *Kalyani Publishers, New Delhi*
2. Maheswari, S.N & Maheswari, S.K., Advanced Accounting, *Vikas Publishing House, New Delhi*
3. Shukla, M.C., & Grewal, T. S., Advanced Accountancy *S. Chand and Company Pvt. Ltd, New Delhi*
4. Shukla, S.M., & Gupta, S.P., Advanced Accounting, *Sahitya Bhavan Publications, Agra*
5. Raman B S *Corporate Accounting United Publishers*
6. *MA Arulanandam and KS Raman, Advanced Accountancy, Himalaya Publications, Mumbai.*
7. The Chartered Accountant (Journal), *Institute of Chartered Accountants of India, New Delhi.*

Core Course -8 QUANTITATIVE TECHNIQUES FOR BUSINESS - I

Instructional Hours: 90 **Credit: 4**

Objective: *To make the students understand the role of statistics and quantitative techniques in business and familiarize them with basic tools applied*

Module I

Introduction to Statistics- Origin and Growth- Meaning- definition- Statistics as data- Statistics as methods- Empirical and quantitative analysis- Descriptive statistics and Inferential statistics- Functions of statistics-, Planning and Business- Limitations of Statistics- Distrust of Statistics **(8 Hours)**

Module II

Statistical Survey- Planning and design of enquiry- Statistical units- Executing a survey- Business Data Sources- Primary and Secondary Data-Methods of collecting Primary data— Drafting a questionnaire- Collection of secondary data- Census method and Sampling – Sampling Methods Probability Sampling and Non- Probability Sampling- Theoretical base of sampling: Law of Statistical regularity and Law of Inertia of Large Numbers- Statistical errors- Editing and Coding of data- Classification- Types of

classification- Tabulation of Data- Objectives of tabulation- Classification Vs Tabulation- Types of tabulation- Cross tabulation- Parts of a table- Statistical Series **(25 Hours)**

Module III

Uni-Variate Data Analysis I -Measures of Central Tendency – Concept –Functions of an average- Characteristics- Arithmetic Mean –Simple mean- Weighted mean- Combined mean- Properties of mean- Median –Quartiles and other partition values- Mode- Empirical relation between mean, median and mode- Graphical location of median and mode- Geometric Mean-Harmonic Mean-relation between Arithmetic mean, Geometric mean and Harmonic Mean Application of various measures- Merits and Demerits of various measures of central tendency - **(20 Hours)**

Module IV

Uni-Variate Data Analysis II- Measures of dispersion - Concept-Properties of a good measure of dispersion- Absolute and Relative Measure-Range-Inter Quartile Range- Quartile Deviation-Mean Deviation-Standard Deviation-Lorenz curve- Merits and Demerits of various measures-Relevance and Applications in Business-Mathematical properties of standard deviation - Variance and Co-efficient of Variation–Measures of Skewness –Definition of skewness- types- Test of skewness- Relatives measures of skewness- Moments- Central moments- Raw moments- Conversion of raw moments into central moments- Skewness based on moments- Kurtosis-meaning and types **(25 Hours)**

Module V

Interpolation and Extrapolation- Meaning of interpolation and extrapolation- Significance and utility- Assumptions- Methods of Interpolation- (a) Newton's Method of Advancing differences (b) Binomial Expansion method (c) Lagrange's method – Extrapolation- Forecasting using extrapolation

(12 Hours)

Suggested Readings

1. Richard, Levin & Rubin, David, S., Statistics for Management, *Prentice Hall of India, New Delhi.*
2. Spiegel, M.R., Theory and Problems of Statistics, *Schaum's Outlines Series, McGraw Hill Publishing Co.*
3. Kothari, C.R., Research Methodology, *New Age Publications, New Delhi.*
4. Sharma, J. K., Business Statistics, *Pearson Education.*
5. Gupta, S.C., Fundamentals of Statistics, *Himalaya Publishing House.*
6. Gupta, S.P. & Gupta, Archana, Elementary Statistics, *Sultan Chand and Sons, New Delhi.*
7. Elhance D N, Elhance,Veena and Aggarwal B M *Fundamentals of Statistics , Kitab Mahal*
8. Gupta, C B and Gupta, Vijay., *An Introduction to Statistical Methods, Vikas Publishing House*
9. Pillai, R S N and Bagavathi,V *., Statistics , S Chand & Co*

Core Course -9 FINANCIAL MARKETS AND OPERATIONS

Instructional Hours: 72 **Credit: 3**

Objective: *The course is intended to familiarise the students with financial market operations in India*

Module I

Indian Financial System- Savings and Investment – The Indian Financial System-Components - Role and Functions-Interactions among the Components- Recent Developments in the Indian Financial System- Financial Markets-Classification- Capital Market and Money Market Instruments- Indian Money Market- Role of RBI in Money Market- SEBI-Establishment-Objectives-Powers and functions.

(16 Hours)

Module II

Primary Market- Functions of New Issue Market - Methods of New Issue - IPO - FPO - ASBA- Green Shoe Option- Public Issue - Bonus Issue- Right Issue- Private Placement-Book Building - ESOP-Indian Depository Receipts - Intermediaries in the New Issue Market-Registrars to the Issue-Brokers to the Issue-Bankers to the Issue - Underwriters-Qualified Institutional Placement and Qualified Institutional Buyers- Innovative Financial Instruments**.** **(14 Hours)**

Module III

Secondary Market- Role and Functions of Stock Exchanges - Listing of Securities - Stock Exchanges in India - Members of the Stock Exchanges- Methods of Trading in a Stock Exchange- Online Trading- Depositories – Role - Mark to Market System - Stock Market Indices - Methodology for Calculating Index.- Type of Speculators- Speculative Transactions in Stock Exchanges - Insider trading - SEBI regulations- Foreign Institutional Investors in Securities market- Foreign Portfolio Investment- Private Equity **(18 Hours)**

Module IV

Mutual Funds -Meaning- Objectives- Advantages - Classification of Mutual Funds–Exchange Traded Fund- Constitution and Management of Mutual Funds in India- AMFI- Concept of Net Asset Value – Advantages and limitations of Mutual Funds**-** **(12 Hours)**

Module V

Derivatives (Brief study only)- Features of Derivatives -Types of Derivatives– Forwards – Futures- Options-Swaps- Commodity Futures – Major Commodity Exchanges in India **(12 Hours)**

Suggested Readings

1. Khan, M.Y., Indian Financial System, *Tata McGraw Hill, New Delhi.*
2. Singh, Preethi, Dynamics of Indian Financial System, *Ane Books, New Delhi*
3. Guruswami, S., Capital Markets, *Tata McGraw Hill, New Delhi*
4. Avadhani, V. A., Investment and Securities Market in India, *Himalaya Publishing House.*

Journals

SEBI and Corporate Laws - Taxmann, New Delhi
SEBI Monthly Bulletin

Core Course 10: MARKETING MANAGEMENT

Instructional Hours:54 **Credit: 3**

Objective: *The objective of this course is to provide a sound understanding of the basic principles of marketing management and their applications in the business and industry.*

Module I

Marketing Management–Market and Marketing- Meaning- Definition of marketing- Marketing Concepts – Marketing environment- Functions of marketing-Marketing Management- Marketing Mix-

4Ps and 4Cs- Importance of marketing mix- Factors affecting marketing mix- Market Segmentation – Concept – Need – Basis-benefits- Market Targeting- Market Positioning- differentiated and undifferentiated marketing **(12 Hours)**

Module II

Product Mix- Product – Meaning- Classification of products- -Product Line and Product Mix-New Product development- Steps- Reasons for failure of new products- - Product Life Cycle- – Branding- Types of brand- Brand Equity- Brand Loyalty- Trade Mark- Packaging-Role of packaging- Essentials of good packaging- Product Labelling- Marketing of services- Pricing of Products- Factors Influencing Pricing- Pricing Policies and Strategies -Types of Pricing

(12 Hours)

Module III

Price Mix – Pricing-Factors affecting pricing decision- Role of pricing in marketing strategy- Steps in formulating pricing- Pricing methods and strategies- Pricing of a new product- Resale Price Maintenance

(12 Hours)

Module IV

Physical Distribution Mix- - Logistic and Supply Chain Management – Elements- Channels of Distribution –Types- Factors Affecting the Choice of a Channel of Distribution-Functions of various Intermediaries – retailing- Types of retailing- Direct Marketing- Merits and demerits **(12 Hours)**

Module V

Recent Trends in Marketing (Overview Only)-Relationship Marketing - Social Marketing -Online Marketing- -Green Marketing-Tele Marketing -Viral Marketing- Relationship Marketing-De-marketing-Remarketing- Guerilla marketing – Ambush Marketing. **(6 Hours)**

Suggested Readings

1. Kotler, Philip & Keller, Kevin Lane, Koshy, Abraham, & Mithileshwar Jha, Marketing Management, A South Asian Perspective, *Pearson Education.*
2. Armstrong, Gary, and Kotler, Philip, The Essentials of Marketing, *Pearson Education, New Delhi*
3. Majaro, Simon, The Essence of Marketing, *Prentice Hall, New Delhi.*
4. Chhabra, T.N., Principles of Marketing, *Sun India Publication.*
5. Czimkota, Marketing Management, *Vikas Publishing House (P) Ltd.*
6. *Biplab S Bose, Marketing management, Himalaya Publishing House, Mumbai*
7. Rajan Nair and Varma M M – *Marketing Management- Sultan Chand and Sons*
8. Sontakki C N, *Marketing Management- Kalyani Publishers*
9. Ramaswamy V S and Namakumari *Marketing Management , McMillan India Ltd*

SEMESTER 4

Core Course 11: CORPORATE ACCOUNTS – II

Instructional Hours -108 **Credit - 4**

Objective*: To equip the students with the preparation of financial statements of insurance companies and to understand the accounting procedure for reconstruction and liquidation of companies*.

Module – I

Accounts of Insurance Companies – Insurance Companies – Special Terms – Final Accounts of Life Insurance – Revenue Account - Profit and Loss Account and Balance Sheet (As per IRDA Regulation Act, 2002) – Determination of Profit in Life Insurance Business – Valuation Balance Sheet – Accounts of General Insurance Companies (Fire and Marine only) – Revenue Account – Profit and Loss Account and Balance Sheet (as per IRDA Regulation Act) **(20 Hours)**

Module – II

Accounts of Banking Companies – Meaning – Important Provisions of Banking Companies Act, 1949 – Preparation of Final Accounts of Banking Companies – Profit and Loss Account, Balance Sheet – Transactions of Special Type – rebate on bills discounted- Asset Classification and Provisions – Non Performing Assets- Capital Adequacy. **(20 hours)**

Module – III

Internal Reconstruction -Alteration of Share Capital- Capital Reduction –Accounting procedure- Surrender of Shares- Accounting Treatment – Revised Balance Sheet. **(20 Hours)**

Module – IV

Amalgamation, Absorption and External Reconstruction – Meaning- Amalgamation in the nature of Merger, Purchase , External Reconstruction – Applicability of AS 14- Calculation of Purchase consideration (all methods) – Journal Entries in the books of Transferor and Transferee Companies, Revised Balance Sheet (excluding inter - company holdings)

(34 Hours)

Module –V

Liquidation of Companies – Meaning-Types – Contributories-Preferential Creditors- Fraudulent Preference- Preparation of Liquidator's Final Statement of Account (Statement of Affairs excluded) .

(14 Hours)

Suggested Readings

1. Jain, S.P & Narang, K.L., Advanced Accountancy, *Kalyani Publishers, New Delhi*
2. Maheswari, S.N & Maheswari, S.K., Advanced Accounting, *Vikas Publishing House, New Delhi*
3. Shukla, M.C., & Grewal, T.S., Advanced Accountancy, *S Chand and Company Pvt. Ltd, New Delhi*
4. Shukla, S.M., & Gupta, S.P, Advanced Accounting , *Sahitya Bhavan Publications, Agra.*
5. MA Arulanandam and KS Raman, *Advanced Accountancy, Himalaya Publishing House, Mumbai.*
6. Raman B S, *Corporate Accounting United Publishers*
7. The Chartered Accountant (Journal), Institute of Chartered Accountants of India, New Delhi.

Core Course 12: QUANTITATIVE TECHNIQUES FOR BUSINESS- II

Instructional Hours: 108 **Credit : 4**

Objective: *The objective of this course is to familiarize the students with more advanced tools of data analysis and forecasting and also to have an understanding of the fundamentals of theory of probability*

Module – I

Bi-Variate Data Analysis- I- Correlation - Concept- Correlation and Causation -Types of Correlation-Methods- Scatter diagram and Correlation graph- -Karl Pearson's Co-efficient of Correlation-Spearman's Rank Correlation Co-efficient- - Probable Error-Concurrent Deviation Method- Concept of lag and lead in correlation (Problems- Un grouped Data only) **(22 Hours)**

Module II

Bi-Variate Data Analysis- II -Regression Analysis– Concept-Utility- Comparison of correlation and regression- Lines of Regression- - Regression Equations and regression co-efficient- Algebraic Methods of studying regression- Standard Error of estimate - (Problems- Un grouped Data only) **(20 Hours)**

Module – III

Index Numbers-Meaning-Importance- Characteristics and uses of Index Numbers- Types of index numbers- Problems in construction of index numbers- Methods of constructing price index, quantity index and value index- : Unweighted Index numbers- Simple aggregative method and Simple average of price relatives method- Weighted Index numbers- Weighted average of price relative method- Weighted aggregative method applying Laspeyer's, Paasche's and Fishers methods- Test of Consistency of index numbers- Cost of Living Index Numbers and its Uses- Construction of cost of living index numbers- Aggregate expenditure method and family budget method- Concepts of Fixed base index numbers, chain based index numbers, base shifting, deflating and splicing(*theory only*)- Limitations of index numbers **(22 Hours)**

Module - IV

Time Series Analysis-Meaning-Definition- Components of Time Series-Time series analysis- Utility of Time Series Analysis- Mathematical models- Determination of Trend- Free hand curve method- Method of semi averages- Method of Moving Average-Method of Least Squares (first degree only)- Shifting the origin of trend- converting annual trend into monthly trend- **(20 Hours)**

Module – V

Probability-Meaning-Definition - Basic Terms-Concepts-Approaches to Assigning Probability - Permutation and Combination-Theorems of Probability- Addition Theorem- Multiplication Theorem-Conditional Probability- Baye's Theorem of Inverse probability (**24 Hours)**

Suggested Readings

1. Richard, Levin & Rubin, David, S., Statistics for Management, *Prentice Hall of India, New Delhi.*
2. Spiegel, M.R., Theory and Problems of Statistics, *Schaum's Outlines Series, McGraw Hill Publishing Co.*
3. Kothari, C.R., Research Methodology, *New Age Publications, New Delhi.*
4. Sharma, J. K., Business Statistics, *Pearson Education.*
5. Gupta, S.C., Fundamentals of Statistics, *Himalaya Publishing House.*
6. Gupta, S.P. & Gupta, Archana, Elementary Statistics, *Sultan Chand and Sons, New Delhi.*
7. Elhance D N, Elhance,Veena and Aggarwal B M *Fundamentals of Statistics , Kitab Mahal*
8. Gupta, C B and Gupta, Vijay., *An Introduction to Statistical Methods, Vikas Publishing House*
9. Pillai , R S N and Bagavathi,V *., Statistics , S Chand & Co*

Core Course -13

ENTREPRENEURSHIP DEVELOPMENT AND PROJECT MANAGEMENT

Instructional Hours: 90 **Credit: 4**

Objectives:

- *To develop entrepreneurial spirit among students*
- *To empower students with sufficient knowledge to start up their venture with confidence*
- *To mould young minds to take up challenges and become employer than seeking employment and to make them aware of the opportunities and support for entrepreneurship in India*

Module I

Introduction to Entrepreneurship- Definition and Meaning- Distinction between entrepreneur and manager- Characteristics and traits of an entrepreneur- Skills - Motivation of Entrepreneur- -Functions of an Entrepreneur- Role and importance of Entrepreneurship in economic development- Factors affecting growth of entrepreneurship **(10 Hours)**

Module II

Classification of entrepreneurs- Dimensions of Entrepreneurship-Intrapreneurship-Technopreneurship-Cultural Entrepreneurship- International Entrepreneurship-Ecopreneurship- Social Entrepreneurship and Women Entrepreneurship- Problems faced by Women Entrepreneurs-Entrepreneurship in Agriculture sector and service sectors- New avenues- Dealership, Networking and Franchising- Entrepreneurship in MSME- Micro Small Medium Enterprises-Definition- Role of MSME- Steps to establish an enterprise. **(25 Hours)**

Module III

Project Identification-Project- Meaning- Types- Project Management- Project life Cycle- Project identification- Sources of Project idea- Constraints in a project- Sources of Business idea-Protecting the Idea-Legal Protection in India-Trademarks- Copyright- Patent- Geographical Indication- Designs-Plant and Farmer Rights- **(15 Hours)**

Module IV

Project Formulation and Report- Formulation of a project**-** Stages in project formulation**- -** preparation of a project report- contents- project appraisal- various aspects of appraisal (Problems of appraisal techniques excluded) **(20 Hours)**

Module V

Entrepreneurial Support in India- Entrepreneurial Education and training- Entrepreneurship Development Programmes- Objectives and Methodology- The Concept, Role and Functions of Business Incubators- Start-Ups- Govt. of India Funding and Support for Start-Ups- Cluster Development Schemes- Pradan Mantri Mudra Yojana- Industrial Estates- Special Economic Zones- Other initiatives and assistance- Green Channel clearances- - Bridge Capital- Seed Capital Assistance- Special Institutions for Entrepreneurial Development and assistance in India-Functions of EDII, NIESBUD,NSIC, SIDBI and DIC **(20 Hours)**

Suggested Readings

1. Anjan, R. *Managing New Ventures, Concepts and Cases in Entrepreeurship,* New Delhi, PHI Learning Private limited.
2. Bhide A, *The Origin and Evolution of New Businesses,* New York, Oxford University Press.
3. Brandt, S. C. (1997). *Entrepreneuring: The 10 Commandments for Building a Growth Company.* New Delhi: Mc Millan Business Books.
4. Manjunath, N. (2008). *Entrepreneurship & Management.* Bangalore: Sanguine Technical Publishers.
5. Khanka S S- Entrepreneurial Development- S Chand and Sons
6. Desai,Vasant- Small Scale Business and Entrepreneurship- Himalaya Publications
7. AP Padnekar, Entrepreneurship, *Himalaya Publishing House, Mumbai.*
8. Rao, V S P- Business, Entrepreneurship and Management- Vikas Publishing House
9. Pandya, Rameswary- **.** Skill Development and Entrepreneurship in India, New Century Publications

SEMESTER 5

Core Course : COST ACCOUNTING- I

Instructional Hours: 108 **Credit: 4**

Objectives: *To familiarise the students with cost concepts and to make the students learn the Fundamentals of cost accounting as a separate system of accounting.*

Module I

Introduction to Cost Accounting- Meaning- Definition- Cost Concepts-Costing- Cost Accounting- Cost Accountancy- Objectives and functions of Cost Accounting- Cost Unit- Cost Centre- Responsibility Centres- Profit Centre- Cost Control- Cost Reduction- Distinction between Cost Accounting and Financial Accounting-Essentials of a good costing system- Installation of costing system- Methods and Techniques of Cost Accounting- Advantages and Disadvantages of Cost Accounting**-** Cost concepts and classification- elements of cost **(18 Hours)**

Module II

Accounting and Control of Material Cost- Material Purchase Procedure- Inventory control- Material Stock Level-EOQ- ABC- VED and FSN Analysis-JIT- Stock turnover- Material Issue control- Stores records- Bincard and Stores ledger- Documents authorizing movement of materials-Inventory systems: Perpetual and Periodic Inventory System-Continuous Stock Taking - Material Losses-Wastage- Scrap-Spoilage-Defectives- Pricing of issue of materials- FIFO- LIFO- Simple Average- Weighted Average- **(25 Hours)**

Module III

Accounting and Control of Labour Cost- Time Keeping and Time Booking-Methods - Systems of Wage Payment-Time Rate System- Piece Rate System- Differential Piece Rate – Taylor's differential piece rate system- Merrick's differential piece rate system- Gantt Task and Bonus plan- Incentive Plans-Halsey Plan - Rowan Plan-Idle Time- Overtime and their Accounting Treatment- Labour Turnover-Causes and effects- Methods of Calculating Labour Turnover**.** **(20 Hours)**

Module IV

Accounting for Overhead-Classification of Overhead- Segregation of semi variable overhead-Production overhead- Allocation and apportionment- Primary and Secondary Distribution Summary-Absorption of Overhead- Methods of absorption of overheads- Overhead absorption rates- Actual and pre-determined rates- Blanket and Multiple rates- Over-absorption and Under-absorption- Reasons-Disposal- Introduction to Activity Based Costing (Problems of ABC excluded) **(25 Hours)**

Module V

Preparation of Cost Sheet- Cost sheet- Objectives- preparation- Tender and Quotation-Reconciliation Statement –Need- Reasons for disagreements in Profits-Preparation- Memorandum Reconciliation Account **(20 Hours**)

Suggested Readings

1. Jain, S.P., & Narang, K.L., Advanced Cost Accounting, *Kalyani Publishers, New Delhi.*
2. Iyengar, S. P., Cost Accounting, *Sultan Chand & Sons, New Delhi.*
3. Maheswari, S.N., Advanced Cost Accounting, *Sultan Chand & Sons, New Delhi.*
4. Arora, M. N., Cost Accounting, *Vikas Publishing House Pvt. Ltd, New Delhi.*
5. J Madegowda, Advanced Cost accounting, *Himalaya Publishing House, Mumbai*
6. Shukla, M.C., and Grewal, T.S., Cost Accounting, *Sultan Chand & Sons, New Delhi.*
7. Lall Nigam B M and Jain I C, Cost Accounting Principles and Practice, Prentice Hall of India

Core Course 15: ENVIRONMENT MANAGEMENT AND HUMAN RIGHTS

Instructional Hours: 90 **Credit: 4**

Module I (18 Hours)

Unit 1 : Multidisciplinary nature of environmental studies (**2 Hours**)

Definition, scope and importance -need for public awareness.

Unit 2 : Natural Resources :

Renewable and non-renewable resources : Natural resources and associated problems.

Forest resources : Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. -**Water resources** : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. **Mineral resources** : Use and exploitation, environmental effects of extracting and using mineral resources, case

studies. **Food resources** : World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. **Energy resources**: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources, Case studies. **Land resources**: Land as a resource, land degradation, man induced landslides, soil erosion and desertification - Role of individual in conservation of natural resources- Equitable use of resources for sustainable life styles.
(**10 Hours**)

Unit 3: Ecosystems

Concept of an ecosystem -Structure and function of an ecosystem -Producers, consumers and decomposers- Energy flow in the ecosystem -Ecological succession-Food chains, food webs and ecological pyramids-Introduction, types, characteristic features, structure and function of the given ecosystem:- Forest ecosystem (**6 Hours**)

Module II (26 hours)

Unit 1: Biodiversity and its conservation

- Introduction –Bio geographical classification of India -Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values-India as a mega-diversity nation-Hot-sports of biodiversity-Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts-Endangered and endemic species of India

(**8 Hours**)

Unit 2: Environmental Pollution

Definition,Causes, effects and control measures of: - Air pollution,Water pollution, Soil pollution, Marine pollution, Noise pollution,Thermal pollution, Nuclear hazards,Solid waste Management: Causes, effects and control measures of urban and industrial wastes-Role of an individual in prevention of pollution,Pollution case studies, Disaster management: floods, earthquake, cyclone and landslides.

(**8 Hours**)

Unit 3: Social Issues and the Environment

Urban problems related to energy, Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation of people: its problems and concerns, Case studies, Environmental ethics: Issues and possible solutions,-Climate change, global warming, acid rain, ozone layer depletion , nuclear accidents and holocaust, Case studies- Consumerism and waste products- Environment Protection Act - Air (Prevention and Control of Pollution) Act,Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation, Public awareness

(**10 Hours**)

Module – III (15 Hours)

Recent developments- Green Accounting- Meaning- History- Scope and Importance- Importance- Advantages and limitations- Green Banking- Meaning- benefits- coverage- steps in green banking- environmental risks for banks- Green banking initiatives- International initiatives- Initiatives in India- Green Marketing- Meaning- Need and benefits- Challenges-

Green marketing in India- Green washing and consequences- Eco tourism- significance- eco tourism activities in India- Opportunities and challenges – carbon credit and carbon exchanges (over view only) - Environmental audit- concept- need and scope **(15 Hours)**

Module – IV (13 Hours)

Right to Information Act 2005- Basic terms- Public authority- Competent authority- Appropriate Government- Third Part- Information – record- Right to information- Objectives of the Act- Features of the Act- Obligation of Public authority- Procedure for request of information- time limit- fee- ground of rejection- appeal- exemption from disclosure- Right to access information on specific issues- Banking transactions, insurance transactions, government dealing and related services (**13 Hours)**

Module – V (18 Hours)

Unit 1- Human Rights– An Introduction to Human Rights, Meaning, concept and development, Three Generations of Human Rights (Civil and Political Rights; Economic, Social and Cultural Rights).

Unit-2 Human Rights and United Nations – contributions, main human rights related organs UNESCO, UNICEF, WHO, ILO, Declarations for women and children, Universal Declaration of Human Rights.

Human Rights in India – Fundamental rights and Indian Constitution, Rights for children and women, Scheduled Castes, Scheduled Tribes, Other Backward Castes and Minorities

Unit-3 Environment and Human Rights - Right to Clean Environment and Public Safety: Issues of Industrial Pollution, Prevention, Rehabilitation and Safety Aspect of New Technologies such as Chemical and Nuclear Technologies, Issues of Waste Disposal, Protection of Environment

Conservation of natural resources and human rights: Reports, Case studies and policy formulation. Conservation issues of Western Ghats- mention Gadgil committee report, Kasthurirangan report. Over exploitation of ground water resources, marine fisheries, sand mining etc. **(18 Hours)**

Assignment may include Field study involving

- Visit to a local area to document environmental grassland/ hill /mountain
- Visit a local polluted site – Urban/Rural/Industrial/Agricultural Study of common plants, insects, birds etc
- Study of simple ecosystem-pond, river, hill slopes, etc

Suggested Readings

1. Bharucha Erach, Text Book of Environmental Studies for undergraduate Courses. University Press, IInd Edition 2013 (TB)
2. Clark.R.S., Marine Pollution, Clanderson Press Oxford (Ref)

3. Cunningham, W.P.Cooper, T.H.Gorhani, E & Hepworth, M.T.2001 Environmental Encyclopedia, Jaico Publ. House. Mumbai. 1196p .(Ref)
4. Dc A.K.Enviornmental Chemistry, Wiley Eastern Ltd.(Ref)
5. Down to Earth, Centre for Science and Environment (Ref)
6. Heywood, V.H & Watson, R.T. 1995. Global Biodiversity Assessment, Cambridge University Press 1140pb (Ref)
7. Jadhav.H & Bhosale.V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284p (Ref)
8. Mekinney, M.L & Schock.R.M. 1996 Environmental Science Systems & Solutions. Web enhanced edition 639p (Ref)
9. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co. (TB)
10. Odum.E.P 1971. Fundamentals of Ecology. W.B. Saunders Co. USA 574p (Ref)
11. Rao.M.N & Datta.A.K. 1987 Waste Water treatment Oxford & IBII Publication Co.Pvt.Ltd.345p (Ref)
12. Rajagopalan. R, Environmental Studies from crisis and cure, Oxford University Press, Published: 2016 (TB)
13. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut (Ref)
14. Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science (Ref)
15. Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards, Vol I and II, Enviro Media (Ref)
16. Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (Ref)
17. Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p (Ref)
18. (M) Magazine (R) Reference (TB) Textbook
19. Amartya Sen, The Idea Justice, New Delhi: Penguin Books, 2009.
20. Chatrath, K. J.S., (ed.), Education for Human Rights and Democracy (Shimla: Indian Institute of Advanced Studies, 1998)
21. Law Relating to Human Rights, Asia Law House,2001.
22. Shireesh Pal Singh, Human Rights Education in 21st Century, Discovery Publishing House Pvt.Ltd, New Delhi,
23. S.K.Khanna, Children And The Human Rights, Common Wealth Publishers,1998. 2011.
24. Sudhir Kapoor, Human Rights in 21st Century,Mangal Deep Publications, Jaipur,2001.
25. United Nations Development Programme, Human Development Report 2004: Cultural Liberty in Today's Diverse World, New Delhi: Oxford University Press, 2004.
26. Monica Loss,,Green Marketing Strategies and Consumer Behaviour, Global Vision Publishing House
27. Robert Dahlstrom- Green Marketing:Theory, Practice and Strategies, Cengage Learning India Private Limited
28. A N Sarkar , Green Banking , Atlantic Publishers
29. Thomas Aronsson and Karl Gustaf Lofgren, Edgar Handbook of Environmental Accounting, Elgar Publishing

30. M Sarngadharan and G Raju , Tourism and Sustainable Economic Developments: Indian and Global Perspectives – New Century Publishers
31. ICAI Study Material of Auditing
32. Right to Information Act, 2005

Core Course 16: FINANCIAL MANAGEMENT

Instructional Hours: 90 **Credit: 4**

Objectives:
To familiarise the students with the functional areas and principles of financial management.

Module I
Introduction-Meaning of Finance – Financial Management-Importance - Scope – Objectives – Profit Maximization – Wealth Maximization – Finance Function -Role of Finance Manager-Financial Management and other Disciplines- Concept of Time value of money- Discounting and compounding **(15 Hours)**

Module II
Financing Decision - Sources of Finance – Equity – Debt – Preference- Retained earnings- Cost of Capital-Concept- Importance- Measurement of Specific Costs– Cost of Debt – Cost of Preference Capital – Cost of Equity – Cost of Retained Earnings – Capitalisation - Capital Structure-Meaning of Capital Structure –Optimum Capital Structure- Factors Determining Capital Structure- Leverage-Meaning-Types-Operating Leverage- Meaning and Computation -Financial Leverage- Meaning and Computation-Composite Leverage- Meaning and Computation- Financial Risk and Business Risk. (*Capital Structure theories excluded*) **(30 Hours)**

Module III
Investment Decision- Capital Budgeting – Meaning- Importance- Determination of Cash Flows – Evaluation Methods –Traditional Techniques- Pay Back Period – ARR –Discounted Cash flow techniques- NPV –IRR – Profitability Index – Discounted PBP- Interpretation of Results. **(20 Hours)**

Module IV
Management of Working Capital - Meaning–Definition – Importance-Types of working capital- Gross Working Capital- Net Working Capital- Factors Determining Working Capital–Estimation of Working Capital Requirements- Methods **(15 Hours)**

Module V
Dividend Decision- Meaning- Types of Dividend-Dividend Policy-Conservative Vs Liberal Policy-Pay-out Ratio- Retention Ratio- Factors Determining Dividend Policy- Bonus Shares- Stock Split and Reverse Split. *(Dividend theories excluded)* **(10 Hours)**

Suggested Readings

1. Pandey, I. M., Financial Management, Vikas *publishing House Pvt. Ltd.New Delhi.*

2. Khan, M.Y. & Jain, P.K., Financial Management, *McGraw Hill (India) Private limited; New Delhi.*
3. Rustagi, R. P., Financial Management, Theory, concepts and Problems, *Galgotia Publishing Company, New Delhi.*
4. Prasanna Chandra, Financial Management, *Tata McGraw Hill publishing company limited, New Delhi.*
5. *OP Agarwal, Financial Management, Himalaya Publishing House, Mumbai*
6. Raman B S*, Financial Management- United Publishers*
7. Srivastava, T. M., Financial Management, Principles and Problems*, Pragatiprakashan, Meerut.*

SEMESTER 6

Core Course 17: COST ACCOUNTING- II

Instructional Hours: 108 **Credit: 4**

Objectives: 1 *To acquaint the students with different methods and techniques of costing. and to enable the students to identify the methods and techniques applicable for different types of industries.*

Module I

Specific Order Costing- Job Costing – Meaning - Procedure- Batch Costing- Meaning- Procedure- Economic Batch Quantity- Contract Costing-Meaning- Objectives- Work-in-Progress Work Certified and Uncertified- Retention money and progress payments- Determination of Profit on Incomplete Contract- Treatment-Balance Sheet- Escalation Clause- Cost-plus Contract.

(20 Hours)

Module II

Operating Costing- Definition- Transport costing- Canteen costing- Hospital costing

(15 Hours)

Module III

Process Costing- Process Accounts- Process Losses- Normal and Abnormal losses- Abnormal Gain - Treatment- Joint Products and By-products- Methods of Apportioning Joint costs- Accounting for By-products **(24 Hours)**

Module IV

Marginal Costing and Break Even Analysis- Marginal Costing- Meaning-Definition- Difference between Marginal Costing and Absorption Costing - Differential Costing- Advantages and Disadvantages of Marginal Costing -Break Even Analysis- Cost Volume Profit Analysis- Break even chart- Simple Break Even Chart- Marginal Costing and Decision Making- Pricing Decisions- Key Factor- Make or Buy- Sales Mix- Acceptance of foreign Order. **(25 Hours)**

Module V

Budget and Budgetary Control- Meaning and Definition- Objectives- Steps in budgetary control- - Budget Manual Budget Committee- Budget key factor- Types of budgets- Advantages and limitations of

budgetary control- Preparation of Cash Budget and Flexible Budget- Zero base Budgeting- Performance Budgeting. **(24 Hours)**

Suggested Readings

1. Jain, S.P., & Narang, K.L., Advanced Cost Accounting, *Kalyani Publishers, New Delhi*.
2. Iyengar, S. P., Cost Accounting, Sultan Chand & Sons, New Delhi.
3. Maheswary,S.N., Advanced Cost Accounting, Sultan Chand & Sons, New Delhi.
4. Arora, M. N., Cost Accounting, Vikas Publishing House Pvt. Ltd, New Delhi.
5. Shukla, M.C., & Grewal, T. S., Cost Accounting, Sultan Chand & Sons, New Delhi.
6. J Madegowda, Advanced cost accounting, *Himalaya Publishing House, Mumbai*
7. Lall Nigam B M and Jain I C- Cost Accounting Principles and Practice- Prentice Hall of India

Core Course 19: ADVERTISEMENT AND SALES MANAGEMENT

Instructional Hours: 72 **Credit: 3**

OBJECTIVE- *To make the students aware of the strategy, concept and methods of advertising and sales promotion.*

MODULE-1

Introduction : Advertising-Meaning-Origin and development - Objectives-Importance- Functions of advertising-Role of advertisement in marketing mix- Classification and Types of advertisement- Merits and demerits- Advertisement process- Advertising planning- Key players in advertising industry- Advertisement agencies- Types and functions of advertising agencies- -Advertisement campaign - Social, economical and legal aspects of advertisement- Ethics in advertisement- meaning- perceived role of advertisement-Forms of ethical violation- misleading advertisements- advertising to children- product endorsements- stereotyping, cultural, religious and racial sensitivity in advertising- obscenity in advertising-misleading and deceptive advertising- false claims- Advertisement Standards Council of India – Regulation of advertising in India **(18 Hours)**

MODULE-2

Advertisement appeal and media- Advertisement appeal- Meaning- essentials of an advertisement appeal- types of appeal- advertisement copy- requisites of an effective advertisement copy-types of copy- Elements of copy-Lay out- Functions of lay out- Elements of layout- Principles of design and layout- copy writing- qualities of a good copy writer- -Copy testing and advantages- Advertising media-Media planning and strategy-Types of media- Media selection-Importance of media planning and selection- problems in media planning- Internet as an advertisement medium- Objects of internet advertisement- Advantages and disadvantages of internet advertising – Permission marketing- Steps in permission marketing- **(18 Hours)**

MODULE-3

Advertising research-Need for advertisement research- Measuring the effectiveness of advertising-Importance of measuring the effectiveness- Methods: Pre-testing, Concurrent testing and Post- testing-Constraints in measuring the effectiveness- DAGMAR model **(10 Hours)**

MODULE-4

Sales promotion-Promotion mix- Components- Sales promotion-Concept- Definition-Scope-Objectives- Importance of sales promotion- Methods and techniques of sales promotion -Sales promotion strategies- Differences between advertisement and sales promotion—Advantages and drawbacks of sales promotion- Sales promotion budget and its preparation-Sales promotion campaign-Evaluation of sales promotion strategies **(18 Hours)**

MODULE-5

Personal selling-Nature and importance-Essential elements of personal selling- Process-Principles of personal selling- Types of sales persons-Sales force management-Designing and managing the sales force- Evaluating sales force **(8 Hours)**

Suggested Readings

1. Wells, Moriarty & Burnett, *Advertising, Principles & Practice, Pearson Education*
2. Kenneth Clow. Donald Baack, *Integrated Advertisements, Promotion and Marketing communication, Prentice Hall of India, New Delhi,*
3. S. H. H. Kazmi and Satish K Batra, *Advertising & Sales Promotion, Excel Books, New Delhi,*
4. Manendra Mohan - *Advertising Management – Concepts and Cases, Tata McGraw Hill*
5. Sherlekar, Victor & Nirmala Prasad - *Advertising Management - Himalaya Publishing House*
6. S.A. Chunawalla - *Promotion Management Himalaya Publishing House*
7. C.L. Tyagi, Arun Kumar- *Advertising Management- Atlantic Publishers and Distributors*

Core Course 19: AUDITING AND ASSURANCE

Instructional Hours – 90 **Credits: 4**

objectives:

1. *To familiarize the students with the principles and procedure of auditing.*
2. *To enable the students to understand the duties and responsibilities of auditors and to undertake the work of auditing.*

Module I

Introduction-Meaning and Nature of Auditing- Definition of Audit- Basic Principles Governing an Audit, Scope of Audit, Objectives of Audit- Main Object and Subsidiary Objects -Advantages of an Audit, Inherent Limitations of Audit , Differences between Accountancy and Auditing. The Auditor: Qualities and Qualifications of an Auditor- Types and Conduct of Audit- Tax Audit- Performance Audit-Social Audit. Auditing standards : Overview, Role of Auditing and Assurance Standards Board in India **(17 Hours)**

Module II

Audit Engagement, Documentation and Evidence – Audit Planning, Audit Programme Preparation before Audit. Audit files: Permanent and current audit files, Ownership and custody of working papers, Audit working papers. Audit evidence – Meaning, Types, Reliability of audit evidence, Methods of

obtaining audit evidence- Physical verification, Documentation, Direct confirmation, Re-computation, Analytical review techniques, Representation by management. **(15 Hours)**

Module III

Internal Control –Concept of internal control**,** Internal Control and the Auditor, Internal Control Questionnaire, Internal Control and Computerized Environment-General Control and Application Controls- Internal Check - Meaning and Definition , Objects of Internal Check, Auditors Duties as Regards Internal Check, Internal Audit- Internal Auditor and independent Auditor - Difference between Internal Check- Internal Control and Internal Audit- Internal Check as Regards Cash Transactions, purchases- sales- wages and stores. Vouching- meaning of Vouching- Definition -Vouchers- Points to be noted in Vouchers-Importance of vouching- Vouching of Cash Transactions - Vouching of Receipts and Payments, Vouching of Wages. Verification and Valuation of Assets and Liabilities - Concept, objects, Auditors Duty in Verification and Valuation.

(25 Hours)

Module IV

Audit of Limited Companies –(based on Companies Act 2013) Company Auditor- Qualifications- Disqualifications- Appointment Removal- Powers and Duties of an Auditor- Liabilities of an Auditor - Audit Report- Contents and Types.

(15 Hours)

Module V

Special Audits and Investigation – Government Audit, General Duties and powers of Comptroller and Audit General , Miscellaneous Audits (Procedure only)- Audit of Charitable organizations- Educational Institutions (College) – Hospital - Club- Audit in computerized environment- Audit around computer and audit through computer- Investigation**-** Meaning and Definition of Investigation- Scope of investigation- Distinction between Investigation and Auditing- Investigation on Acquisition of Running Business, Investigation when Fraud is suspected.

(18 Hours)

Suggested Readings

1. Tandon, B.N., Sudharsanam, S., & Sundharabahu, S., A Handbook of Practical Auditing, *S.Chand & Compaly Ltd, New Delhi.*
2. Arun Jha, *Auditing* – University Edition, *Taxman Publications*
3. Saxena, R. G., Principles and Practice of Auditing, *Himalaya Publishing House, Mumbai*
4. Sharma, T. R., Auditing *Sahitya Bhawan Publication Agra.*
5. Saxena, R. G., Principles and Practice of Auditing, *Himalaya Publishing House, New Delhi.*
6. ICAI Study material for IPCC and Final

Core Course 20 : MANAGEMENT ACCOUNTING

Instructional Hours: 90 **Credit: 4**

Objective: *To acquaint the students with management accounting techniques for the analysis and interpretation of financial statements and to study the basic framework of financial reporting.*

Module I

Introduction to Management Accounting – Meaning- evolution- Definition- Nature and characteristics- scope- Objectives- Functions- Distinction between financial accounting and management accounting- distinction between cost accounting and management accounting- Tools of management accounting- Limitations of Management accounting **(10 Hours)**

Module II

Financial Statement Analysis - Financial Statements –Nature and limitations of financial statements- Analysis and Interpretation of Financial Statements- Objectives – Importance – Types of Financial Analysis – Internal- External – Horizontal – Vertical – Techniques of Analysis – Comparative Statements – Common Size Statements – Trend Analysis. **(15 Hours)**

Module III

Ratio Analysis –Meaning – Objectives- Importance and Uses – Limitations – Types and classification of Ratios – Liquidity Ratios –Solvency Ratios- Activity Ratios - Profitability Ratios – Preparation of Trading and Profit and Loss Account and Balance Sheet by using Ratios. **(25 Hours)**

Module IV

Fund flow Analysis – Introduction – Meaning and Definition of Fund - Need for Fund Flow Statement – Managerial Uses- Limitations –Schedule of Changes in Working Capital- Funds from operations- Preparation of Fund Flow Statement. **(20 Hours)**

Module V

Cash Flow Statement – Introduction – Meaning – Uses- Comparison between Fund Flow Statement and Cash Flow Statement – Preparation of Cash Flow Statement as per Accounting Standard 3 – Direct Method and Indirect method **(20 Hours)**

Suggested Readings:

1. Manmohan & Goyal, S.N., Management Accounting*, Sahithya Bhawan Publication, New Delhi.*
2. Lal, Jawahar, Corporate Financial Reporting, Theory & Practice*, Taxmann Applied Services, New Delhi.*
3. J Madegowda, Advanced Management Accounting, *Himalaya Publishing House, Mumbai*
4. Arora, M. N., Cost Accounting and Management Accounting*, Vikas Publishing House Pvt. Ltd, New Delhi.*
5. S P Gupta, Management Accounting, Sahityabhavan, Agra
6 Raiyani, J. R., & Lodha, G., International Financial Reporting Standard (IFRS) and Indian Accounting Practices*, New Century Publications*.
7. Pillai R S N and Bagavathi- *Management Accounting- S Chand & Company*
8. Management Accountant (Journal), *Institute of Cost Accountants of India, Kolkata.*

Optional Core Courses
Finance & Taxation
SEMESTER III

Optional – 1- GOODS AND SERVICES TAX

Instructional hours 90 **Credit 4**

Course objective ***: To give the students a general understanding of the GST law in the country with a practical perspective and employability to the students in the commercial tax practices.***

Module 1

Stages of Evolution of GST - Methodology of GST - CGST - SGST - IGST - Important concepts and Definitions. GSTN. **(30 hours)**

Module 2

Levy and Collection of Tax - Scope of Supply - Composite and Mixed Supplies- Levy and Collection - Time of Supply of Good s- Time of Supply of Services - Input Tax Credit - Recovery of Credit - Tax Invoice - Unauthorised Collection of Tax - Credit Notes - Debit Notes - Accounts and Records. **(20 hours)**

Module 3

Registration - Returns And Payment of Tax - Persons Liable for Registration - Compulsory Registration - Deemed Registration- Procedure For Registration - Amendment of Registration - Cancellation of Registration - Returns - Furnishing Details of Supplies - Payment of Tax, Interest, Penalty - Tax Deduction at Source - Collection of Tax At Source - Refunds. **(15 Hours)**

Module 4

Assessment - Types - Audit Inspection - Search - Seizure - Inspection of Goods in Movement - Power of Authorities - Demands And Recovery - Fraud and Suppression of Facts - Liabilities - Provisional Attachment. **(15 Hours)**

Module 5

Appeals - Appellate Authorities - Powers - Procedure - Appeal to High Court -Supreme Court - Offences and Penalties. **(10 Hours)**

(All the provisions in the Central GST, State GST and Integrated GST Acts and Rules as amended up to date will be applicable)

Suggested Readings:

1) *Indirect Taxes - Vinod K Singania,Taxmann's Publications, New Delhi*
2) *Indirect Taxes - H.C Mehrotra, Sahitya Bhavan Publications, New Delhi*
3) *Bare Act CGST*
4) *Bare Act SGST*
5) *Bare Act IGST*

SEMESTER IV

Optional Core – 2: FINANCIAL SERVICES

Instructional Hours: 90 **Credit: 4**

Objectives: *1. To provide the students with an overall idea of financial services available in the country and to create an understanding about recent trends in financial services sector.*

MODULE I

Introduction to Financial Services – Meaning – Types- Fund Based Financial Services- Fee Based Financial Services- Introduction to Merchant Banking Services in India- Role and Functions of Merchant Bankers **(15 Hours)**

MODULE II

Venture Capital and Securitisation - Features and Types of Venture Capital- various Stages of Venture Capital Financing- Factors affecting investment decision- Investment nurturing- Venture capital Exit strategies- Venture Capital Firms in India- Securitisation of Debt- Parties involved- Steps of securitisation - Types of securitisation- Advantages- Limitations – SARFAESI Act 2002- Background- Purpose of the Act- Main provisions **(20 Hours)**

MODULE III

Leasing and Factoring– Leasing- Essentials –Types- Operating and Financial Lease- Sale and Lease back- Other classifications- Advantages and Limitations of Leasing—Leasing Vs Hire purchase- Factoring-Parties involved- Process of Factoring- Functions of a Factor- Different Forms of Factoring Services- Factoring Vs. Bill Discounting – Forfaiting- Mechanism of Forfaiting- Factoring Vs. Forfaiting **(20 Hours)**

MODULE IV

Credit Rating –Meaning, types of Credit Rating- Need for credit rating-Factors affecting credit rating- Advantages and Limitations of Credit rating- Rating process and methodology Credit Rating Agencies in India. **(15 Hours)**

MODULE V

Mergers and Acquisition- Expansion of business firms- Internal and external expansion- forms of combinations- merger, acquisition and take over- Reasons for merger- Types of merger- Legal aspects involved- Valuation methods- Forms of financing mergers-Merger Vs Take over- Types of take over- Defense strategies against hostile takeovers- Mergers in India**-** Recent trends in financial services- Shadow Banking -Angel Funds- Hedge funds **(20 Hours)**

Suggested Readings

1. Bhole, L.M., Financial Institutions and Markets: Structure, Growth and Innovations *Tata Mc-Grow Hill. New Delhi:*
2. Gupta, N. K., Financial Markets, Institutions and Services, *Ane Books Pvt. Ltd. New Delhi*
3. Khan, M.Y., Financial Services - *Tata McGraw Hill New Delhi.*
4. Siddaiah, T., Financial Services Pearson Education New Delhi.
5. VA Avadhani, Financial Services in India, *Himalaya Publishing House, Mumbai*
6. Yogesh, M., Investment Management*, PHI Learning Pvt. Ltd. New Delhi:*
7. Shashi K Gupta and Nisha Agarwal- *Financial Services- Kalyani Publishers*

SEMESTER V

Optional Core-III: INCOME TAX- I

Instructional Hours-90 **Credit-4**

Objective :*To familiarise the students with Income Tax Act 1961 and to enable the students to compute Income taxable under the first three heads of Income.*

Module I

Introduction - Brief History of Income Tax in India - Basic Concepts- Finance Act- Definition of Income- Gross Total Income- Total Income-Assessee- Assessment Year Average Rate of Tax - Maximum Marginal Rate- Previous Year - Accelerated Assessment -Person - Finance Act- Rates of Income Tax-Capital and Revenue **(15 Hours)**

Module II

Residential Status- Incidence of Tax- Income Exempt from Tax- Heads of Income. **(15 Hours)**

Module III

Income from Salary- Chargeability- Definition – Perquisites- Profit in lieu of Salary -Deductions from Salary- Provident Funds and Treatment - Computation of Income from Salary

(25 Hours)

Module IV

Income from House Property - Basis of Charge - Deemed Ownership- Income from House Property Exempt from Tax- Annual Value and its Determination in Various Cases- Deductions Permissible- Unrealised Rent and Recovery of Unrealized Rent and Arrears of Rent- Computation of Income from House Property **(15 Hours)**

Module V

Profit and Gains of Business or Profession - Chargeability - Deductions Expressly Allowed - General Deductions - Depreciation - Expenses/Payments Not Deductible - Expenses Allowed on Actual Payment Basis Only- Deemed Profits U/S 41 - Computation of Profits and Gains of Business or Profession

(20 Hours)

Suggested Readings

1. Singhania,Vinod, K., & Singhania Monica, Students Guide to Income Tax, *Taxman Publication, New Delhi.*
2. Mehrotra, H.C., Goyal, S. P., Direct Taxes Law and Practice- *Sahithya Bhawan Publications, Agra.*
3. Gaur, V.P, & Narang, D.B., Direct Taxes- *Kalyani Publishers, New Delhi.*
4. Income Tax Act

SEMESTER VI

Optional Core-IV: INCOME TAX -II

Instructional Hours-90 **Credit-4**

Objective- *To have an understanding of determination of Total Income and tax payable and to get an overview regarding returns to be filed by an individual and also assessment procedure*

Module-I

Capital gains - Basis of charge - Capital assets - Kinds- Computation of Short term and Long term Capital Gains- Computation of Capital Gain in following Special Cases - Conversion of Capital Asset into Stock in Trade - Transfer of Capital Asset by a Partner to a Firm, AOP, BOI - Compensation on Compulsory Acquisition of Assets and also Enhanced Compensation - Right Share and Bonus Shares - Converted Shares/Debentures - Capital Gains Exempt from Tax - Capital Gains Account Scheme - Computation of Income from Capital Gain. **(20 Hours)**

Module-II

Income from Other Source- General and Specific Chargeability- Kinds of Securities and Grossing up of Interest- Bond Washing Transaction- Deductions Allowed - Deduction Not permitted- Computation of Income under the head Income from Other Source. **(10 Hours)**

Module-III

Clubbing of Income - Aggregation of Incomes- Set off and Carry forward of Losses - Order of Set off - Computation of Gross Total Income - Deductions under Chapter VI A -Payment or Contribution deductions applicable to individuals from Sec 80C to 80GGC and deduction under Sec 80U- Total income **(25 Hours)**

Module-IV

Assessment of individuals - Agricultural Income - Partly Agricultural Income - Clubbing of Agricultural Income - Computation of Tax **(20 Hours)**

Module-V

Income Tax authorities - Powers and Functions - Assessment- Assessment procedure- Types of Return – E- filing of Return - Return through TRP- PAN - Types of Assessment - Tax Deducted at Source- TCS- TAN - A brief study on areas (a) Advance payment of tax (b) Refund (c) Recovery of tax (d) Tax Clearance Certificate – Tax planning -Tax evasion – Tax avoidance – Tax management (theory only) **(15 Hours)**

Suggested Readings

1. Singhania,Vinod, K, & Singhania Monica, Students Guide to Income Tax, *Taxmann Publication, New Delhi.*
2. Mehrotra, H.C., & Goyal, S. P., Direct Taxes-Law and Practice, *Sahitya Bhawan Publications, Agra.*
3. Gaur, V.P., &Narang, D.B., Direct Taxes, *Kalyani Publishers, New Delhi.*
4. Income Tax Act

Optional Courses- Computer Applications

SEMESTER III

Optional Core I-INFORMATION TECHNOLOGY FOR BUSINESS

Instructional Hours: 90 (54 theory and 36 practical) **Credit: 4**

Objectives: *1. To make the students aware of the role of information technology in business and make them capable of developing web pages for business*

Module I

Introduction to Information Technology -Informatics - Information Technology -E-World -Information Systems–Hardware and Software: Input, Processing, Storage, Output and Communication Hardware– Software: System Software and Application Software – Operating System: WINDOWS, UNIX and LINUX – Versions. Free Software Movement – Futuristic IT – Artificial Intelligence – Virtual Reality.

(16 Hours)

Module II

Social Informatics - IT and Society –IT Applications in Commerce, Business and Industry – IT Applications in Education, Teaching and Learning – Computer and Health Issues – Proper Usage of Computers and Internet – Cyber Ethics - Cyber Addiction –Cyber Crime -E-waste and Green Computing.

(12 Hours)

Module III

Network and Communications - Computer Networks – Types of Networks: WAN, MAN, LAN, PAN, CAN- Benefits of Networks, Network Topology –Work Group Computing & Groupware - Telecommuting & Virtual Offices - Network Security –Firewalls. Communication Medium: Wired and Wireless – Generations in Communication. **(15 Hours)**

Module IV

HTML and Webpage - Introduction to HTML – Essentials- Static & Dynamic Web Pages - Structure of a Web Page - Designing Web Pages- HTML Tags -Text Formats- Working with Text- Presenting and Arranging Text-Paragraphs- Animated Effects: Marquee – using White Space - Tables in HTML- Working with Links, E-mail Links, Lists, Images, Thumbnails, Rollover Images, Audio & Video-Forms & Frames - Website Management. **(34 Hours)**

Module V

Internet -Working Concepts -Devices, History, Benefits and Drawbacks - Internet Structure, Internet Protocols: TCP/IP, FTP, HTTP, etc., IP Address, Domain Name System (DNS), URL, Web Browsers, WWW Consortium, Search Engines – Types, Academic Search Techniques - Business Applications of Internet, Internet Access Methods - Intranet and Extranet.

(13 Hours)

Practical Training:

1. Designing a web page for your Department
2. Designing a web page for a Retail Marketing Firm.
3. Design a web page for a Hotel

Suggested Readings

1. Alexis Leon & Mathews Leon, Fundamentals of Information Technology, *Vikas Publishing House, New Delhi.*
2. Williams &Sawyer, Using Information Technology (6th Edition*), Tata McGraw Hill Company.*

3. Avi Silberschatz Peter Galvin & Greg Gagne, Operating System Concepts (Windows XP update) .Willey *India.*
4. *Uyless Black,*Computer Networks, Protocols, Standards and Interface, *Prentice Hall India Pvt. Ltd.*
5. Nagpal, D.P., Web Design Technology Theory and Techniques on the Cutting Edge, *S.Chand& Company Ltd*

SEMESTER IV

Optional Core II:INFORMATION TECHNOLOGY FOR OFFICE

Instructional Hours: 90 (54 theory and 36 practical) **Credit: 4**

Objectives- *The objective of this course is to make the students capable of managing the office activities with the help of information technology.*

Module-I

Word Processing Package: MS-Word 2013- Introduction-Features- Word User Interface Elements- Creating New Documents- Basic Editing- Saving a Document- Printing a Document- Print Preview-Page Orientation- Viewing Documents- Setting Tabs-Page Margins- Indents- Ruler- Formatting Techniques- Font Formatting- Paragraph Formatting- Page Setup- Headers &Footers-Bullets and Numbered List- Borders and Shading- Find and Replace-Page Break Page Numbers-Mail Merging-Spelling and Grammar Checking- Thesaurus- Macros- Tables- Side-By-Side and Nested Tables- Formatting Tables- Drawing- Word art- Paint Brush Document Templates – Email Editor. **(18 Hours)**

Module-II

Desktop Publishing- PageMaker 7.0 - Introduction to Desktop Publishing as a Process- PageMaker Tools and Palettes- Working With Objects -Type Styling Options - Working With Text - Formatting Options- Leading, Margins and Indents - Scaling Text-Paragraph Formatting Options -Working With Grids - Creating Frames - Layers**.** **(18 Hours)**

Module-III

Spreadsheet Package: MS -Excel 2013-Introduction-Excel User Interface- Working With Cell and Cell Addresses- Selecting a Range, Moving, Cutting, Copying With Paste-Inserting and Deleting Cells- Freezing Cells- Adding, Deleting and Copying Worksheet Within a Workbook- Renaming a Worksheet- Cell Formatting Options- Formatting Fonts- Aligning-Wrapping and Rotating Text- Using Borders- Boxes and Colors- Centering a Heading, Changing Row/Column Height / Width-Formatting a Worksheet Automatically- Insert Comments- Clear Contents in a Cell- Using Print Preview- Preparing Worksheet for the Printer- Selecting Print Area-Margin and Orientation- Centering a Worksheet- Using Header and Footer- Inserting Page Breaks- Sorting Data. **(22 Hours)**

Module-IV

Advanced Features of Excel: All Functions in Excel- Using Logical Functions-Statistical Functions-Mathematical Functions - Linking Data between Worksheet- Elements of Excel Charts-Categories-Create a Chart- Choosing Chart Type- Edit Chart Axis - Titles, Labels, Data Series and Legend- Adding a Text Box- Rotate Text in a Chart- Converting a Chart on a Web Page- Saving a Chart- Designing of Templates in Excel. **(20 Hours)**

Module-V

Presentation Package: Ms-Power Point 2013-Advantages of Presentation- Screen Layout- Creating Presentation- Inserting Slides-Adding Sounds and Videos-Formatting Slides -Slide Layout Views in Presentation - Colour Scheme- Background Action Buttons- Slide Transition- Custom Animation-Creating Master Slides- Managing Slide Shows - Using Pen Setting Slide Intervals.

(12 Hours)

Practical Training:

1. Create a small poster using PageMaker
2. Create a Brochure using PageMaker
3. Prepare Pay rolls in Excel
4. Conditional Cell Formatting
5. Analysis and presentation of data using charts in Excel
6. Usage of Functions in Excel
7. Mail merging feature of Word.

Suggested Readings

1. Gini, Courter & Annette Marquis, Ms-Office *2013, BPB Publications*
2. Patrick Blattner, Louie Utrich. Ken Cook & Timothy Dyck, *Special Edition Ms Excel 2013*, *Prentice Hall India Pvt. Ltd.*
3. Atman Rebecca & Atman Rich, Mastering PageMaker*, BPB Publications*
4. *Building a Foundation with Microsoft Office 2013*
5. *Welcome to Microsoft Office*

SEMESTER V

Optional Core III: COMPUTERIZED ACCOUNTING

Instructional Hours: 90 (54 theory and 36 practical) **Credit :4**

Objectives:

1. *To equip the students to meet the demands of the industry by mastering them with industry sought after computerized accounting packages.*
2. *To expose the students to computer applications in the field of accounting.*
3. *To develop practical skills in the application of Tally Accounting Package.*

Module I

Introduction to Computerized Accounting**-** Computerized Accounting Vs. Manual Accounting- Merits of Computerized Accounting –Tally ERP9-Features of Tally ERP 9– Screen Components-Creation of Company-Selecting a Company – Altering/ Modifying Company Creation Details – Deleting a Company – F 11 Features – F 12 Configuration. **(6 Hours)**

Module II

Accounts and Vouchers– Account Groups – Pre-Defined Groups – Creating Single& Multiple Groups – Creation of Primary Account Groups – Creating Ledger Accounts in Single & Multiple – Displaying-Altering and Deleting Account Groups and Ledgers –Accounting Vouchers- Entering Transactions in Accounting Vouchers – Bill Wise Details -Altering and Deleting a Voucher Entry – Creating New Voucher Types – Modifying an Existing Voucher – Duplicating a Voucher – Optional Vouchers – Post-Dated Vouchers – Reverse Journal – Bank Reconciliation Statement - Creating Budget - Generating Reports - Configuring Reports Balance Sheet – Profit and Loss Account – Trial Balance – Day Books – Account Books –Statement of Accounts – Ratio Analysis - Cash Flow - Fund Flow – List of Accounts – Exception Reports. **(20 Hours)**

Module III

Accounts With Inventory– Enabling F 11 and F 12 - Stock Category – Stock Group Single/Multiple Creation of Stock Category and Stock Group – Creation of Units of Measurement – Creating Single/Multiple Stock Items – Creating Godowns - Displaying, Altering and Deleting Stock Groups, Units, Items and Godowns – Cost Categories- Cost Centres – Creating Cost Categories and Cost Centres - Displaying, Altering and Deleting Cost Categories and Cost Centres – Purchase / Sales Orders - Inventory Vouchers - Using Inventory Vouchers – Using Accounting Vouchers With Inventory Details (Invoice Mode) - Tally Security - Tally Vault –Tally Audit – Advanced Security Control – Back-Up and Restore – Inventory Reports – Stock Summary - Inventory Books – Statement Of Inventory.

(22 Hours)

Module IV

Accounting With Tax– F 11 &F 12 Settings For Taxation – TDS – Ledgers Related to TDS – Creating TDS Voucher Types - TDS Reports – TCS – Service Tax - VAT –VAT Terminologies – Computing VAT – Ledgers and Vouchers Pertaining to VAT – VAT Reports – VAT Forms – Interstate Trade and CST. **(20 Hours)**

Module V

Payroll: Enabling Payroll – Creating Pay Heads – Single/Multiple Creation of Employee Groups - Single/Multiple Creation of Employee Head – Salary Details – Configuration of Salary Details - Creating Units of Work – Managing and Creating Attendance / Production Types – F 12 Payroll Configuration – Payroll Vouchers – Creating Payroll Voucher Types -Displaying, Altering and Deleting Payroll Documents – Payroll Reports (Full) – Configuring All Payroll Reports – Statutory Deductions – PF – Employers Contribution to PF – PF Ledger Heads– PF Related Heads in Pay Structure –Gratuity Calculation, Creation and Accounting - Generating a Sample Pay Slip – Employee Loan & Salary Advance Management. **(22 Hours)**

Practical Training

- Prepare final accounts of a Company in Tally ERP 9 with Inventory
- Prepare final accounts of a company in Tally ERP 9 incorporating VAT and TDS
- Preparation of payroll

Suggested Readings

1. Roopa, Tally for Every one - *ATC Publishing Chennai*.
2. Nadhani, A.K. Implementing Tally ERP 9
3. A Comprehensive Guide to Tally ERP 9, Tally Manual

SEMESTER VI

Optional Core IV: SOFTWARE FOR BUSINESS AND RESEARCH

Instructional Hours 90 (54 theory and 36 practical) Credit 4

Objectives:

- *To impart knowledge to use IT in business research analysis.*
- *To develop practical skills in the applications of business software.*

Module I

Data Analysis: Data – Meaning and Definition – Sources of Data – Data Life Cycle – Processing – Methods and Types- EDP – Information – Value of Information in Decision Making - Information and Analysis of Business Research – Data Processing Software. **(6 Hours)**

Module II

Introduction to SPSS: Menus, tool bar – SPSS layout- Variable View – Data View – Output View – Terminology - Basic Steps for Performing any Statistical Procedure – Creating a Data file- Defining Variables- Variable Characteristics- Default Values - Entering the Data – Inserting Variable and Cases – Selecting Cases - Listing Cases – Identifying Duplicate Cases and Unusual Cases- Sorting Cases.

(24 Hours)

Module – III

Data Transformation: Computing New Variables – Recoding Variables – Automatic Recode – Visual Binning – Rank cases – Types of Measurement Scales – Summary Measures - Frequency, Explore and Cross Tabs – Describing Data Graphically - Descriptive Data Analysis- Number of cases, Minimum, Maximum, Sum, Mean, Standard Deviation, Variance, Kurtosis, Skewness - Bivariate Correlation.

(20 Hours)

Module – IV

Libre Office Writer: Free Software – Libre Office - Writer – User Interface – Creating new Document – Page setup - Saving Documents – Basic Editing – Find and Replace - Formatting Text – Copying and Moving Text – Indenting and Spacing – Headers and Footers – Bulleted and Numbered lists – Tables - Previewing and Printing. **(20 Hours)**

Module – V

Libre Office Calc: Spread Sheet – Features – User Interface – Cells – Selecting – Moving and Copying – Text Alignment – Formatting Text – Inserting and Deleting Columns and Rows – Adding and Renaming Worksheets – Borders, Boxes and Colors – Formatting Worksheet – Entering Formulae – Functions – Charts – Previewing and Printing. **(20 Hours)**

Practical Training

- List out frequency table, cross tab and graphs related with the marks and details of students in a class.
- Prepare a report on descriptive analysis of any relevant Socio demographic details related with social issue.
- Prepare a letter using Writer
- Prepare a mark sheet using Calc

Suggested Readings

1. Tutorial of IBM SPSS Statistics.
2. Kiran Panya, Smruti Bulsari & Sanjay Sinha., *SPSS in Simple Steps,* First edition, Durga Enterprises, Delhi.
3. Field A., *Discovering Statistics Using SPSS,* Fourth Edition, SAGE Publishers, 2013
4. Libre Office Handbook
5. Keith Gordon, Principles of Data Management, BCS Publications, UK

Optional Courses- CO-OPERATION

SEMESTER III

Optional Core I: BASICS OF CO-OPERATION

Instructional Hours-90 **Credit-4**

Objectives:

• *To inculcate the principles of co-operation among the students and to acquaint the students with the management and working of co-operatives*.

MODULE-I

Origin and Development of Co-operation- Meaning-Definition- Features Importance- Objectives- Benefits of Co-operation- Different aspects of Co-operation- Economic, Social and Morale. **(10 Hours)**

MODULE-II

Co-operation and other Economic Systems- Capitalism- Socialism and Communism -Co-operatives and other Forms of Business Organizations- Distinctive Features of a Co-operative Organization vis-à-vis- Partnership and Joint Stock Companies- A Co-operative as an Institution and as an Enterprise - Co-operative Common Wealth. **(15 Hours)**

MODULE-III

Co-operative Principles-Different Stages-Rochdale Pioneers- Karve Committee on Co-operative Principles- Principles of ICA in 1995 (IV^{th} Stage) - Distinction between Co-operative Values and Co-operative Principles **(15 Hours)**

MODULE-IV

Types of Co-operatives in India and in Kerala (i) Short term and Medium term Co-operative Credit Structure- Primary Agricultural Credit Societies- Urban Cooperative Banks- Employees Credit societies- District Co- operative Banks and State Co-operative Banks (ii) Long term Credit Structure- PCARDBs and SCARDBs (iii) General Purpose and Special Purpose Agricultural Marketing Societies- Primary Marketing Societies and their Federations including NAFED- Rubber Marketing Societies and their

Federations- Dairy Co-operative Societies and their Federations- Fishery Co-operatives and their Federations (iv) Processing Co-operatives- Need and Importance (v) Housing Cooperatives and their Federations (vi) Consumer Co-operatives and their Federations (vii) Industrial Co-operatives and their Federations- Handlooms and Power looms – Coir - Handicrafts (viii) Workers Co-operatives- Significance of Workers Co-operatives in Kerala. **(35 Hours)**

MODULE-V

Co-operative Movement in Foreign Countries - Great Britain (Consumer)- Germany (Agricultural Credit)- Sweden (KF) - Denmark (Dairy)- China (Induscos)- Japan (Multi -purpose)- USA (Marketing) (Brief Study). **(15 Hours)**

Suggested Readings

1. Hejela,T.N., Principles, Problems and Practice of Co-operation, Konark Publishers, New Delhi.
2. Krishnaswami, O.R., Fundamentals of Co-operation, S. Chand & Company, New Delhi.
3. Krishnaswami, O.R., Kulandaisamy, V., Theory of Co-operation- An in-depth Analysis, Shanma Publication, Coimbatore.
4. Mathur, B.S., Co-operation in India, SahithyaBhavan Publishers, Agra.
5. Bedi, R.D., Theory, History and Practice of Co-operation. R. Lal Book Depot, Meerut.

SEMESTER IV

Optional Core II: MANAGEMENT OF CO-OPERATIVE ENTERPRISES

Instructional Hours-90 **Credit-4**

Objectives:

1. *To familiarize the students with the principles and practice of co-operative management and administration.*
2. *To enable the students to identify the issues in the process of management and administration of co-operatives.*

Module-I

Co-operative Management - Nature and Importance- Managing Members- Dual Role of Members as Users and Owners of Co-operative Enterprise- Democracy in Co-operatives- Managing the Relationship between the Board of Directors and Members- Corporate Governance- Relation between Member Societies and their Federations. **(20 Hours)**

Module-II

Issues in Co-operative Management- Managing the Social Process in a Cooperative- Competition, Conflict and Co-operation- Associative Character of a Co-operative and Managing a Co-operative Association- Issues in Organizing a Co-operative Size of the Organization- Small Area vs. Large Area, Single Purpose vs. Multipurpose Co-operatives –Multipurpose vs. Multi-functional Co-operatives- Unitary vs. Federal Co-operatives Designer vs. Green House Co-operatives - Issues in Financing a Co-operative- Evaluating a Co-operative Organization - Member Dimension, Enterprise Dimension and Ethical Dimension.

(20 Hours)

Module-III

Administrative Set up of Co-operative Department in Kerala - State Level - District level and Thaluk level - Powers and Responsibilities of Co-operative Department - Conferment of Powers of Registrar - Functional Registrars in Kerala - Need for Separating Administration from Audit – Employment Opportunities in Co-operative Sector – Selection Procedure. **(15 Hours)**

Module- IV

Co-operative Education and Training- Need and importance- Arrangements for Co-operative Education and Training in India and in Kerala - NCUI, NCCT, VAMNICOM- Institute of Cooperative Management-Institute Kerala State Co-operative Union, Circle Co-operative Unions, Specialized Sectoral Training Institutes in Kerala **(15 Hours)**

Module- V

Management and Working of Major Co-operative Organizations and Institutions in - Aid of Co-operatives - NAFED, IFFCO, KRIBCO, NABARD, NDDB, NCDC, and National Housing Bank and other National Organizations Providing Assistance to Housing Co-operatives.

(20 Hours)

Suggested Readings

1. Krishnaswami, O.R., Kulandaiswamy V., Co-operation Concept and Theory *Arundhra Academy, Coimbatore.*
2. Bedi, R.D., Theory, History and Practice of Co-operation, *R. Lal Book Depot, Meerut.*
3. Kulandaiswamy, V., Principles of Co-operative Management*, Rainbow Publication, Coimbatore.*
3. Nakkiran, S., a Treatise on Co-operative Management, *Rainbow Publications Coimbatore.*
4. Sinha S.K., Sahaya R., Management of Co-operative Enterprises *NCCT, New Delhi.*
5. ILO, Co-operative Management and Administration, *Oxford IBH, Publishing Co. Pvt. Ltd., 1988.*

SEMESTER V

Optional Core III: CO-OPERATIVE LEGAL SYSTEMS

Instructional Hours: 90 **Credit: 4**

Objectives:

1. *To give an insight into the prevailing co-operative legal system*
2. *To enable the students to understand the legal framework of co-operation in India and in Kerala.*

Module I

Co-operative Legislation in India and in Kerala- Evolution of Co-operative Legislation in India- 1904 Act - Act of 1912- Co-operation as a State Subject in 1919- Madras Co-operative Societies Act, 1932- Multi State Co-operative Societies Act 1984- and its Replacement in 2002- Evolution of Cooperative legislation in Kerala- Cochin Co-operative Societies Act-Travancore Co-operative Societies Act- Kerala Co-operative Societies Act 1969.

(15 Hours)

Module II

Kerala Co-operative Societies Act (Act 21 of 1969) Preamble and its Significance- Important Definitions- Registration of Co-operative Societies- Procedure for Registration, Byelaws- Contents -Amendment of Byelaws- Change of Name and Liability- Amalgamation and Division of Co-operative Societies- Membership- Qualification for Membership- Rights and Liabilities of Members- Removal and Expulsion of Members- Withdrawal and Transfer of Shares by Members- Restriction on Holding Shares- Nomination by Members **(20 Hours)**

Module III

Management of Co-operatives- Annual General Meeting- Special General Meeting- Powers of General Body- Constitution of Committee- Term- Reservation for Weaker Sections- Disqualification of Committee Members- Election- State Co-operative Election Commission and its Powers - Election Procedure- Appointment of Delegates- Supersession of the Committee- Appointment of Administrator / Administrative Committee Seizure of Books and Records- Privileges of Co-operatives Charge and Set-off- Register of Members as Prima facie Evidence - Exemption from Stamp Duty- Taxes and Fees- Deduction of Dues of Co-operatives Exemption from Compulsory Registration of Certain Documents- Enquiry, Inspection and Supervision procedures - Surcharge procedures. **(25 Hours)**

Module IV

Settlement of Disputes, Arbitration and Awards - Provisions and procedures - Execution and Enforcement of Awards - Provisions and Procedures- Appeals, review and revision - Meaning and Distinction - Authority of Appeals - Co-operative Tribunal- Constitution and Powers- Offences and Penalties, Provisions and Procedures. **(20 Hours)**

Module V

Winding up and Dissolution of Co-operative Societies- Appointment and Powers of Liquidators- Procedures - Settlement of Claims. **(10 Hours)**

Suggested Readings

1. Kerala Co-operative Societies Act,1959 (Bare Act)
2. Goyal, D.B , Co-operative Legislation :Trends and Dimensions
3. Mohanan, P.N , Co-operative Societies Laws in Kerala, *Kerala State Publications*
4. Trivedi, B.B , Law and Management of Co-operatives
5. Pillai F.R (ed) , Kerala Co-operative Societies Act and Rules

SEMETER VI

Optional Core IV: ACCOUNTING FOR CO-OPERATIVE SOCIETIES

Instructional Hours-90 **Credit-4**

Objectives:

1. *To familiarize the students with the special features of accounting and auditing of co-operatives.*
2. *To enable the students to understand the procedures of co-operative audit.*

Module-1

Co-operative Accounting- Meaning-Importance-Special Features of Cooperative Accounting- Books and Registers Kept by Co-operatives as per Kerala Co-operative Societies Act and Rules **(12 Hours)**

Module -II

Sources of Funds- State Aid to Co-operatives - Share Capital Contribution - Principal State Partnership Fund - Subsidiary State Partnership Fund - Grants - Subsidies - Owned Funds Borrowed Funds.

(20 Hours)

Module -III

Trial Balance - Preparation of Trial Balance - District Co-operative Bank-State Co-operative Bank-Agricultural and Rural Development Banks- Preparation of Receipts and Disbursement Statement of Primary Societies- Consumer –Marketing-Housing – Dairy –Fishery –Industrial – Processing Societies - Practical Problems. **(20 Hours)**

Module -IV

Final Accounts- Statutory Forms - Preparation of Trading-Profit and Loss Account and Balance Sheet of Consumer –Marketing-Housing – Dairy- Primary Agricultural Credit Societies and Primary Agricultural and Rural Development Banks - Disposal of Net Profit - Statutory and Non- Statutory Requirements.

(18 Hours)

Module -V

Co-operative Audit - Definition - Objectives - Scope - Advantage - Difference between Audit of Co-Operative Societies and Joint Stock Companies - Special Features of Co-operative Audit Administrative Set Up for Co-operative Audit - Types of Audit - Preparations for Audit and Framing of Audit Programme - Stages of Practical Audit - Mechanical Audit- Administrative Audit- Preparation of Final Statements - Reconciliation of Bank Accounts – Co-operative Auditor - Duties - Powers and Liabilities - Audit Report - Audit Certificate - Audit Classification - Assessment and Levy of Audit Fees.

(20 Hours)

Suggested Readings

1. Khandelwal, M. C., Co-operative Audit x-rayed, A Study Based on the Cooperative Banking Institutions of Rajasthan, *Pitaliya Pustak Bhandar,Jaipur.*
2. Krishnaswami, O.R., Co-operative Account Keeping *Oxford and IBH Publishing Company Pvt Ltd,New Delhi* .
3. Krishnaswami, O.R, Co-operative Audit *Oxford and IBH Publishing Company Pvt Ltd New Delhi* .
4. Samiuddin, M. R. Cooperative Accounting and Auditing, *Himalaya Publishing House, New Delhi.*
5. Department of Co-operation, Government of Kerala Co-operative Audit Manual.

Optional Courses- TRAVEL & TOURISM

SEMESTER III

Optional Core I: FUNDAMENTALS OF TOURISM

Instructional Hours-90 **Credit-4**

Objectives- *To provide the basic knowledge of tourism as a growing industrial branch of the Indian Economy*

MODULE-I

Introduction to Tourism Industry- Meaning and Definition of Tourism- Nature and Scope- Historical Perspective of Tourism Industry in India- Growth of Indian Tourism- Ministry of Tourism (GOI)-Aims and Functions. **(15 Hours)**

MODULE-II

Types of Tourism- Pilgrimage- Cultural-Folklore-Farm-Eco-Business- Adventure Rural- Cuisine-Monsoon- Community-Based Tourism- Sports Tourism- Health Tourism- Responsible Tourism -Main Characteristics and Activities Involved. **(15 Hours)**

MODULE-III

Tourism Products- Meaning And Concept- Components- Art and Architecture -Archaeological Sites-Monuments- Forts and Palaces Museums-Traditions and Festivals- Nature-Based Tourism- Wild-Life Sanctuaries-National Parks- Hill-Resorts- Desert Safari- Indian Beaches And Backwaters- Indian Folk-Culture-Customs- and Costumes. **(20 Hours)**

MODULE-IV

Tourism Planning and Development-General concepts of Planning- Major Types of Planning-Need for Tourism Planning-Different Types of Tourism Planning-Ten Main Steps or Phases in the Planning Process- Sustainability and Sustainable Tourism Development

(20 Hours)

MODULE-V

Impact of Tourism: - Meaning, Positive and Negative Impacts of Tourism: - Social, Cultural, Economic and Environmental. Tourism Economic Multiplier- Employment Multiplier- The WTO Conference- The Manila Declaration **(20 Hours)**

Suggested Readings

1. Bhatya, A.K., Tourism Development Principles and Practices, *Kalyani publishers West Bengal*.
2. Kamra, K.K., & Mohinder Chand Basics of Tourism, *Sterling Publication, New Delhi.*
3. Ratandeep Singh, Dynamics of Modern Tourism –*Kanishka Publication New Delhi*
4. Tewari, S.P., Tourism Dimensions, *Atma Ram and Sons Publication New Delhi.*
5. Sinha, P.C., Tourism Impact Assessment, *Anmol Publications Pvt. Ltd. New Delhi*.

SEMESTER - IV

Optional Core II: TRAVEL AND TOURISM INFRASTRUCTURE

Instructional Hours: 90 **Credit-4**

Objective- *To introduce the role of travel and infrastructure in the development of tourism industry.*

MODULE-I

Tourism Infrastructure - Meaning and Scope of Tourism Infrastructure- Transport- Roads and Canals- Building for Residential Accommodation- Recreation Centres- Amusement Parks- Relationship between Tourism Infrastructure and the Arrival of the International Tourists - Role of Government in Improving and Preserving Tourism Infrastructure- National Policy of the Government for Promoting Infrastructural Facilities**.** **(20 Hours)**

MODULE-II

Historical Growth and Development of Travel Agency and Tour Operation Business **-** Travel Agency- Meaning- Definition- Importance- Types of Travel Agency- Functions of Travel Agency -Tour Operators-Features of Tour- Operators-Types of Tour Operators - Functions of Tour Operators - Role of Tour Operators and Travel Agencies in the Growth of Tourism Industry. **(15 Hours)**

MODULE-III

Setting up of Travel Agency and Tour Operation Business - Travel Agency and Tour Operation Business- Approval Formalities-Setting Procedure and Process- Ministry of Tourism, Govt. of India and IATA Guidelines - Revenue Sources of Travel Agency and Tour Operation - Financial Incentives Available for Travel Agency and Tour Operator in India **(20 Hours)**

MODULE-IV

Tourism Demand - Concept of Demand and Supply in Tourism - Unique Features of Tourist Demand - Determinants of Demand for Tourism- Measuring Demand for Tourism - Importance of Measurement of Demand- Tourist Statistics-Volume Statistics- Value (Expenditure) Statistics-Visitor Profile (Characteristics) Statistics. **(15 Hours)**

MODULE-V

Travel Formalities and Regulations-Concept- Meaning and Scope- Issues of Passports- Visa- Foreign Exchange- Customs and Immigrations- Air Cargo Documentation- Domestic and International Rate- Departure and Arrival Formalities- Nature of Cargo- Security of Cargo and its Clearance- Information Technology and Travel Formalities. **(20 Hours)**

Suggested Readings:

1. Jagmohan Negi, Travel Agency and Tourism Operations and Concepts and Principles, *Kanishka Publishers*.
2. Sinha,P.C., Encyclopedia of Tourism Management, *Anmol Publications*.
3. Sunetra Roday, Archana Biwal & Vandana Joshi, Tourism Operations and Management *Oxford University Press.*
4. Manjula Chaudhary, Tourism Marketing, *Oxford University Press.*
5. Jha,S.M, Services *Marketing*, *Himalaya Publishing House*

SEMESTER V

Optional Core III: HOSPITALITYMANAGEMENT

Instructional Hours: 90 **Credit: 4**

Objective*- To Understand the Essentials of Hospitality Management for Taking up Hospitality Business.*

Module I

Introduction to Hospitality Management- Concept of Hospitality-Meaning-Definition and Nature of Hospitality- Hospitality in the Cultural Settings of India- Inducting Management in Hospitality Industry-Historical Perspective of Hospitality Management- Objectives of Hospitality Management- Prerequisites of Hospitality Management- Hospitality Management in the Indian Scenario.

(10 Hours)

Module II

Organization and Function of Hotel Industry-Hotel Industry - Concept- Meaning and Scope- Functional Departments of Hotel Industry- Functions of Front Office-Management of Front Office-House-Keeping functions-Nature and Dimensions- Food and Beverages- Managements of Food Services- Restaurant Infrastructure and Management- Food Production Infrastructure- Supporting Services- Purchase- Storage and Sales **(15 Hours)**

Module III

Accommodation Marketing- Role of Accommodation in Tourism- Types of Accommodation- Grouping and Categorization of Hotels- Registration Forms of Hotel Ownership- Pricing Strategies of Hotels-Price-offs as Sweep Takers in the Competitive Economy- Promotion of Hotel Accommodation- Domestic and Overseas Promotion- Emerging Trends in Promotion of Hotel Accommodation - Public Relation and Hotel Industry. **(25 Hours)**

Module IV

Managerial Issues in Hospitality Management.-Concept of Managerial Issues Ethical, Cultural and Social Issues- Threats and Challenges of Managing Hotel-Human Resources Management of Hotels Interface between Travel Agencies and Hotelier's- Catering - Types - Railways - Airways - Role of Private and Public Agencies in Catering for Tours. **(20 Hours)**

Module V

Emerging Trends in Hospitality Management- Changing Scenario of the Hospitality Industry-Eco-friendly Accommodation-Heritage Accommodation - Seasonality and Promoting Domestic Market for Hotel Industry- Multi-Purpose Accommodation- Seminar- Conference- Business Meet- Independent Guest Houses- Private Agencies in Guest House Accommodation- Government and Hotel Industry-Fiscal and Non-Fiscal Incentives- Challenges of Hospitality Industry in India **(20 Hours)**

Suggested Readings:

1. John, R., Warker, Introduction of Hospitality, *PHI, New Delhi.*
2. Zeithaml, V.A., Service Marketing, *McGraw Hill, London*
3. Gray & Ligouri, Hotel and Motel Management and Operations, *PHI, New Delhi*
4. Andrews, Hotel Front Office Training Manual, *Tata McGraw Hill, Mumbai*
5. Negi, Hotels for Tourism Development, *S.Chand, New Delhi.*

SEMESTER VI

Optional Core IV: TOURISM AND CULTURAL HERITAGE OF INDIA

Instructional Hours-90 **Credit-4**

Objective- *To provide the students an insight of the relevance of Indian culture and heritage for the development of tourism industry.*

Module I

Introduction to the Indian Culture - Definition of Culture- Heritage and Civilization- Culture and its Determinants- Culture Society and History- Political Structure and their Impact on Culture- Outside Influences and Culture- Cultural Awareness and History- Indian Culture-Perspectives for Tourism.

(15 Hours)

Module II

Historical Evolution- Harappan Period- Vedic Civilization- Early Vedic Period- Later Vedic Period-Post Vedic Period – Social and Structural Change- Family-Lineage and Caste- Buddhist Epoch- Gupta Period-Post Gupta Period – Medieval Period – Changes in Hindu and Muslim Caste-Colonial Period-Post Colonial Period- Contemporary Period. **(15 Hours)**

Module III

Conservation of Culture-Culture of Tourism Versus Tourism of Culture- Conservation and Significance-Conservation of Natural Heritage-Conservation of Historical Heritage- Archaeological Sites and Monuments-World Heritage List- Main Problems of Conservations of Monuments- Organization of Enterprise-Conservation and Preservation of the Artistic and Cultural Heritage- Tourism and Culture the Views in Indian Context. **(20 Hours)**

Module IV

Features of Indian Culture-Assimilation-Unity in Diversity-Patriarchy and Women- Syncretic Tradition-Religious Tolerance-Cultural Tolerance of Elite and Masses- Contribution of Mughals to the Indian Culture – Art and Architecture Under Mughals- The British – Birth of Indian Nationalism– Factors favouring Growth of Nationalism– Independent India. **(20 Hours)**

Module-V

Emergence of Political Struggle for Responsible Govt. (Kerala) - Anti Colonial Movement- Modern Kerala's Political and Cultural Changes - Educational Progress and Trends in Kerala Tourism

(20 Hours)

Suggested Readings

1. Jha, D.N., Ancient India – An introductory out line ,*Rupa & Co. New Delhi*
2. Pandey, A.B., *The Medieval India (Mughal period), Vol.II*
3. Kosambi, D.D., Culture and Civilization of Ancient India in Historical Outline
4. Sharma, R.S., Aspects of Ancient Indian Political Ideas and Institutions- *1959, Delhi.*
5. Sharma,R.S., Indian Society, Historical Probing,

Optional Courses- MARKETING

SEMESTER III

Optional Core I: CUSTOMER RELATIONSHIP MANAGEMENT

Instructional Hours – 90 Hours **Credit -3**

Objectives: *The purpose of this course is to familiarize the students with the concepts and strategies involved in Customer Relationship Management*

MODULE I

Customer Relationship Management – Introduction – Definition-Need for CRM - Concepts - Customer Loyalty and Optimizing Customer Relationships - Strategic Framework for CRM - Origin and Role of CRM - Components of CRM-CRM Processes. **(20 Hours)**

MODULE II

Customer Satisfaction- Product Marketing- Direct Marketing- Customer Learning Relationship- Key Stages of CRM-Forces Driving CRM- Benefits of CRM-Growth of CRM Market in India- Key Principles of CRM. **(20 Hours)**

MODULE III

CRM Strategy- CRM Strategy Development Process-CRM Value Creation Process- Customer Profitability- Customer Acquisition and Retention - Customer Strategy **(15 Hours)**

MODULE IV

CRM Process Framework- Governance Process- Performance Evaluation Process- Monitoring System- Key Performance Indicators- CRM Budget and CRM Return on Investment **(15 Hours)**

MODULE V

Use of Technology in CRM- Call Centre Process- CRM Technology Tools -Implementation- Selection of CRM Package- Reasons for Failure of CRM **(20 Hours)**

Suggested Readings

1. Peelen, E.D., Customer Relationship Management, *Pearson Education, Mumbai.*
2. Francis, Buttle & Stan Maklan, Customer Relationship Management Concepts and Technologies, *Taylor and Francis , UK.*
3. Bhat, G.K., Customer Relationship Management, *Himalaya Publishing House, Mumbai.*
4. Peeru, H., Mohamed & Sagadevan, A., Customer Relationship Management, *Vikas Publishing House,Noida.*
5. Sontakki,C.N., Marketing management,10th revised edition (2013), *Kalyani Publishers, New Delhi.*

SEMESTER – IV

Optional Core II: SERVICE MARKETING

Instructional Hours: 90 **Credit -4**

Objective: *To develop insights into emerging trends in the service sector and tackle issues involved in the management of services.*

MODULE-I

Concept of Service – Meaning – Definition - Components and Tangibility-Growth of Service Sector-Challenges and Strategies-Classification of Services- Marketing Triangle-Marketing of Services. **(16 Hours)**

MODULE -II

Marketing Mix in Service Marketing-7 Ps- Product Decision- Pricing Strategies-Promotion of Services-Placing or Distribution of Services -Additional Dimensions – People-Physical Evidences-Process. **(20 Hours)**

MODULE -III

Consumer Behaviour in Services- Behavioural Profile of Consumers-Customer Satisfaction and Expectation Gap Analysis-Quality Perceptions in Service- Measurement of Service Quality-SERVQUAL Dimensions-Service Recovery and Problem Solving-Employees Role in Service Marketing-Role of Technology. **(20 Hours)**

MODULE -IV

Service Market Segmentation - Bases – Positioning-Differentiation and Retention Strategies Applicable to Service Marketing- Relationship Marketing. **(16 Hours)**

MODULE –V

Marketing of Services with Reference to Tourism - Financial Services and Health-Trends in Service Marketing. **(18 Hours)**

Suggested Readings:

1. Christopher Lovelock, Service Marketing, *Pearson,Mumbai.*
2. Helen Woodruffle, Service Marketing, *Macmillaian India.*
3. Rao, Service marketing, *Pearson, Mumbai.*
4. Roland Rust and Anthony Timothy, Service Marketing, *Haper Collins College Publishers.*
5. *Indian Journal of Marketing (ISSN 0973-8703),New Delhi-110016*

SEMESTER V

Optional Core III: MARKETING RESEARCH

Instructional Hours: 90 **Credit: 4**

Objective*: To acquaint the students with the method and techniques of marketing research.*

Module-I

Research-Types-Marketing Research-Definition-Significance-Areas Covered by Marketing Research-Market and Marketing Research-Outside Agencies and Research-Reliable Information Sources in India-Limitations of Marketing Research. **(14 Hours)**

Module-II

Research Design-Exploratory-Descriptive-Diagnostic-Experimental-Before only - Before and After-After Only with Control-Before and After With Control Independent and Extraneous Variable-Treatment **(16 Hours)**

Module-III

Collection of Data-Primary and Secondary-Sampling and Sampling Design-Probability and Non Probability Sampling-Collection of Data-Methods for Collection of Both Primary and Secondary Data-Scale of Measurement and its Basics **(18 Hours)**

Module-IV

Data Processing-Coding-Editing-Tabulation-Testing of Hypotheses- Steps –Parametric and Non Parametric Tests(Theory only) -ANOVA -MANOVA-ANCOVA-Chi-square Test -Use of SPSS **(30 Hours)**

Module-V

Reporting- Report of Research Findings-Types of Report-Report Format-Contents **(12 Hours)**

Suggested Readings

1. Kotler, Philip, Armstrong, Gary, Prafulla Y Agnihotri& Khsanul Haque, Principles of Marketing, *Pearson Education Inc, South Asia.*
2. Kotler, Philip, Kerin Lave, Koshy, Abraham, & Jha, Mitheleswar, Marketing Management, *Pearson Education Inc., South Asia.*
3. Stanton, J.W., Fundamentals of Marketing, *McGraw Hill, New York.*
4. Pillai, R.S.N., & Bagavathy, V., Modern Marketing, Principles and Practices, *S Chand Company Private Ltd, New Delhi*.
5. Nair, Rajan, Marketing Management, *S Chand Company Private Ltd, New Delhi*.

SEMESTER VI

Optional Core IV: INTERNATIONAL MARKETING

Instructional Hours-90 **Credit-4**

Objective-*To equip the students with environmental, procedural, institutional and decisional aspects of international marketing.*

Module I

International Marketing-Definition-Nature-Benefits-Special Problems-Features of International Marketing vis-a vis Domestic Marketing-Internationalisation Stages-International Marketing Orientation-Planning for International Marketing **(20 Hours)**

Module II

International marketing Research-Objectives of Marketing Research-Features, Advantages and Limitations of Marketing Research-Steps In Marketing Research Process-Importance of International

Marketing Research-Research Agencies-Market Entry and Operating Strategies

(15 Hours)

Module III

International Marketing Environment- Economic, Political, Legal, Demographic and Cultural Environment, International Institutions-Free Trade Zone- Globalisation –Positive and Negative Effects of Globalization- Globalisation and Its Impact on International Marketing-Marketing Barriers-Tariff and Non-Tariff Barriers **(20 Hours)**

Module IV

Foreign Trade Strategy of India-Foreign Trade Policy-India and World Trade-Export and Import Policy-Major Problems of India's Export Sector-Procedure and Documentation on Exporting-Export Promotion Council-Export Finance **(20 Hours)**

Module V

International Marketing Mix-Product Strategies-International Marketing and PLC-Pricing Strategies-Promotion Strategies-Distribution Strategies (**15 Hours)**

Suggested Readings

1. Keegen, Global Marketing Management, *Pearson, Mumbai*
2. Cateora Philip, John Graham & Mary Gilly, International Marketing, *McGraw Hill/Irwin.*
3. Sak Onkvisit & John J Shaw, International marketing analysis and strategies, *Routledge Taylor and Francis group,UK*
4. Cherunilam, Francis, International Marketing Text and cases, *Himalaya Publishing House,Mumbai*
6. Indian Journal of Marketing (ISSN 0973-8703*), New Delhi-110016*

OPEN COURSES

FUNDAMENTALS OF BANKING AND INSURANCE

Instructional Hours: 72 **Credit: 4**

Objective: *To familiarize the students with the basic concepts and practice of banking and the principles of Insurance*

Module I

Introduction to Banking - Origin and Evolution of Banks – structure of banking system -Types of Banks – Functions of Commercial Banks- Primary and Secondary- Credit Creation -Reserve Bank of India-Functions of RBI **(16 Hours)**

Module II

Banking Practice – Banker – Customer – relationship between banker and customer – general and special relationship – Cheque – essentials of a valid cheque – crossing – dishonour of cheque – liabilities of wrongful dishonour – opening and operation of accounts by special types of customers – minor, married woman, firm, company. **(16 Hours)**

Module III

Innovations in Banking – Social Banking- E-Banking – CORE – ECS – EFT – RTGS – NEFT – SWIFT – Mobile banking – Precautions in mobile banking – internet banking - Credit and Debit Cards- Banking Ombudsman Scheme **(18 Hours)**

Module IV

Insurance- Evolution of insurance – Role and Importance - Insurance Contract- Principles of Insurance - Insurance and Assurance **(10 Hours)**

Module V

Types of Insurance (Overview only) - Life insurance – Distribution system of life insurance – life insurance plans - General insurance - Marine insurance - Fire insurance - Health Insurance - Motor Insurance - Burglary insurance - Personal Accident Insurance. **(12 Hours)**

Suggested Readings

1. Shekhar, K.C, Banking Theory and Practice, *Vikas Publishing House*, *New Delhi*
2. Maheswary, S.N., Banking Law and Practice, *Kalyani Publishers*, *New Delhi*
3. Sundharam,Varshney, Banking Theory Law & Practice, *Sulthan Chand & Sons*, *New Delhi.*
4. Agarwal, O.P., Banking and Insurance*, Himalya Publishing House, Mumbai*
5. Saxena, G.S., Legal Aspects of Banking Operations*, Sultan Chand and Sons, New Delhi*
6. Tripati, Nalini & Prabil Pal., Insurance: Theory and Practice, *PHI Pvt Ltd, New Delhi*
7. Gupta, P.K., Insurance and Risk Management, *Himalaya Publishing House, Mumbai*
8. Mishra, M.N., Principles and Practices of Insurance, *S. Chand and Sons, New Delhi*

CAPITAL MARKET AND INVESTMENT MANAGEMENT

Instructional Hours-72 **Credit-3**

MODULE-1

Financial Systems – Indian financial System - Components - Role and Functions - money market and capital market - characteristics of capital market in India- Instruments in capital market: equity shares, preference shares, debentures, bonds, Govt. securities, and new instruments – SEBI- Objectives and functions- Recent developments in the Indian Capital market. **(15 Hours)**

MODULE-2

Primary and secondary markets: Primary market: Definition and functions - Methods of New issues, Right issue - Operators in the new issue market: Managers to the issue, underwriters, brokers to the issue - Merchant bankers - Minimum subscription - Types of issue - Allotment - Listing. Secondary Market:

Stock exchanges in India - role and functions- membership - Trading and settlement – Speculators- Bulls, bears, stags and lame duck - Dematerialized securities - On-line trading - Depositories - Stock Market indices – **(20 Hours)**

MODULE-3

Derivatives- Features of Derivatives -Types of Derivatives– Forwards – Futures- Options-Swaps **–** (Brief study only) **(12 Hours)**

MODULE-4

Investment Management – Process- Investment, Speculations and Investment, Gambling and Investment, Investment Objectives- Investment process- Meaning of portfolio

(15 Hours)

MODULE-5

Investment Avenues: Corporate Securities - Government bonds - Post office saving certificate and deposits - Public Provident Fund scheme, Mutual Fund schemes, Bank deposits - Insurance - Real Estate- Other Investment Avenues.

(10 hours)

Suggested Readings

1. Khan, M.Y., Indian Financial System, Tata McGraw Hill, New Delhi.
2. Singh, Preethi, Dynamics of Indian Financial System, Ane Books, New Delhi
3. Guruswami, S., Capital Markets, Tata McGraw Hill, New Delhi
4. Avadhani, V. A., Investment and Securities Market in India, *Himalaya Publishing House.*

Journals

SEBI and Corporate Laws - Taxmann, New Delhi
SEBI Monthly Bulletins

FUNDAMENTALS OF ACCOUNTING

Instructional Hours-72 **Credit-3**

OBJECTIVE- *To familiarise the students with the basic accounting principles and practices in business.*

MODULE-1 Accounting – Introduction- meaning- Book keeping and Accounting –Objectives of Accounting - Accounting Principles- Concepts and Conventions- Double Entry System- Books of Accounts- Accounting Equation- Golden Rule of Accounting **(15 Hours)**

MODULE-2 Journal- Meaning – Journalising- Journal Entry- Simple and Compound Entries- opening Entry . **(15 Hours)**

MODULE-3 Ledger - Form of an Account -Posting - Balancing of Accounts-Subdivision of Journals- Purchase book- Sales Book - Cash book (simple, triple column)-Petty Cash book. **(22 Hours)**

MODULE-4 Trial Balance - Meaning - Objects-Preparation- **(8 Hours)**

MODULE-5 Final Accounts-Trading and Profit and Loss Account- Balance Sheet

(without adjustments) **(12 Hours)**

Suggested Readings

1. R L Gupta and M Radhaswamy - Advanced Accountancy-.Sultan Chand Publishers
2. P C Tulsian. Advanced Accountancy- S Chand Publications-
3. S Kr. Paul- Fundamentals of Accounting - New Central Agency
4. M.C.Shukla and T.S.Grewal- Advanced Accounting, S Chand Publication
5. Jain and Narang- Fundamentals of Accounting, Kalyani Publishers
6. B S Raman – Financial Accounting- United Publishers

Guidelines for Practical Examinations , Project and Viva and Industrial Visit/Study Tour

Practical Examination
Practical examinations will be conducted only at the end of even semesters.

Project Report
All students are to do a **project in the area of core course.**

This project can be done individually or in groups (not more than five students) which may be carried out in or outside the campus.

The report of the project in duplicate is to be submitted in English with not less than 30 pages (Printed in A4 size paper) to the Department at the sixth semester and are to be produced before the examiners appointed by the University.

External Project Evaluation and Viva / Presentation are compulsory and will be conducted at the end of the Programme.

Structure of the Report

- Title Page
- Declaration by the student
- Certificate from the guide
- Acknowledgements
- Contents
- Chapter I: Introduction (Research problem, Objectives of the study, methodology etc)
- Chapter II: Review of Literature/Conceptual Framework
- Chapter III: Data Analysis
- Chapter IV: Summary /findings/ Recommendations
- Appendix (Questionnaire, Specimen copies of forms, other exhibits etc).
- Bibliography

Evaluation of the Project Report.

The project report shall be subject to **Internal and External Evaluation** followed by a **Viva-voce**.

- Internal Evaluation is to be done by the supervising teacher and external evaluation by an examiner appointed by the University and the Head of the Department or his nominee.

- A viva voce related to the project work will also be conducted by the external evaluation board consisting of an examiner appointed by the University as chairman and the Head of the Department or his nominee as member. The students have to attend the viva voce individually. Grades are to be awarded to the students combining the internal evaluation, external evaluation and viva voce.

Components of External Evaluation of Project / Dissertation (External)	**Marks** **50**
Relevance of Topic	10
Statement of Objectives	5
Methodology	10
Presentation of Facts and Figures	5
Quality of Analysis and Findings	15
Bibliography	5
Viva-Voce (External) -	**30**
Total	**80**

Components for Internal Evaluation of Project (20 marks)

Punctuality	5
Experimentation/Data Collection	5
Knowledge(Based on individual assessment)	5
Report	5
Total	**20**

Industrial Visit /Study Tour

An industrial visit cum tour for three to five days form part of the course of study for regular students during the programme and a report of the same shall be prepared and submitted to the department.

Note

Only Commerce Teachers whose appointments are approved by the University and Commerce Teachers of Government Colleges should be entrusted with the setting of Question Papers, Valuation of Answer Scripts of Common, Core, Complementary, Open and Choice Based Core elective Courses and the conduct of Practical Examinations

RESTRUCTURED CURRICULUM AND SYLLABI FOR THE B.COM DEGREE PROGRAMME (MODEL II)UNDER THE CHOICE BASED CREDIT AND SEMESTER SYSTEM



MAHATMA GANDHI UNIVERSITY
PRIYADARSHINI HILLS P O
KOTTAYAM, KERALA

2017

(Effective from 2017-18 admissions)

ACKNOWLEDGEMENT

There are many pro-active, sapient people whose relentless support and guidance made this syllabus restructuring 2017 a success. I take this opportunity to express my sincere appreciation to all those who were part of this endeavour for restructuring the syllabus U G course in Commerce under Mahatma Gandhi University, Kottayam.

I express profound gratitude to the Honourable Vice-Chancellor, Pro-Vice Chancellor, Registrar, Members of the Syndicate and Academic Council for their sincere co-operation and guidance for completion of this work. My thanks and appreciation also goes to the members of Faculty of Commerce and Board of Studies for their untiring efforts. I also appreciate the efforts of members of University Academic Section and other staff. .

Furthermore, I would also like to acknowledge with much appreciation the crucial role of all teachers who participated in the workshops organised by the University for restructuring the syllabus. I also place on record my gratitude to all professionals, academicians and other stakeholders who gave valuable suggestions in this regard.

Dean- Faculty of Commerce

Mahatma Gandhi University

Kottayam

Courses and Duration of Examinations

Total credits: **120**
Semesters- 6
Working Days per Semester: **90**
Working Hours per Semester: **450**
Examination- External Evaluation: 80% and Internal evaluation- 20%

B.Com Degree Programme Model-II Course Structure

Common Courses

Sl No	Course Name	Credit	Hours per week
1	Language- English-I	4	5
2	Second Language-I	4	5
3	Language- English-II	4	5
4	Second Language-II	4	5
5	Language- English- III	3	5
6	Language- English -IV	3	5
	TOTAL	**22**	

Complementary Courses

Sl No	Course Name	Credit	Hours per week
1	Banking and Insurance	3	3
2	Principles of Business Decisions	3	3
3	Finance and Taxation-E- Commerce	**4**	**5**
	Computer Application- Programming in 'C' (Theory)	**3**	**3**
	Computer Application Programming in 'C' (Practical)	**1(combined practical exam in even sem)**	**2**
	Travel and Tourism E Commerce	**4**	**5**
	Marketing E Commerce	**4**	**5**
	Logistics Management- E Commerce	**4**	**5**

4	Finance and Taxation-Income Tax- Assessment and Planning	**4**	**5**
	Computer Application- Database Management System	**3**	**3**
	Computer Application Database Management System (Practical)	**1(combined practical exam)**	**2**
	Travel and Tourism Tourism Environment and Ecology	**4**	**5**
	Marketing Consumer Behaviour	**4**	**5**
	Logistics Management- Consumer Behaviour	**4**	**5**
	TOTAL	**14**	

Core Courses

Sl No	Course Name	Credit	Hours per week
1	Dimensions and Methodology of Business Studies	**2**	**3**
2	Financial Accounting I	**4**	**5**
3	Corporate Regulations and Administration	**3**	**4**
4	Financial Accounting II	**4**	**5**
5	Business Regulatory Framework	**3**	**4**
6	Business Management	**3**	**3**
7	Corporate Accounts I	**4**	**4**
8	Quantitative Techniques for Business- 1	**4**	**4**
9	Financial Markets and Operations	**3**	**4**
10	Marketing Management	**3**	**3**
11	Optional - 1	**4**	**5**
12	Corporate Accounts II	**4**	**5**
13	Quantitative Techniques for Business- II	**4**	**5**
14	Entrepreneurship Development and Project Management	**4**	**5**
15	Optional - 2 -	**4**	**5**
16	Cost Accounting - 1	**4**	**6**
17	Environment Management and Human Rights	**4**	**5**
18	Optional - 3	**4**	**5**
19	Cost Accounting - 2	**4**	**6**
20	Advertisement and Sales Management	**3**	**4**
21	Management Accounting	**4**	**5**
22	Optional - 4	**4**	**5**

23	**Project and Viva**	1	-
	TOTAL	**81**	

Details of Optional Courses

Sl No	Course Name	Credit	Hours per week
FINANCE AND TAXATION			
1	Goods and Services Tax	4	5
2	Financial Services	4	5
3	Income Tax- I	4	5
4	Income Tax - II	4	5

COMPUTER APPLICATIONS			
1	Information Technology for Business	4	5
2	Information Technology for Office	4	5
3	Computerized Accounting	4	5
4	Software for Business and Research	4	5
TRAVEL AND TOURISM			
1	Fundamentals of Tourism	4	5
2	Travel and Tourism Infrastructure	4	5
3	Hospitality Management	4	5
4	Tourism and Cultural Heritage of India	4	5
MARKETING			
1	Customer Relationship Management	4	5
2	Services Marketing	4	5
3	Marketing Research	4	5
4	International Marketing	4	5
LOGISTICS MANAGEMENT			
1	Introduction to Logistics Management	4	5
2	Principles of Logistics Information	4	5
3	Air Cargo Logistics Management	4	5
4	Shipping and Ocean Freight Logistics Management	4	5

OPEN COURSES OFFERED

Sl No	Course Name	Credit	Hours per week
1	**CO5OP01**- Fundamentals of Banking and Insurance	3	4
2	**CO5OP02**- Capital Market and Investment Management	3	4
3	**CO5OP03**- Fundamentals of Accounting	3	4

	TOTAL	**3**	

Semester-wise details

Semester- 1

Sl No	Course Code	Course Name	Credit	Hours per week
1		Language- English-I	4	5
2		Second Language-I	4	5
3	CO1CRT01	Dimensions and Methodology of Business Studies	**2**	**3**
4	CO1CRT02	Financial Accounting I	**4**	**5**
5	CO1CRT03	Corporate Regulations and Administration	**3**	**4**
6	CO1CMT01	Banking and Insurance	3	3
		TOTAL	**20**	**25**

Semester- 2

Sl No	Course Code	Course Name	Credit	Hours per week
1		Language- English-I	4	5
2		Second Language-I	4	5
3	CO2CRT04	Financial Accounting II	**4**	**5**
4	CO2CRT05	Business Regulatory Framework	**3**	**4**
5	CO2CRT06	Business Management	**3**	**3**
6	CO2CMT02	Principles of Business Decisions	3	3
		TOTAL	**21**	**25**

Semester 3

Sl No	Course Code	Course Name	Credit	Hours per week
1		Language- English-I	3	5
2	CO3CRT07	Corporate Accounts I	**4**	**4**
3	CO3CRT08	Quantitative Techniques for Business- 1	**4**	**4**
4	CO3CRT09	Financial Markets and Operations	**3**	**4**
5	CO3CRT10	Marketing Management	**3**	**3**
6		Optional - 1		
	CO3OCT01	Finance and Taxation-Goods and Services Tax	**4**	**5**
	CO3OCT02	Computer Application- Information Technology for Business (Theory)	**3**	**3**

		Information Technology for Business (Practical)- ***Exam in semester 4 only***	**-**	**2**
	CO3OCT04	Travel and Tourism Fundamentals of Tourism	**4**	**5**
	CO3OCT05	Marketing Customer Relationship Management	**4**	**5**
	CO3OCT06	Logistics Management 1Introduction to Logistics Management	**4**	**5**
		TOTAL for streams other than Computer Applications	**21**	**25**
		TOTAL for Computer Application Stream	**20**	**25**

Semester- 4

Sl No	Course Code	Course Name	Credit	Hours per week
1		Language- English-I	**3**	**5**
2	CO4CRT11	Corporate Accounts II	**4**	**5**
3	CO4CRT12	Quantitative Techniques for Business- II	**4**	**5**
4	CO4CRT13	Entrepreneurship Development and Project Management	**4**	**5**
5		Optional - 2 -	**4**	**5**
	CO4OCT01	Finance and Taxation- Financial Services	**4**	**5**
	CO4OCT02	Computer Application- Information Technology for Office (Theory)	**3**	**3**
		Information Technology for Office (Practical)	**-**	**2**
	CO34OCP01	***Computer Application Practical Examination*** for Information Technology for Office and Information technology for Business	**2**	**NA**
	CO4OCT04	Travel and Tourism Travel and Tourism Infrastructure	**4**	**5**
	CO4OCT05	Marketing Services Marketing	**4**	**5**
	C04OCT06	Logistics Management Principles of Logistics Information	**4**	**5**
		TOTAL for streams other than Computer Application	**19**	**25**
		TOTAL for Computer Application Stream	**20**	**25**

Semester- 5

Sl No	Course Code	Course Name	Credit	Hours per week
1	CO5CRT14	Cost Accounting - 1	**4**	**6**
2	CO5CRT15	Environment Management and Human Rights	**4**	**5**
3	CO5CMT07	Complementary Course Finance and Taxation- E- Commerce	**4**	**5**
	CO5CMT08	Computer Application- Programming in 'C' (Theory)	**3**	**3**
		Programming in 'C' (Practical)- ***Examination in sem 6 only***	**-**	**2**
	CO5CMT07	Travel and Tourism E Commerce	**4**	**5**
	CO5CMT07	Marketing E Commerce	**4**	**5**
	CO5CMT07	Logistics Management- E Commerce	**4**	**5**
4		Optional - 3		
	CO5OCT01	Finance and Taxation- Income Tax- I	**4**	**5**
	CO5OCT02	Computer Application- Computerised Accounting(Theory)	**3**	**3**
		Computerised Accounting (Practical)- **Examination in 6th Semester only**	**-**	**2**
	CO5OCT04	Travel and Tourism Hospitality Management	**4**	**5**
	CO5OCT05	Marketing Marketing Research	**4**	**5**
	CO5OCT06	Logistics Management Air Cargo Logistics Management	**4**	**5**
5		Open Course	**3**	**4**
		TOTAL for streams other than Computer Application	**19**	**25**
		TOTAL for Computer Application stream	**17**	**25**

Semester- 6

Sl No	Course Code	Course Name	Credit	Hours per week

1	CO6CRT17	Cost Accounting - 2	**4**	**6**
2	CO6CRT18	Advertisement and Sales Management	**3**	**4**
3	CO6CMT09	Complementary Course Finance and Taxation Income Tax- Assessment and Planning	**4**	**5**
	CO6CMT10	Computer Application- Database Management System	**3**	**3**
		Database Management System (Practical)	**-**	**2**
	CO56CMP01	***Computer Application*** ***Practical Examination*** for Programming in C and Data Base Management System	**2**	**NA**
	CO6CMT11	Travel and Tourism Tourism Environment and Ecology	**4**	**5**
	CO6CMT12	Marketing Consumer Behaviour	**4**	**5**
	CO6CMT12	Logistics Management- Consumer Behaviour	**4**	**5**
4	CO6CRT20	Management Accounting	**4**	**5**
5	CO6OCT	Optional - 4	**4**	**5**
	CO6OCT01	Finance and Taxation- Income Tax- II	**4**	**5**
	CO6OCT02	Computer Application- Software for Business and Research (Theory)	**3**	**3**
		Software for Business and Research(Practical)	**-**	**2**
	CO56OCP01	**Computer Application-** Practical Examination – Computerised Accounting and Software for Business and Research	**2**	**NA**
	CO6OCT04	Travel and Tourism Tourism and Cultural Heritage of India	**4**	**5**
	CO6OCT05	Marketing International Marketing	**4**	**5**
	CO6OCT06	Logistics Management Shipping and Ocean Freight Logistics Management	**4**	**5**
6	**CO6PR01**	**Project and Viva**	**1**	**-**
		TOTAL for streams other than Computer Application	**20**	**25**
		TOTAL for Computer Application Stream	**22**	**25**

SEMESTER 1

Core Course : DIMENSIONS AND METHODOLOGY OF BUSINESS STUDIES

Instructional Hours: 54 **Credit: 2**

Objectives

- *To understand business and its role in society*
- *To have an understanding of Business ethics and CSR*
- *To comprehend the business environment and various dimensions*
- *To familiarise Technology integration in business*
- *To introduce the importance and fundamentals of business research*

Module 1

Business and Environment Business- Functions - Scope - Significance of business - Objectives of business - Business and development - Forms of business organisations- Stake holders of business- Business Environment – Definition - Features- Importance - Components of business environment- Internal environment and external environment - Micro environment and macro environment- Global business environment **(10 Hours)**

Module 2

Business in India- Stages and developments of business in the Indian economy since independence - Role of public, private, co-operative sectors - Liberalisation, Privatisation and Globalization – Disinvestment – Outsourcing –Recent economic initiatives - Niti Ayog - Make in India initiative **(10 Hours)**

Module 3

Technology integration in business- E Commerce- Meaning- Functions - Operation of E-commerce - Types of E-Commerce -B2C-B2B-C2C- C2B- B2E- B2G- P2P- E-Commerce and E-Business – M-Commerce- Meaning- Advantages- Challenges – E-Payment systems (brief study) Debit/Credit card payment, Net banking, Digital wallet, e-cheque, e-cash – Payment gateway. **(14 Hours)**

Module 4

Business Ethics – Importance - Principles of business ethics - Factors Influencing Business Ethics - Arguments in favour and against business ethics - Social responsibility of business – objectives and principles - Arguments in favour and against social responsibility. Corporate Governance – Meaning and importance – Objectives – Principles **(10 Hours)**

Module 5

Business Research – Research**-** Meaning and Definition- Importance of research- Quantitative and qualitative approach to research-Inductive and deductive reasoning- Major Types of Research (Pure-Applied - Exploratory- Descriptive- Empirical- Analytical) - Business Research- Elements of Business Research-Management Research- -Objectives- Research Methods vs Research Methodology -Research Process(brief outline only) –Research report **(10 Hours)**

Suggested Readings

1. Keith Davis and William C.Frederick*: Business and Society Management, Public Policy, Ethics.*
2. Peter F. Drucker*: Management Tasks, Responsibilities, Practices.*

3. Peter F Drucker*: The Practice of Management.*
4. P.T.Joseph, S.J., E-Commerce: An Indian Perspective , Prentice Hall of India
5. Kamalesh K Bajaj and Debjani Nag: *E-Commerce, the Cutting Edge of Business:, Tata McGraw Hill.*
6. Schneider *E-Commerce:, Thomson Publication*
7. CSV Murthy*, Business Ethics, Himalaya Publishing House, Mumbai*
8. C R Kothari *Research Methodology – New Age Publishers*
9. O R Krishnaswamy- *Research Methodology- Himalaya Publications*
10. N V Badi and R.V. Badi *Business Ethics: Vrinda Publications*
11. Cherunilam, Fransis, Business environment, *Himalaya Publishing House, Mumbai.*
12. Fernando, A, C,. Business Environment, *Pearson, New Delhi*
13. Francis, Ronald & Mishra, Muktha, Business Ethics: An Indian Perspective, *Tata McGraw Hill Pvt Ltd, New Delhi*
14. Sharma, J.P., Corporate Governance, Business Ethics, and CSR, *Ane Books Pvt Ltd, New Delhi.*
15.. Ghosh, B.N., Business Ethics and Corporate Governance, *Tata McGraw Hill Pvt Ltd, Delhi.*

Core Course : FINANCIAL ACCOUNTING– I

Instructional Hours: 90 **Credit: 4**

Objective: *To equip the students with the skill of preparing accounts and financial statements of various types of business units other than corporate undertakings*

Module – I

Preparation of Financial Statements –Conceptual framework- Accounting Principles - Accounting Concepts - Accounting Conventions- - Capital and Revenue Expenditure - Capital and Revenue Receipts - Capital and Revenue Losses - Deferred Revenue Expenditure–Accounting Standards- Objectives -Final Accounts of Sole Trader - Trading Account - Manufacturing Account - Profit and Loss Account - Balance Sheet - Adjusting entries - Closing Entries- Practical Problems with all Adjustments. **(26 Hours)**

Module -II

Accounting of Incomplete Records - Single Entry System - Features - Advantages - Disadvantages - Distinction between Single Entry and Double Entry System- Ascertainment of Profit/loss - Statement of Affairs Method - Conversion Method - Steps for Conversion of Single Entry into Double Entry - Preparation of Trading and Profit and Loss Account and Balance Sheet. **(20 Hours)**

Module - III

Royalty Accounts – Meaning – Minimum Rent – Short Working – Recovery– Journal Entries in the books of Lessor and Lessee – Preparation of Minimum Rent Account – Short Working Account – Royalty Account (Excluding Sublease)– Special Circumstances :Adjustment of Minimum Rent in the event of Strike and Lock - outs - Govt. Subsidy in case of Strikes/Lockouts **(18 Hours)**

Module - IV

Accounting for Consignment - Meaning – Important Terms – Journal Entries in the books of Consignor and Consignee – Preparation of Consignment Account – Consignee's Account – Goods Sent at Cost or Invoice Price Delcredre commission- Valuation of Stock – Normal and Abnormal Loss **(18 Hours)**

Module – V

Farm Accounts- Meaning- Characteristics- Objectives and advantages- Recording of farm transactions- Preparation of farm account, crop account, dairy account, livestock account etc- Preparation of final accounts of farming activities- **(8 Hours)**

Suggested Readings

1. Jain, S.P., & Narang, K.L., Advanced Accountancy, *Kalyani Publishers*, *New Delhi*
2. Maheshwari, S.N., & Maheswari, S.K., Advanced Accountancy, *Vikas Publishing House*, *New Delhi.*
3. Shukla, M.C., & Grewal, T.S., Advanced Accountancy, *S Chand and Company (Pvt.) Ltd*, *New Delhi.*
4. Ashok, Sehgal, & Deepak Sehgal, Financial Accounting *Taxmann Allied Service (Pvt.) Ltd*, *New Delhi.*
5. MA Arulanandam and KS Raman, *Advanced Accountancy, Himalaya Publications, Mumbai.*
6. Paul, S. K., & Chandrani, Paul, Advanced Accountancy, *New Central Book Agency*, *New Delhi.*
7. Raman B S, *Financial Accounting- United Publishers*
8. The Chartered Accountant(Journal), Institute of Chartered Accountants of India, New Delhi.

Core Course

CORPORATE REGULATIONS AND ADMINISTRATION

Instructional Hours: 72 **Credit: 3**

Objective: *To familiarise the students with the management and administration of joint stock companies in India as per Companies Act, 2013*

Module 1

Company - Definition – Characteristics – Classifications –History and framework of Company Law In India - Companies Act 2013 - one person company, small company, associate company, dormant company, producer company; association not for profit; illegal association **(Instructional Hours - 10)**

Module 2

Promotion and formation of a company- Body Corporate - promoter- legal position-duties-remuneration - Memorandum of Association – Articles of Association - Contents and alteration Incorporation of Company - On-line registration of a company – CIN - Companies With Charitable Objects - Doctrines of Indoor Management, Constructive Notice, Ultra-Vires - Lifting up of Corporate veil - Conversion Of Companies **(Instructional Hours - 12)**

Module 3

Share Capital – Types - Public Offer - Private Placement - Prospectus - Contents of Prospectus – Types of prospectus – Deemed prospectus - Shelf Prospectus - Red Herring Prospectus - Abridged prospectus- Liability for Misstatements in Prospectus – Issue and Allotment of Securities – Types - Voting Rights – DVR- Application of Premiums - Sweat Equity Shares - Issue and Redemption of Preference Shares- Transfer and Transmission of Securities- Punishment for impersonation of Shareholder - Further Issue of Share Capital- Bonus Shares- Debenture Issue - **(Instructional Hours - 15)**

Module 4

Membership in company and meetings- modes of acquiring membership-rights and liabilities of members- Control -cessation of membership- Register of Members - Company meetings – Annual General Meeting - Extraordinary General Meeting- Notice of Meeting - Quorum - Chairman - Proxies - Voting - Show Of Hands – E-Voting - Poll- Postal Ballot- Motions - Resolutions - Types - Minutes - Books of accounts - Annual Return- Directors - Types - legal position – Appointment - Duties - Disqualifications - DIN - Vacation of Office - Resignation - Removal - Meetings Of Board - Resolutions And Proceedings - Powers of Board - Key Managerial Personnel- CEO- CFO - Audit and Audit Committee - related party- transactions - Corporate Social Responsibility.

(Instructional Hours - 20)

Module 5

Winding up - Contributory – Modes of winding up - Winding Up by Tribunal - Petition for Winding Up - Powers of Tribunal- Liquidators - Appointments- Submission of Report - Powers and Duties - Effect of Winding Up Order- Voluntary Winding Up - Circumstances - Declaration of Solvency - Meeting of Creditors- Commencement of Voluntary Winding Up- Appointment of Company Liquidator- Final Meeting and Dissolution of Company Official Liquidators –Appointment -Powers - Functions - Winding up of unregistered companies. **(Instructional Hours - 15)**

Suggested Readings

1. Shukla, M.C., & Gulshan, Principles of Company Law, *S.Chand, New Delhi*.
2. Venkataramana, K., Corporate Administration, *Seven Hills Books Publications.*
3. Kapoor,N.D., Company Law and Secretarial Practice, Sultan Chand,*New Delhi.*
4. Bansal C.L., Business and Corporate Law, *Vikas Publishers, New Delhi.*
5. Bhandari, M.C., Guide to Company Law Procedures, Wadhwa Publication.
6. S.N. Maheswari and S.K. Maheswari, Elements of Corporate Law, Himalaya Publications,
7. Kuchal, S.C., Company Law and Secretarial Practice, *Vikas Publishers, New Delhi*
8. Chartered Secretary, *The Institute of Company Secretaries of India.*

Complementary Course 1: BANKING AND INSURANCE

Instructional Hours: 54 **Credit: 3**

Objective: *To familiarize the students with the basic concepts and practice of banking and the principles of Insurance*

Module I

Introduction to Banking- Origin and Evolution of Banks - Meaning and Definition-Classification of Banks – Functions of Commercial Banks- Primary and Secondary- Credit Creation-Reserve Bank of India-Functions of RBI-Banking Ombudsman Scheme. **(10 Hours)**

Module II

Innovations and Reforms in Banking – E-banking – ATM – CDM - telephone/ Mobile Banking –ECS – EFT – NEFT – RTGS – SWIFT - CORE Banking - Cheque Truncation System - Credit and Debit Cards – CIBIL – KYC - Banking Sector Reforms-Prudential Norms- Capital Adequacy Norms - NPA – NBA - Basel norms - Small Finance Banks - Payment Banks - Financial Inclusion - PMJDY. **(12 Hours)**

Module III

Banker and Customer- Meaning and Definition- Relationship- General and Special- Different Types of Accounts- Cheque- dishonour of cheque – payment in due course – Crossing - Endorsement.

(12 Hours)

Module IV

Insurance - Introduction- Concept of Risk**-** Insurance - Need and Importance - Principles of Insurance contract Insurance Industry in India**-** IRDA - Insurance Sector Reforms – Bancassurance.

(8 Hours)

Module V

Types of insurance - Life Insurance– Features - Classification of Policies - Policy Conditions - Application and Acceptance- Assignments - Nomination - -Surrender-Foreclosure- Marine Insurance – Features- Policy Conditions - Clauses - Fire Insurance- Motor vehicle insurance - Health Insurance- Burglary insurance-personal accident insurance- Re-Insurance- Group insurance.

(12 Hours)

Suggested Readings

1. Shekhar, K.C, Banking Theory and Practice, *Vikas Publishing House*, *New Delhi*
2. Maheswari, S.N., Banking Law and Practice, *Kalyani Publishers*, *New Delhi*
3. Sundharam,Varshney, Banking Theory Law & Practice, *Sulthan Chand & Sons*, *New Delhi.*
4. Agarwal, O.P., Banking and Insurance*, Himalya Publishing House, Mumbai*
5. Saxena, G.S., Legal Aspects of Banking Operations*, Sultan Chand and Sons, New Delhi*
6. Agarwal, O.P., Banking and Insurance*, Himalya Publishing House, Mumbai*
7. Tripati, Nalini & Prabil Pal., Insurance: Theory and Practice, *PHI Pvt Ltd, New Delhi*
8. Gupta, P.K., Insurance and Risk Management, *Himalaya Publishing House, Mumbai*
9. Mishra, M.N., Principles and Practices of Insurance, *S. Chand and Sons, New Delhi*

SEMESTER 2

Core Course : FINANCIAL ACCOUNTING – II

Instructional Hours: 90 **Credit: 4**

Objective**:** *To acquaint the students with the preparation of books of accounts of various types of business activities and application of important accounting standards*

Module I

Accounting for Hire Purchase – Meaning and Features of Hire Purchase System – Hire purchase Agreement –Hire purchase and Sale - Hire Purchase and Installment – Interest Calculation – Recording Transactions in the Books of both the Parties – Default and Repossession- Complete repossession- Partial repossession- **(25 Hours)**

Module II

Branch Accounts – Objectives- Features – Types – Accounting for Branches keeping full system of accounting – Debtors System – Stock and Debtors System – Independent Branches and Incorporation of Branch Accounts in the Books of H.O – Cash in Transit and Goods in Transit – Consolidated Balance Sheet.(accounting for foreign branches excluded) **(20 Hours)**

Module III

Departmental Accounts – Meaning – Objectives – Advantages – Distinction between branch and department- Accounting Procedure – Allocation of Expenses and Income- Inter Departmental Transfers – Provision for Unrealized Profits. (**10 Hours)**

Module IV

Accounting for Dissolution of partnership firm- Dissolution of a firm- Settlement of Accounts on dissolution- - Insolvency of a partner-Application of decision of Garner Vs Murray Case - Settlement of accounts when all partners are insolvent- Piecemeal distribution- Highest Relative Capital Method- Maximum Possible Loss method **(25 hours)**

Module V

Accounting Standards- Importance- Accounting Standards Board- Applicability of Accounting Standards – Brief learning of AS1, AS2, AS9, AS10 and AS 19 (Theory only) (**10 Hours)**

Suggested Readings

1. Jain S.P & Narang K.L., Advanced Accountancy, *Kalyani Publishers*, *New Delhi*
2. Maheshwari, S.N., & Maheswari, S.K., Advanced Accountancy, *Vikas Publishing House*, *New Delhi.*
3. Shukla, M.C., & Grewal, T.S., Advanced Accountancy, *S Chand and Company Pvt.Ltd*, *New Delhi.*
4. Ashok Sehgal & Deepak Sehgal, Financial Accounting *Taxmann Allied Service (Pvt) Ltd*, *New Delhi.*
5. Paul, S. K., & Chandrani Paul, Advanced Accountancy, *New Central Book Agency*, *New Delhi.*
6. MA Arulanandam and KS Raman*, Advanced Accountancy,Himalaya Publications, Mumbai.*
7. Raman B S*, Financial Accounting United Publishers*
8. The Chartered Accountant (Journal), Institute of Chartered Accountants of India, New Delhi.

Core Course- BUSINESS REGULATORY FRAMEWORK

Instructional Hours: 72 **Credit: 3**

Objective: *The course is intended to familiarise the students with the legal framework influencing business decisions***.**

Module I

Introduction to Mercantile Law -Law of Contract - Definition - Kinds of Contracts - Valid – Void - Voidable - Contingent and Quasi Contract - E-Contract - Essentials of a Valid Contract - Offer and Acceptance - Communication of Offer - Acceptance and its Revocation - Agreement - Consideration - Capacity to Contract - Free Consent - Legality of Object and Consideration - Performance of Contract - Discharge of Contract -Breach of Contract - Remedies for Breach of Contract. **(25 Hours)**

Module II

Special Contract I-Bailor and Bailee - Finder of Lost Goods - Pledge - Essentials - Rights and Duties of Pawner and Pawnee **(15 Hours)**

Module III

Special Contract II- Indemnity and Guarantee- Indemnity - Meaning and Definition - Contract of Guarantee - Kinds of Guarantee - Rights and Liabilities of Surety - Discharge of Surety.

(10 hours)

Module IV

Law of Agency - Essentials, kinds of agents, rights and duties of agent and principal, creation of agency, termination of agency-Sub agents and substituted agents- Relationship **(12 Hours)**

Module V

Sale of Goods Act, 1930 -Essentials of Contract of Sale Goods - Classification of Goods - Condition and Warranties - Transfer of Property in Goods - Right of Unpaid Seller - Buyer's Right Against Seller - Auction Sale. **(10 Hours)**

Suggested Readings

1. Aswathappa, K., Business Laws, *Himalaya Publishing House*, *Bengaluru.*
2. Kapoor,N.D., Business Laws, *Sultan Chand publications* New Delhi.
3. Sharma,S.C., Business Law, *International Publishers, Bengaluru*
4. Tulsian, Business Law, *McGraw-Hill Education Mumbai.*
5. Indian Contract Act No. IX, 1972
6. Indian Sale of Goods Act, 1930

Journals

1. The Indian Journal of Law and Technology, National Law School of India University, Bangalore.
2. E bulletin of Students Company Secretary

Core Course : BUSINESS MANAGEMENT

Instructional Hours: 54 **Credit: 3**

Objectives: *To familiarise the students with concepts and principles of management.*

Module 1

Introduction to Management - Meaning , Nature, Scope and Functional Areas of Management - Management as a Science, Art and Profession - Management & Administration - Principles of Management- Managerial roles: Mintzberg Model - Functions of Management - Contributions of F.W.Taylor and Henry Fayol. **(12 Hours)**

Module II

Planning - Planning - Meaning - Nature - Importance - Types of Plans - Planning Process- Barriers to Effective Planning - M.B.O - Features – Steps - Coordination - Meaning and Importance - Techniques for Effective Coordination **(10 Hours)**

Module III

Organizing - Meaning - Nature - Importance - Principles of Organisation - Types of Organisation - Organisation Chart - Organisation Manual - Centralization – Decentralization- Authority - Delegation of Authority -Responsibility and Accountability.

(10 Hours)

Module IV Direction and Control – Principles of direction- Leadership: Concept and Styles; Trait and Situational Theory of Leadership, Managerial Grid by Blake and Mouton, Likert's Four System Model - Motivation: Concept and Importance; Maslow's Need Hierarchy Theory; Herzberg's Two Factors Theory. Control: Concept and Process-Control Techniques.

(12 Hours)

Module V

Management Techniques – (Brief Study) Quality circle-Total Quality Management - Business Process Reengineering (BPR)- Six sigma-Kaizen

(10 Hours)

Suggested Readings

1. Koontz, O Donnell, Management, *McGraw-Hill*
2. Appaniah, Reddy, Essentials of Management, *Himalaya Publishing House*.
3. Prasad, L. M., Principles of management, *Sultan Chand and Sons*.
4. Srinivasan, Chunawalla, Management Principles and Practice, *Himalaya Publishing House.*
5. Tulsian, P.C., & Pandey, Vishal, Business Organization and Management, Pearson Education

Complementary Course -2 – PRINCIPLES OF BUSINESS DECISIONS

Instructional Hours: 54 **Credit: 3**

Objective: *The course is intended to familiarise the students with the economic concepts and principles underlying business decision making*

Module I

Introduction –Decision making- Definition of decision and decision making- Importance of decision making- Steps in decision making- Types of decisions- Decision making environment- Elements of a decision- Application of economic theories in decision making- Areas where economic theories can be applied for business decision making - Important Economic concepts and theories applied in decision making- – Incremental Reasoning – Time Perspective – Discounting Principle – Opportunity Cost – Equi- marginal Principle **(8 Hours)**

Module II

Demand Theory –Demand**–**Meaning- Law of Demand – Reasons for Law of demand – Exceptions to the Law –Demand determinants- Movements Vs Shift in Demand- Demand distinctions- Elasticity of Demand – Price elasticity- Importance of price elasticity- Income elasticity-Advertisement elasticity – Cross elasticity – Measurement of elasticity - Demand Forecasting –Short Term and Long Term Forecasting – Methods of Forecasting(theory only) -Forecasting demand for new products- Characteristics of a good forecasting technique. **(16 Hours)**

Module III

Production Analysis– Production- Production Function –Assumptions and uses of production function- Cobb Douglas Production Function – Laws of Production – Law of Diminishing Returns or variable proportions- –Law of Returns to Scale – Economies And Diseconomies of Scale – Isoquant Curve-Isocost Curve – Optimum Combination of Inputs **(8 Hours)**

Module IV

Cost Analysis-Cost concepts- Determinants of cost- Cost output relationship in the short run and long run- Optimum firm **(6 Hours)**

Module V

Pricing in Different Markets –Price theory and price mechanism- objectives of pricing- Various market forms and pricing- Perfect Competition –Features- Price determination- Equilibrium of a firm under perfect competition- Monopoly- Features and kinds of monopoly- Price and output determination- Price Discrimination- Types- conditions- degree of price discrimination- Monopolistic competition- features- Price-output determination- - Oligopoly—features- Kinked Demand Curve- Price Leadership – Pricing under Collusion **(16 Hours)**

Suggested Readings

1. Dean, Joel Managerial economics- *Prentice Hall of India*
2. Varshney, R.L., & Maheshwari, K.L., Managerial Economics, *Sultan Chand & Sons Private Ltd.*, *New Delhi*
3. Kasi Reddy M., & Saraswathi, S., Managerial Economics and Financial Accounting, *PHI Learning, New Delhi.*
4. Mehta, P. L., Managerial Economics, *Sultan & Chand, New Delhi*
5. *DM Mithani, Managerial economics, Himalaya Publishing House Mumbai.*
6. Trivedi, M.L., Managerial Economics Theory and Applications, *McGraw Hill Education Private Ltd, New Delhi.*
7. Dwivedi, D. N., Managerial Economics, *Vikas Publishing House Private Limited, New Delhi.*
8. Chopra P.N., Principles of Business Decisions, *Kalyani Publishers*

SEMESTER 3

Core Course : CORPORATE ACCOUNTS - I

Instructional Hours: 72

Credit: 4

Objective: *To make the students familiarise with corporate accounting procedures and to understand the accounting for banking companies.*

Module 1

Accounting for Shares– Redemption of Preference Shares– ESOP-Rights Issue – Bonus Issue – Buyback of Shares **(16 Hours)**

Module II

Underwriting of Shares and Debentures – Marked and Unmarked Applications – Firm Underwriting– Determining the Liability of Underwriters in respect of an Underwriting Contract – Complete Underwriting – Partial Underwriting – Firm Underwriting **(8 Hours)**

Module III

Final Accounts of Joint Stock Companies (Vertical form- As per provisions of Companies Act 2013) – Preparation of Company Final Accounts including Balance Sheet – Calculation of Managerial Remuneration- Profit (Loss) Prior to Incorporation **(22 Hours)**

Module IV

Investment Account – Cum-interest- Ex-interest- Cum-dividend- Ex-dividend- Accounting entries- Preparation of Investment Accounts- Treatment of Bonus Share and Right Shares – Preparation of Investment Accounts **(12 Hours)**

Module V

Insurance claims- Loss of stock- computation of claim for loss of stock- Application of average clause- elimination of abnormal/defective items – Loss of profit policy- Calculation of claim- **(14 Hours)**

Suggested Readings

1. Jain, S.P., & Narang, K.L. , Advanced Accountancy, *Kalyani Publishers, New Delhi*
2. Maheswari, S.N & Maheswari, S.K., Advanced Accounting, *Vikas Publishing House, New Delhi*
3. Shukla, M.C., & Grewal, T. S., Advanced Accountancy *S. Chand and Company Pvt.Ltd, New Delhi*
4. Shukla, S.M., & Gupta, S.P., Advanced Accounting, *Sahitya Bhavan Publications, Agra*
5. Raman B S *Corporate Accounting United Publishers*
6. *MA Arulanandam and KS Raman, Advanced Accountancy, Himalaya Publications, Mumbai.*
7. The Chartered Accountant (Journal), *Institute of Chartered Accountants of India, New Delhi.*

Core Course : QUANTITATIVE TECHNIQUES FOR BUSINESS - I

Instructional Hours: 72

Credit: 4

Objective: *To make the students understand the role of statistics and quantitative techniques in business and familiarize them with basic tools applied*

Module I

Introduction to Statistics- Origin and Growth- Meaning- definition- Statistics as data- Statistics as methods- Empirical and quantitative analysis- Descriptive statistics and Inferential statistics- Functions of statistics-, Planning and Business- Limitations of Statistics- Distrust of Statistics **(5 Hours)**

Module II

Statistical Survey- Planning and design of enquiry- Statistical units- Executing a survey- Business Data Sources- Primary and Secondary Data-Methods of collecting Primary data—- Drafting a questionnaire- Collection of secondary data- Census method and Sampling – Sampling Methods Probability Sampling and Non- Probability Sampling- Theoretical base of sampling: Law of Statistical regularity and Law of Inertia of Large Numbers- Statistical errors- Editing and Coding of data- Classification- Types of classification- Tabulation of Data- Objectives of tabulation- Classification Vs Tabulation- Types of tabulation- Cross tabulation- Parts of a table- Statistical Series **(20 Hours)**

Module III

Uni-Variate Data Analysis I -Measures of Central Tendency – Concept –Functions of an average- Characteristics- Arithmetic Mean –Simple mean- Weighted mean- Combined mean- Properties of mean- Median –Quartiles and other partition values- Mode- Empirical relation between mean, median and mode- Graphical location of median and mode- Geometric Mean-Harmonic Mean-relation between Arithmetic mean, Geometric mean and Harmonic Mean Application of various measures- Merits and Demerits of various measures of central tendency - **(15 Hours)**

Module IV

Uni-Variate Data Analysis II- Measures of dispersion - Concept-Properties of a good measure of dispersion- Absolute and Relative Measure-Range-Inter Quartile Range- Quartile Deviation-Mean Deviation-Standard Deviation-Lorenz curve- Merits and Demerits of various measures-Relevance and Applications in Business-Mathematical properties of standard deviation - Variance and Co-efficient of Variation–Measures of Skewness –Definition of skewness- types- Test of skewness- Relatives measures of skewness- Moments- Central moments- Raw moments- Conversion of raw moments into central moments- Skewness based on moments- Kurtosis-meaning and types **(20 Hours)**

Module V

Interpolation and Extrapolation- Meaning of interpolation and extrapolation- Significance and utility- Assumptions- Methods of Interpolation- (a) Newton's Method of Advancing differences (b) Binomial Expansion method (c) Lagrange's method – Extrapolation- Forecasting using extrapolation

(12 Hours)

Suggested Readings

1. Richard, Levin & Rubin, David, S., Statistics for Management, *Prentice Hall of India, New Delhi.*
2. Spiegel, M.R., Theory and Problems of Statistics, *Schaum's Outlines Series, McGraw Hill Publishing Co.*
3. Kothari, C.R., Research Methodology, *New Age Publications, New Delhi.*
4. Sharma, J. K., Business Statistics, *Pearson Education.*
5. Gupta, S.C., Fundamentals of Statistics, *Himalaya Publishing House.*
6. Gupta, S.P. & Gupta, Archana, Elementary Statistics, *Sultan Chand and Sons, New Delhi.*
7. Elhance D N, Elhance,Veena and Aggarwal B M *Fundamentals of Statistics , Kitab Mahal*
8. Gupta, C B and Gupta, Vijay., *An Introduction to Statistical Methods, Vikas Publishing House*
9. Pillai, R S N and Bagavathi,V *., Statistics , S Chand& Co*

Core Course : FINANCIAL MARKETS AND OPERATIONS

Instructional Hours: 72 **Credit: 3**

Objective: *The course is intended to familiarise the students with financial market operations in India*

Module I

Indian Financial System- Savings and Investment – The Indian Financial System-Components - Role and Functions-Interactions among the Components- Recent Developments in the Indian Financial

System- Financial Markets-Classification- Capital Market and Money Market Instruments- Indian Money Market- Role of RBI in Money Market- SEBI-Establishment-Objectives-Powers and functions.

(16 Hours)

Module II

Primary Market- Functions of New Issue Market - Methods of New Issue - IPO - FPO - ASBA- Green Shoe Option- Public Issue - Bonus Issue- Right Issue- Private Placement-Book Building - ESOP-Indian Depository Receipts - Intermediaries in the New Issue Market-Registrars to the Issue-Brokers to the Issue-Bankers to the Issue - Underwriters-Qualified Institutional Placement and Qualified Institutional Buyers- Innovative Financial Instruments**.** **(14 Hours)**

Module III

Secondary Market- Role and Functions of Stock Exchanges - Listing of Securities - Stock Exchanges in India - Members of the Stock Exchanges- Methods of Trading in a Stock Exchange- Online Trading- Depositories – Role - Mark to Market System - Stock Market Indices - Methodology for Calculating Index.- Type of Speculators- Speculative Transactions in Stock Exchanges - Insider trading - SEBI regulations- Foreign Institutional Investors in Securities market- Foreign Portfolio Investment- Private Equity **(18 Hours)**

Module IV

Mutual Funds -Meaning- Objectives- Advantages - Classification of Mutual Funds–Exchange Traded Fund- Constitution and Management of Mutual Funds in India- AMFI- Concept of Net Asset Value – Advantages and limitations of Mutual Funds**-** **(12 Hours)**

Module V

Derivatives (Brief study only)- Features of Derivatives -Types of Derivatives– Forwards – Futures- Options-Swaps- Commodity Futures – Major Commodity Exchanges in India **(12 Hours)**

Suggested Readings

1. Khan, M.Y., Indian Financial System, *Tata McGraw Hill, New Delhi.*
2. Singh, Preethi, Dynamics of Indian Financial System, *Ane Books, New Delhi*
3. Guruswami, S., Capital Markets, *Tata McGraw Hill, New Delhi*
4. Avadhani, V. A., Investment and Securities Market in India, *Himalaya Publishing House.*

Journals

SEBI and Corporate Laws - Taxmann, New Delhi
SEBI Monthly Bulletin

Core Course : MARKETING MANAGEMENT

Instructional Hours:54 **Credit: 3**

Objective: *The objective of this course is to provide a sound understanding of the basic principles of marketing management and their applications in the business and industry.*

Module I

Marketing Management–Market and Marketing- Meaning- Definition of marketing- Marketing Concepts – Marketing environment- Functions of marketing-Marketing Management- Marketing Mix-4Ps and 4Cs- Importance of marketing mix- Factors affecting marketing mix- Market Segmentation – Concept – Need – Basis-benefits- Market Targeting- Market Positioning- differentiated and undifferentiated marketing **(12 Hours)**

Module II

Product Mix- Product – Meaning- Classification of products- -Product Line and Product Mix-New Product development- Steps- Reasons for failure of new products- - Product Life Cycle- – Branding-Types of brand- Brand Equity- Brand Loyalty- Trade Mark- Packaging-Role of packaging- Essentials of good packaging- Product Labelling- Marketing of services- Pricing of Products- Factors Influencing Pricing- Pricing Policies and Strategies -Types of Pricing **(12 Hours)**

Module III

Price Mix – Pricing-Factors affecting pricing decision- Role of pricing in marketing strategy- Steps in formulating pricing- Pricing methods and strategies- Pricing of a new product- Resale Price Maintenance **(12 Hours)**

Module IV

Physical Distribution Mix- - Logistic and Supply Chain Management – Elements- Channels of Distribution –Types- Factors Affecting the Choice of a Channel of Distribution-Functions of various Intermediaries – retailing- Types of retailing- Direct Marketing- Merits and demerits **(12 Hours)**

Module V

Recent Trends in Marketing (Overview Only)-Relationship Marketing - Social Marketing -Online Marketing- -Green Marketing-Tele Marketing -Viral Marketing- Relationship Marketing-De-marketing-Remarketing- Guerilla marketing – Ambush Marketing. **(6 Hours)**

Suggested Readings

1. Kotler, Philip & Keller, Kevin Lane, Koshy, Abraham, & Mithileshwar Jha, Marketing Management, A South Asian Perspective, *Pearson Education.*
2. Armstrong, Gary, and Kotler, Philip, The Essentials of Marketing, *Pearson Education, New Delhi*
3. Majaro, Simon, The Essence of Marketing, *Prentice Hall, New Delhi.*
4. Chhabra, T.N., Principles of Marketing, *Sun India Publication.*
5. Czimkota, Marketing Management, *Vikas Publishing House (P) Ltd.*
6. *Biplab S Bose, Marketing management, Himalaya Publishing House, Mumbai*
7. Rajan Nair and Varma M M – *Marketing Management- Sultan Chand and Sons*
8. Sontakki C N*, Marketing Management- Kalyani Publishers*
9. Ramaswamy V S and Namakumari *Marketing Management , McMillan India Ltd*

SEMESTER 4

Core Course : CORPORATE ACCOUNTS – II

Instructional Hours -90 **Credit - 4**

***Objective**: To equip the students with the preparation of financial statements of insurance companies and to understand the accounting procedure for reconstruction and liquidation of companies.*

Module – I

Accounts of Insurance Companies – Insurance Companies – Special Terms – Final Accounts of Life Insurance – Revenue Account - Profit and Loss Account and Balance Sheet (As per IRDA Regulation Act, 2002) – Determination of Profit in Life Insurance Business – Valuation Balance Sheet – Accounts of General Insurance Companies (Fire and Marine only) – Revenue Account – Profit and Loss Account and Balance Sheet (as per IRDA Regulation Act) **(18 Hours)**

Module – II

Accounts of Banking Companies – Meaning – Important Provisions of Banking Companies Act, 1949 – Preparation of Final Accounts of Banking Companies – Profit and Loss Account, Balance Sheet – Transactions of Special Type – rebate on bills discounted- Asset Classification and Provisions – Non Performing Assets- Capital Adequacy. **(16 hours)**

Module – III

Internal Reconstruction -Alteration of Share Capital- Capital Reduction –Accounting procedure- Surrender of Shares- Accounting Treatment – Revised Balance Sheet. **(14 Hours)**

Module – IV

Amalgamation absorption and External Reconstruction – Meaning- Amalgamation in the nature of Merger, Purchase , External Reconstruction – Applicability of AS 14- Calculation of Purchase consideration (all methods) – Journal Entries in the books of Transferor and Transferee Companies, Revised Balance Sheet (excluding inter - company holdings) **(30 Hours)**

Module –V

Liquidation of Companies – Meaning-Types – Contributories-Preferential Creditors- Fraudulent Preference- Preparation of Liquidator's Final Statement of Account (Statement of Affairs excluded) .

(12 Hours)

Suggested Readings

1. Jain, S.P & Narang, K.L., Advanced Accountancy, *Kalyani Publishers, New Delhi*
2. Maheswari, S.N & Maheswari, S.K., Advanced Accounting, *Vikas Publishing House, New Delhi*
3. Shukla, M.C., & Grewal, T.S., Advanced Accountancy, *S Chand and Company Pvt. Ltd, New Delhi*
4. Shukla, S.M., & Gupta, S.P, Advanced Accounting , *Sahitya Bhavan Publications, Agra.*
5. MA Arulanandam and KS Raman, *Advanced Accountancy, Himalaya Publishing House, Mumbai.*

6. Raman B S, *Corporate Accounting United Publishers*
7. The Chartered Accountant (Journal), Institute of Chartered Accountants of India, New Delhi.

Core Course : QUANTITATIVE TECHNIQUES FOR BUSINESS- II

Instructional Hours: 90 **Credit : 4**

Objective: *The objective of this course is to familiarize the students with more advanced tools of data analysis and forecasting and also to have an understanding of the fundamentals of theory of probability*

Module – I

Bi-Variate Data Analysis- I- Correlation - Concept- Correlation and Causation -Types of Correlation- Methods- Scatter diagram and Correlation graph- -Karl Pearson's Co-efficient of Correlation-Spearman's Rank Correlation Co-efficient- - Probable Error-Concurrent Deviation Method- Concept of lag and lead in correlation (Problems- Un grouped Data only) **(18 Hours)**

Module II

Bi-Variate Data Analysis- II -Regression Analysis– Concept-Utility- Comparison of correlation and regression- Lines of Regression- - Regression Equations and regression co-efficient- Algebraic Methods of studying regression- Standard Error of estimate - (Problems- Un grouped Data only) **(16 Hours)**

Module – III

Index Numbers-Meaning-Importance- Characteristics and uses of Index Numbers- Types of index numbers- Problems in construction of index numbers- Methods of constructing price index, quantity index and value index- : Unweighted Index numbers- Simple aggregative method and Simple average of price relatives method- Weighted Index numbers- Weighted average of price relative method- Weighted aggregative method applying Laspeyer's, Paasche's and Fishers methods- Test of Consistency of index numbers- Cost of Living Index Numbers and its Uses- Construction of cost of living index numbers- Aggregate expenditure method and family budget method- Concepts of Fixed base index numbers, chain based index numbers, base shifting, deflating and splicing(*theory only*)- Limitations of index numbers **(16 Hours)**

Module - IV

Time Series Analysis-Meaning-Definition- Components of Time Series-Time series analysis- Utility of Time Series Analysis- Mathematical models- Determination of Trend- Free hand curve method- Method of semi averages- Method of Moving Average-Method of Least Squares (first degree only)- Shifting the origin of trend- converting annual trend into monthly trend- **(16 Hours)**

Module – V

Probability-Meaning-Definition - Basic Terms-Concepts-Approaches to Assigning Probability - Permutation and Combination-Theorems of Probability- Addition Theorem- Multiplication Theorem- Conditional Probability- Baye's Theorem of Inverse probability (**24 Hours)**

Suggested Readings

1. Richard, Levin & Rubin, David, S., Statistics for Management, *Prentice Hall of India, New Delhi.*
2. Spiegel, M.R., Theory and Problems of Statistics, *Schaum's Outlines Series, McGraw Hill Publishing Co.*
3. Kothari, C.R., Research Methodology, *New Age Publications, New Delhi.*
4. Sharma, J. K., Business Statistics, *Pearson Education*.
5. Gupta, S.C., Fundamentals of Statistics, *Himalaya Publishing House.*
6. Gupta, S.P. & Gupta, Archana, Elementary Statistics, *Sultan Chand and Sons, New Delhi.*
7. Elhance D N, Elhance,Veena and Aggarwal B M *Fundamentals of Statistics , Kitab Mahal*
8. Gupta, C B and Gupta, Vijay., *An Introduction to Statistical Methods, Vikas Publishing House*
9. Pillai , R S N and Bagavathi,V *., Statistics , S Chand& Co*

Core Course

ENTREPRENEURSHIP DEVELOPMENT AND PROJECT MANAGEMENT

Instructional Hours: 90 **Credit: 4**

Objectives:

- *To develop entrepreneurial spirit among students*
- *To empower students with sufficient knowledge to start up their venture with confidence*
- *To mould young minds to take up challenges and become employer than seeking employment and to make them aware of the opportunities and support for entrepreneurship in India*

Module I

Introduction to Entrepreneurship- Definition and Meaning- Distinction between entrepreneur and manager- Characteristics and traits of an entrepreneur- , Skills - Motivation of Entrepreneur- -Functions of an Entrepreneur- Role and importance of Entrepreneurship in economic development- Factors affecting growth of entrepreneurship **(10 Hours)**

Module II

Classification of entrepreneurs- Dimensions of Entrepreneurship-Intrapreneurship-Technopreneurship-Cultural Entrepreneurship- International Entrepreneurship-Ecopreneurship- Social Entrepreneurship and Women Entrepreneurship- Problems faced by Women Entrepreneurs-Entrepreneurship in Agriculture sector and service sectors- New avenues- Dealership, Networking and Franchising- Entrepreneurship in MSME- Micro Small Medium Enterprises-Definition- Role of MSME- Steps to establish an enterprise. **(25 Hours)**

Module III

Project Identification-Project- Meaning- Types- Project Management- Project life Cycle- Project identification- Sources of Project idea- Constraints in a project- Sources of Business idea-Protecting the Idea-Legal Protection in India-Trademarks- Copyright- Patent- Geographical Indication- Designs-Plant and Farmer Rights- **(15 Hours)**

Module IV

Project Formulation and Report- Formulation of a project**-** Stages in project formulation**- -** preparation of a project report- contents- project appraisal- various aspects of appraisal (Problems of appraisal techniques excluded) **(20 Hours)**

Module V

Entrepreneurial Support in India- Entrepreneurial Education and training- Entrepreneurship Development Programmes- Objectives and Methodology- The Concept, Role and Functions of Business Incubators- Start-Ups- Govt. of India Funding and Support for Start-Ups- Cluster Development Schemes- Pradan Mantri Mudra Yojana- Industrial Estates- Special Economic Zones- Other initiatives and assistance- Green Channel clearances- - Bridge Capital- Seed Capital Assistance- Special Institutions for Entrepreneurial Development and assistance in India-Functions of EDII, NIESBUD,NSIC, SIDBI and DIC **(20 Hours)**

Suggested Readings

1. Anjan, R. *Managing New Ventures, Concepts and Cases in Entrepreeurship,* New Delhi, PHI Learning Private limited.
2. Bhide A, *The Origin and Evolution of New Businesses,* New York, Oxford University Press.
3. Brandt, S. C. (1997). *Entrepreneuring: The 10 Commandments for Building a Growth Company.* New Delhi: Mc Millan Business Books.
4. Manjunath, N. (2008). *Entrepreneurship & Management.* Bangalore: Sanguine Technical Publishers.
5. Khanka S S- Entrepreneurial Development- S Chand and Sons
6. Desai,Vasant- Small Scale Business and Entrepreneurship- Himalaya Publications
7. AP Padnekar, Entrepreneurship, *Himalaya Publishing House, Mumbai.*
8. Rao, V S P- Business, Entrepreneurship and Management- Vikas Publishing House
9. Pandya, Rameswary- **.** Skill Development and Entrepreneurship in India, New Century Publications

SEMESTER 5

Core Course : COST ACCOUNTING- I

Instructional Hours: 108 **Credit: 4**

Objectives: *To familiarise the students with cost concepts and to make the students learn the Fundamentals of cost accounting as a separate system of accounting.*

Module I

Introduction to Cost Accounting- Meaning- Definition- Cost Concepts-Costing- Cost Accounting- Cost Accountancy- Objectives and functions of Cost Accounting- Cost Unit- Cost Centre- Responsibility Centres- Profit Centre- Cost Control- Cost Reduction- Distinction between Cost Accounting and Financial Accounting-Essentials of a good costing system- Installation of costing system- Methods and Techniques of Cost Accounting- Advantages and Disadvantages of Cost Accounting**-** Cost concepts and classification- elements of cost **(18 Hours)**

Module II

Accounting and Control of Material Cost- Material Purchase Procedure- Inventory control- Material Stock Level-EOQ- ABC- VED and FSN Analysis-JIT- Stock turnover- Material Issue control- Stores records- Bincard and Stores ledger- Documents authorizing movement of materials-Inventory systems:

Perpetual and Periodic Inventory System-Continuous Stock Taking - Material Losses-Wastage- Scrap-Spoilage-Defectives- Pricing of issue of materials- FIFO- LIFO- Simple Average- Weighted Average- **(25 Hours)**

Module III

Accounting and Control of Labour Cost- Time Keeping and Time Booking-Methods - Systems of Wage Payment-Time Rate System- Piece Rate System- Differential Piece Rate – Taylor's differential piece rate system- Merrick's differential piece rate system- Gantt Task and Bonus plan- Incentive Plans-Halsey Plan - Rowan Plan-Idle Time- Overtime and their Accounting Treatment- Labour Turnover-Causes and effects- Methods of Calculating Labour Turnover**.** **(20 Hours)**

Module IV

Accounting for Overhead-Classification of Overhead- Segregation of semi variable overhead-Production overhead- Allocation and apportionment- Primary and Secondary Distribution Summary-Absorption of Overhead- Methods of absorption of overheads- Overhead absorption rates- Actual and pre-determined rates- Blanket and Multiple rates- Over-absorption and Under-absorption- Reasons-Disposal- Introduction to Activity Based Costing (Problems of ABC excluded) **(25 Hours)**

Module V

Preparation of Cost Sheet- Cost sheet- Objectives- preparation- Tender and Quotation-Reconciliation Statement –Need- Reasons for disagreements in Profits-Preparation- Memorandum Reconciliation Account **(20 Hours)**

Suggested Readings

1. Jain, S.P., & Narang, K.L., Advanced Cost Accounting, *Kalyani Publishers, New Delhi.*
2. Iyengar, S. P., Cost Accounting, *Sultan Chand & Sons, New Delhi.*
3. Maheswari, S.N., Advanced Cost Accounting, *Sultan Chand & Sons, New Delhi.*
4. Arora, M. N., Cost Accounting, *Vikas Publishing House Pvt. Ltd, New Delhi.*
5. J Madegowda, Advanced cost accounting, *Himalaya Publishing House, Mumbai*
6. Shukla, M.C., and Grewal, T.S., Cost Accounting, *Sultan Chand & Sons, New Delhi.*
7. Lall Nigam B M and Jain I C, Cost Accounting Principles and Practice, Prentice Hall of India

Core Course : ENVIRONMENT MANAGEMENT AND HUMAN RIGHTS

Instructional Hours: 90 **Credit: 4**

Module I (18 Hours)

Unit 1 : Multidisciplinary nature of environmental studies (**2 Hours**)

Definition, scope and importance -need for public awareness.

Unit 2 : Natural Resources :

Renewable and non-renewable resources : Natural resources and associated problems.

Forest resources : Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. -**Water resources** : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. **Mineral resources** : Use and exploitation, environmental effects of extracting and using mineral resources, case studies. **Food resources** : World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. **Energy resources**: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources, Case studies. **Land resources**: Land as a resource, land degradation, man induced landslides, soil erosion and desertification - Role of individual in conservation of natural resources- Equitable use of resources for sustainable life styles. (**10 Hours**)

Unit 3: Ecosystems

Concept of an ecosystem -Structure and function of an ecosystem -Producers, consumers and decomposers- Energy flow in the ecosystem -Ecological succession-Food chains, food webs and ecological pyramids-Introduction, types, characteristic features, structure and function of the given ecosystem:- Forest ecosystem (**6 Hours**)

Module II (26 Hours)

Unit 1: Biodiversity and its conservation

Introduction –Bio geographical classification of India -Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values-India as a mega-diversity nation-Hot-sports of biodiversity-Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts-Endangered and endemic species of India (**8 Hours**)

Unit 2: Environmental Pollution

Definition, Causes, effects and control measures of: - Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards, Solid waste

Management: Causes, effects and control measures of urban and industrial wastes-Role of an individual in prevention of pollution, Pollution case studies, Disaster management: floods, earthquake, cyclone and landslides. **(8 Hours)**

Unit 3: Social Issues and the Environment

Urban problems related to energy, Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation of people: its problems and concerns, Case studies, Environmental ethics: Issues and possible solutions,-Climate change, global warming, acid rain, ozone layer depletion , nuclear accidents and holocaust, Case studies- Consumerism and waste products- Environment Protection Act - Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation, Public awareness (**10 Hours**)

Module – III (15 Hours)

Recent developments- Green Accounting- Meaning- History- Scope and Importance- Importance- Advantages and limitations- Green Banking- Meaning- benefits- coverage- steps in green banking- environmental risks for banks- Green banking initiatives- International initiatives- Initiatives in India- Green Marketing- Meaning- Need and benefits- Challenges- Green marketing in India- Green washing and consequences- Eco tourism- significance- eco tourism activities in India- Opportunities and challenges – carbon credit and carbon exchanges (over view only) - Environmental audit- concept- need and scope **(15 Hours)**

Module – IV (13 Hours)

Right to Information Act 2005- Basic terms- Public authority- Competent authority- Appropriate Government- Third Part- Information – record- Right to information- Objectives of the Act- Features of the Act- Obligation of Public authority- Procedure for request of information- time limit- fee- ground of rejection- appeal- exemption from disclosure- Right to access information on specific issues- Banking transactions, insurance transactions, government dealing and related services **(13 Hours)**

Module – V (18 Hours)

Unit 1- Human Rights– An Introduction to Human Rights, Meaning, concept and development, Three Generations of Human Rights (Civil and Political Rights; Economic, Social and Cultural Rights).

Unit-2 Human Rights and United Nations – contributions, main human rights related organs UNESCO, UNICEF, WHO, ILO, Declarations for women and children, Universal Declaration of Human Rights.

Human Rights in India – Fundamental rights and Indian Constitution, Rights for children and women, Scheduled Castes, Scheduled Tribes, Other Backward Castes and Minorities

Unit-3 Environment and Human Rights - Right to Clean Environment and Public Safety: Issues of Industrial Pollution, Prevention, Rehabilitation and Safety Aspect of New Technologies such as Chemical and Nuclear Technologies, Issues of Waste Disposal, Protection of Environment **Conservation of natural resources and human rights**: Reports, Case studies and policy formulation. Conservation issues of Western Ghats- mention Gadgil committee report, Kasthurirangan report. Over exploitation of ground water resources, marine fisheries, sand mining etc. **(18 Hours)**

Assignment may include Field study involving

- Visit to a local area to document environmental grassland/ hill /mountain
- Visit a local polluted site – Urban/Rural/Industrial/Agricultural Study of common plants, insects, birds etc
- Study of simple ecosystem-pond, river, hill slopes, etc

Suggested Readings

1. Bharucha Erach, Text Book of Environmental Studies for undergraduate Courses. University Press, IInd Edition 2013 (TB)
2. Clark.R.S., Marine Pollution, Clanderson Press Oxford (Ref)
3. Cunningham, W.P.Cooper, T.H.Gorhani, E & Hepworth, M.T.2001 Environmental Encyclopedia, Jaico Publ. House. Mumbai. 1196p .(Ref)
4. Dc A.K.Enviornmental Chemistry, Wiley Eastern Ltd.(Ref)
5. Down to Earth, Centre for Science and Environment (Ref)
6. Heywood, V.H & Watson, R.T. 1995. Global Biodiversity Assessment, Cambridge University Press 1140pb (Ref)
7. Jadhav.H & Bhosale.V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284p (Ref)
8. Mekinney, M.L & Schock.R.M. 1996 Environmental Science Systems & Solutions. Web enhanced edition 639p (Ref)
9. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co. (TB)
10. Odum.E.P 1971. Fundamentals of Ecology. W.B. Saunders Co. USA 574p (Ref)
11. Rao.M.N & Datta.A.K. 1987 Waste Water treatment Oxford & IBII Publication Co.Pvt.Ltd.345p (Ref)

12. Rajagopalan. R, Environmental Studies from crisis and cure, Oxford University Press, Published: 2016 (TB)
13. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut (Ref)
14. Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science (Ref)
15. Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards, Vol I and II, Enviro Media (Ref)
16. Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (Ref)
17. Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p (Ref)
18. (M) Magazine (R) Reference (TB) Textbook
19. Amartya Sen, The Idea Justice, New Delhi: Penguin Books, 2009.
20. Chatrath, K. J.S., (ed.), Education for Human Rights and Democracy (Shimla: Indian Institute of Advanced Studies, 1998)
21. Law Relating to Human Rights, Asia Law House,2001.
22. Shireesh Pal Singh, Human Rights Education in 21st Century, Discovery Publishing House Pvt.Ltd, New Delhi,
23. S.K.Khanna, Children And The Human Rights, Common Wealth Publishers,1998. 2011.
24. Sudhir Kapoor, Human Rights in 21st Century, Mangal Deep Publications, Jaipur,2001.
25. United Nations Development Programme, Human Development Report 2004: Cultural Liberty in Today's Diverse World, New Delhi: Oxford University Press, 2004.
26. Monica Loss,,Green Marketing Strategies and Consumer Behaviour, Global Vision Publishing House
27. Robert Dahlstrom- Green Marketing: Theory, Practice and Strategies, Cengage Learning India Private Limited
28. A N Sarkar , Green Banking , Atlantic Publishers
29. Thomas Aronsson and Karl Gustaf Lofgren, Edgar Handbook of Environmental Accounting, Elgar Publishing
30. M Sarngadharan and G Raju , Tourism and Sustainable Economic Developments: Indian and Global Perspectives – New Century Publishers
31. ICAI Study Material of Auditing
32. Right to Information Act, 2005

Complementary Course 3:

(Common for Finance and Taxation, Marketing, Travel and Tourism and Logistics Management streams)

E-COMMERCE

Instructional Hours-90 **Credit-4**

Objectives: *This course intents to build competencies in students-*

- *To understand the basic and emerging topics in E-Commerce*
- *To discuss E-Commerce from an enterprise point of view and think strategically about the role of IT for an organization's competitive position*

Module I

Overview of Electronic Commerce: Introduction to E-Commerce-Definition – Features -Advantages - Disadvantages and Challenges - Functions of E-Commerce – E-commerce transaction cycle – E-commerce opportunities - Types of E-Commerce- B2C-B2B-C2C- C2B- B2E- B2G- P2P - Models of E-Commerce - E-Commerce and E-Business – Transition to e-commerce in India

(20 Hours)

Module II

Application of E-Commerce: E-Banking - Online Share Trading - M-Commerce - E-Learning - E-Publishing - E-marketing – E-advertising – E-branding - Online Entertainment - Online Career Services - Electronic Data Interchange (EDI) - Enterprise Resource Planning (ERP) - Big Data Analysis - Cloud Computing - Google Analytics - Digital India Initiatives – E-Governance - E-Aadhar - Digital Locker - E-Sign – PayGov - Mobile Seva - eTaal **(25 Hours)**

Module III

E-payment Systems: E-payment requirements - Debit/Credit card payment - Net banking - Smartcard based payment – Digital token based payment - Digital wallet - e-cheque - e-cash – Cash on Delivery - Payment gateway - Risk in e-payment - Security Standard for Electronic Payment System

(12 Hours)

Module IV

E-Commerce Security: Need for Security of E-Merchant/Service Provider, Security of Clients, Basic Security Issues in E-Commerce- security threats – security measures - Digital Signature - Digital Certificate - Cyber Law – Provisions of IT Act 2000 - Penalties and Adjudication – Cyber related provisions under IPC - E-Commerce and Consumer Protection in India. **(18 Hours)**

Module V

Setting up of E-Commerce Business: Website development - Open Source E-Commerce Platforms – Components of website - Promotion of Websites and Apps - Search Engine Optimisation - Search Engine

Marketing - Social Media Optimisation - Viral Marketing - Electronic Customer Relationship Management (ECRM) - Electronic Supply Chain Management **(15 Hours)**

Suggested Readings

1. Daniel Minoli, E. M. (2014). *Web Commerce Technology Handbook.* New Delhi: Tata McGrow Hill.
2. Dave, C. (2014). *E- Business and E Commerce Manangement* . New Delhi: Prentice Hall.
3. Deital, H. M. (2013). *e-Business and e-Commerce for Managers.* New Delhi: Prentice Hall.
4. Goyal, D. (2010). *Management Information System.* New Delhi: Macmillan.
5. Joseph, P. (2012). *E Commerce- An Indian Perspective* (5 ed.). New Delhi: PHI.
6. Kamalesh, K. B. (2012). *E-Commerce, the Cutting Edge of Business.* New Delhi: Tata McGrow Hill.
7. Schneider Gary, P. (2015). *Electronic Commerce* (11 ed.). United Kingdom: Cengage Learning.

Complementary Course 3:

Programming in C
(Computer Application Stream)

Instructional hours- (54 theory and 36 practical) **Credit -4**

Module I

Basic concepts of programming. Algorithm and flowchart. Importance of C, Basic structure of C programs, C character set, Identifiers and keywords, Constants, variables, Data types- primary, derived and user defined data types. Defining symbolic constants, Declaration of variables, Operators and expressions- Arithmetic, Relational, Logical, Assignment, Increment & decrement and conditional operators, Evaluation of expressions, operator precedence. Input and output operations- Formatted input and formatted output. **(10 Hours)**

Module II Decision making and Branching : Simple If statement, if else , nesting of if .. else statement, Else if ladder, switch statements. Looping- while, do while, for statements, nested loop, break, continue and go to statements. **(24 Hours)**

Module III

Arrays- one dimensional and two dimensional arrays, Character arrays and strings, declaring string variables, Reading strings from terminal and writing strings to screen String handling functions.

(24 Hours)

Module IV

User defined functions – Need for user defined functions, Elements of function, Definition of functions, function call, Function declaration, Category of functions, Recursion, Scope, visibility and lifetime of variables. library functions: - Math.h, String.h, Conio.h and Stdio.h. **(12 Hours)**

Module V

Structures and Unions : Defining structure, Declaring structure variables, Accessing structure members, Unions- Definition, Difference between structure and Union, Pointer: Fundamentals - Understanding pointers, Declaration of pointer , Pointer expressions, **(20 Hours)**

Practical Session

1. Programs using branching statements
2. Programs using loops
3. Programs using one dimensional array and two dimensional array
4. Programs using User defined functions
5. Simple programs using pointers

Suggested Readings

Programming in ANSI C – E Balaguruswamy - Mc GrawHill Education

References

1. Let Us C – Yashavant Kanetker – BpB Publications

SEMESTER 6

Core Course: COST ACCOUNTING- II

Instructional Hours: 108 **Credit: 4**

Objectives: 1 *To acquaint the students with different methods and techniques of costing.and to enable the students to identify the methods and techniques applicable for different types of industries.*

Module I

Specific Order Costing- Job Costing – Meaning - Procedure- Batch Costing- Meaning- Procedure- Economic Batch Quantity- Contract Costing-Meaning- Objectives- Work-in-Progress Work Certified and Uncertified- Retention money and progress payments- Determination of Profit on Incomplete Contract- Treatment-Balance Sheet- Escalation Clause- Cost-plus Contract. **(20 Hours)**

Module II

Operating Costing- Definition- Transport costing- Canteen costing- Hospital costing **(15 Hours)**

Module III

Process Costing- Process Accounts- Process Losses- Normal and Abnormal losses- Abnormal Gain - Treatment- Joint Products and By-products- Methods of Apportioning Joint costs- Accounting for By-products **(24 Hours)**

Module IV

Marginal Costing and Break Even Analysis- Marginal Costing- Meaning-Definition- Difference between Marginal Costing and Absorption Costing - Differential Costing- Advantages and Disadvantages of Marginal Costing -Break Even Analysis- Cost Volume Profit Analysis- Break even chart- Simple Break Even Chart- Marginal Costing and Decision Making- Pricing Decisions- Key Factor- Make or Buy- Sales Mix- Acceptance of foreign Order. **(25 Hours)**

Module V

Budget and Budgetary Control- Meaning and Definition- Objectives- Steps in budgetary control- - Budget Manual Budget Committee- Budget key factor- Types of budgets- Advantages and limitations of budgetary control- Preparation of Cash Budget and Flexible Budget- Zero base Budgeting- Performance Budgeting. **(24 Hours)**

Suggested Readings

1. Jain, S.P., & Narang, K.L., Advanced Cost Accounting, *Kalyani Publishers, New Delhi*.
2. Iyengar, S. P., Cost Accounting, Sultan Chand & Sons, New Delhi.
3. Maheswary,S.N., Advanced Cost Accounting, Sultan Chand & Sons, New Delhi.
4. Arora, M. N., Cost Accounting, Vikas Publishing House Pvt. Ltd, New Delhi.
5. Shukla, M.C., & Grewal, T. S., Cost Accounting, Sultan Chand & Sons, New Delhi.
6. J Madegowda, Advanced cost accounting, *Himalaya Publishing House, Mumbai*
7. Lall Nigam B M and Jain I C- Cost Accounting Principles and Practice- Prentice Hall of India

Core Course: ADVERTISEMENT AND SALES MANAGEMENT

Instructional Hours: 72 **Credit: 3**

OBJECTIVE- *To make the students aware of the strategy, concept and methods of advertising and sales promotion.*

Module I

Introduction : Advertising-Meaning-Origin and development - Objectives-Importance- Functions of advertising-Role of advertisement in marketing mix- Classification and Types of advertisement- Merits and demerits- Advertisement process- Advertising planning- Key players in advertising industry- Advertisement agencies- Types and functions of advertising agencies- -Advertisement campaign - Social, economical and legal aspects of advertisement- Ethics in advertisement- meaning- perceived role of advertisement-Forms of ethical violation- misleading advertisements- advertising to children- product endorsements- stereotyping, cultural, religious and racial sensitivity in advertising- obscenity in advertising-misleading and deceptive advertising- false claims- Advertisement Standards Council of India – Regulation of advertising in India **(18 Hours)**

Module II

Advertisement appeal and media- Advertisement appeal- Meaning- essentials of an advertisement appeal- types of appeal- advertisement copy- requisites of an effective advertisement copy-types of copy-Elements of copy-Lay out- Functions of lay out- Elements of layout- Principles of design and layout-copy writing- qualities of a good copy writer- -Copy testing and advantages- Advertising media-Media planning and strategy-Types of media- Media selection-Importance of media planning and selection-problems in media planning- Internet as an advertisement medium- Objects of internet advertisement-Advantages and disadvantages of internet advertising – Permission marketing- Steps in permission marketing- **(18 Hours)**

Module III

Adverting research-Need for advertisement research- Measuring the effectiveness of advertising-Importance of measuring the effectiveness- Methods: Pre-testing, Concurrent testing and Post- testing-Constraints in measuring the effectiveness- DAGMAR model **(10 Hours)**

Module IV

Sales promotion-Promotion mix- Components- Sales promotion-Concept- Definition-Scope-Objectives-Importance of sales promotion- Methods and techniques of sales promotion -Sales promotion strategies-Differences between advertisement and sales promotion—Advantages and drawbacks of sales promotion-Sales promotion budget and its preparation-Sales promotion campaign-Evaluation of sales promotion strategies **(18 Hours)**

Module V

Personal selling-Nature and importance-Essential elements of personal selling- Process-Principles of personal selling- Types of sales persons-Sales force management-Designing and managing the sales force- Evaluating sales force **(8 Hours)**

Suggested Readings

1. Wells, Moriarty & Burnett, *Advertising, Principles & Practice, Pearson Education*
2. Kenneth Clow. Donald Baack, *Integrated Advertisements, Promotion and Marketing communication, Prentice Hall of India, New Delhi,*
3. S. H. H. Kazmi and Satish K Batra, *Advertising & Sales Promotion, Excel Books, New Delhi,*
4. Manendra Mohan - *Advertising Management – Concepts and Cases, Tata McGraw Hill*
5. Sherlekar, Victor & Nirmala Prasad - *Advertising Management - Himalaya Publishing House*
6. S.A. Chunawalla - *Promotion Management Himalaya Publishing House*
7. C.L. Tyagi, Arun Kumar- *Advertising Management- Atlantic Publishers and Distributors*

Complementary course 4:

(For Finance and Taxation Stream)

INCOME TAX – ASSESSMENT AND PLANNING

Instructional hours : 90 **Credit : 4**

Module 1. Assessment Of Firms & Association Of Persons : Conditions to Assess a Firm as a Partnership Firms - Unders Sections. 184 and 185 - Computation of Tax on Total Income of a Firm - Alternate Minimum Tax - Assessment of Association of persons/ Body of Individuals - Computation of Income of an AOP or BOI - Taxability on Share of Profit From AOP or BOI

(Instructional hours - 30)

Module 2. Assessment of co-operative societies : Rate of tax for co-operative societies - Deductions from gross total income under chapter VI A applicable to co-operative societies - Computation of Taxable Income and Tax Liability.

(Instructional hours- 15)

Module 3. Assessment of HUF : Hindu Coparcener - Karta of the Family, Schools of Hindu Law - Residential status of H.U.F- Computation of Income – tax payable.

(Instructional hours- 10)

Module 4. Assessment of Companies (Theory only) : Domestic Company - Foreign Company - Company in which Public are Substantially Interested - Rate of Tax applicable for Indian Companies - Rate of Tax applicable for Foreign Companies - Deductions from the gross total income, under Chapter VIA - Minimum Alternate Tax - Book Profit for the purpose of MAT - Tax Credit for Minimum Alternate Tax - Corporate dividend tax - Tax Under Tonnage Tax System.

(Theory only, Instructional hours- 10)

Module 5. Tax planning(Theory only) : Tax evasion -Tax avoidance - Tax planning - Tax management - Difference between Tax Planning and Tax Evasion - Difference between Tax Planning and Tax Management - .Need for Tax Planning - Limitations of Tax Planning – Tax Planning for Employees - Tax planning relating to income from house property - Tax planning relating to income from business - Tax planning relating to capital gains - Tax planning relating to income from other sources.

(Theory only -Instructional hours - 25)

Suggested Readings

1. Singhania,Vinod, K, & Singhania Monica Students Guide to Income Tax, *Taxmann Publication, New Delhi.*
2. Mehrotra, H.C., & Goyal, S. P., Direct Taxes Law and Practice- *Sahitya Bhawan Publications, Agra.*
3. Gaur, V.P., & Narang, D.B., Direct Taxes, *Kalyani Publishers, New Delhi.*
4. Income Tax Act

Complementary course 4:

(For Computer Application Stream)

DATABASE MANAGEMENT SYSTEM

Instructional Hours 90 (Theory 54 and Practical 36) **Credit 4**

Objective**:** *To familiarize the students with the concepts of database management and to equip them to handle the database for business firms*.

Module I

Database Concepts: Meaning – Character- Field-Record-File-Database- Types of Databases- Entities, Attributes, Keys – DBMS - Advantages of Database Systems – Entity Relationship Concepts -Data Independence - Components of DBMS.

(10 Hours)

Module II

RDBMS & Relationships in Database : Data Models - Relational Data Model - RDBMS - Relationships - Types of Relationships - One to One - One to Many - Many to Many – Functional Dependency - Normalization : Meaning , Schemas (1NF, 2NF, 3NF)- Defining Relationships -Referential Integrity- Key: Candidate key , Primary key Foreign Key. **(14 Hours)**

Module III

Basic Elements of Ms- Access 2013 : Introduction - Objects in Ms- Access - Create, Open, and Close a Database - Creating a Data Table - Different ways of Creating Tables - Data Types - The Primary Key - Properties of the Fields - Saving a Table - Closing a Table - Modifying Data Tables - Creating Table Relationships -Editing Relationships. **(24 Hours)**

Module IV

Queries & Forms in Access: Types of Queries - Creating a Query - Saving Queries -Summary Queries - Cross Tab Queries - Action Queries - Forms - The Form Wizard - Editing the Data in a Form - The Form Design View - The Form Design Bar - The Toolbox - Working with Controls. **(24 Hours)**

Module -V

Reports in Access: The Report Wizard - The Report Design View - The Report Design Bar - The Toolbox - The Preview Window - Grouping and Sorting - Printing a Report **(18 Hours)**

Practical Training: Creating and Modifying Data base - Creating Relationship between Tables - Using Queries for Viewing and Modifying Data from Tables -Working with Forms - Managing Controls in Forms -Generating Reports.

Suggested Readings

1. Ritchie, Collin, Principles of database systems and Design.
2. An Introduction to Database Systems: C.J. Date, A.Kannan & S.Swamynathan- Pearson Education.
3. Elmasri,Ramez and Navathe ,Shamkant B, Fundamentals of Database Systems.
4. Viescas, John L and Conrad Jeff , Microsoft Office Access 2013 Inside Out.
5. Connolly, Thomas and Begg, Carolynn , Learning SQL A step-by-step guide.
6. Michael Alexander, Richard Kusleika, Access 2013 Bible, Wiley Books.
7. Joan Lambert & Joyce Cox, Microsoft Access 2013 Step by step, Microsoft

Complementary Course III : TOURISM ENVIRONMENT AND ECOLOGY
(For Travel and tourism stream)

Instructional Hours-90 **Credit-4**

Objective*- To provide the basic knowledge of environmental and ecological aspects of tourism industry*

Module-I

Basic Principles of Ecology- Ecology and its Relevance for the Tourism Sector- Basic Properties of Eco-systems and their Relevance in the Context of Tourism Diversity (habitat, species, community)- Absorbing Capacity- Carrying Capacity-Resilience-Stability Dynamics- Multi-functionality-Integrity and Sustainability -Tourism and Environmental Linkage**.** **(20 Hours)**

Module-II

Tourism And Environment- Introduction To Human Ecology- Tourism Geography- Pollution Ecology- Energy Environment Nexus- Non-equilibrium Ecology- Ecological Footprint- Ecological and Socio-Economic Indicators Ecological Economics- Eco tourism and Eco-Culture Tourism- Adaptive Sustainable Management of Eco-systems with Special Reference to Tourism. **(20 Hours)**

Module-III

Emergence of Ecotourism-Concept and Definitions- Growth and Development- Eco-tourism Principles- Profiling the Eco Tourists- Eco Tourism Resources in India- National Parks- Wild- Life Sanctuaries-Tiger Reserves- Biosphere Reserves-Wetlands- Coral Reefs- Desert Eco-tourism.-Global Significance of Sustainable Tourism- Agenda 21 for Travel and Tourism Industry **(15 Hours)**

Module-IV

Alternative Tourism and Environmental Policy - Environmental Policy - Tourism Policy in India and its Linkage with Tourism- Common Property Resources in Tourism Management- Alternative Tourism- Definition- The Potentials and Constraints- Environment Guidelines and Environment Auditing - Environment Performance- Environment Reporting (**20 Hours)**

Module-V

Environmental Education and Legislation- Need and Strategies with Special Emphasis to Tourism- Planning for Sustainable Tourism- Government Measures- Local Self- government- Role of NGOs- Voluntary Associations- Review of Studies of Adversities of Tourism Industry- Recent trends.

(15 Hours)

Suggested Readings

1. Baldvin, J.H., Environmental Planning and Management, *I.B.D. Dehradun*

2. Singh, Ratandeep, Handbook of Environmental Guidelines for Indian Tourism, *Kanishka Publishers.*

3. Dash, M.C.,Fundamentals of Ecology, *Tata McGraw Hill Co. Ltd., Publishing Co. Ltd.)*

4. Khoshov, T.N., The Planning and Management of Environmentally Sensitive Areas *A.Lengman U.S* .

Complementary Course III : COSUMER BEHAVIOUR
(Common For Marketing stream and Logistics Management stream)

Instructional Hours-90 **Credit-4**

Objective*- To provide the basic knowledge of environmental and ecological aspects of tourism industry*

Module I

Introduction- Concept-Diversity of Consumer Behaviour-Characteristics of Indian Consumer Behaviour—Applications of Consumer Behaviour Knowledge in Marketing-Difficulties & Challenges in Predicting Consumer Behaviour-Emerging Issues **(16 Hours)**

Module II

Consumer Needs- Motives- Theories of Motivation and their Application-Personality and Self-concept-Theories of Personality-Perception-Thresholds of Perception- Consumer Attitude-Attitude Formation- Communication and Persuasion- Self-image- Life Style Analysis-Learning-Theories and its Application- Cognitive Learning Theories- Conditioning Theories. **(20 Hours)**

Module III

Influence on Consumers-Family-Social Class- Group Dynamics and Consumer Reference Groups-Cultural and Sub- cultural Aspects- Values- Beliefs- Tradition- Cross Cultural Consumer Behaviour. **(16 Hours)**

Module IV

Consumer Decision Making-Process of Decision Making-Models- Economic-Learning-Psychological- Sociological-Howard Seth-Engel-Kollat Model-NICOSIA Model- Diffusion of Innovations- Post Purchase Behaviour and Consumer Loyalty- Consumer Satisfaction Concept-Expectancy-Disconfirmation-Equity Theory- Attribution Theory-Loyalty Programmes- Types-Dissonance Management **(20 Hours)**

Module-V

Consumerism and Organizational Behaviour-Definition-Evolution of Consumerism- Consumer Protection Acts- Redressal Agencies-Organizational Behaviour- Meaning- Factors Influencing it-Organizational Buying Process- Future Trends **(18 Hours)**

Suggested Readings

1. Nair, Suja, R., Consumer Behaviour in Indian Perspective, *Himalaya Publishing House, Mumbai*
2. Sontakki, C.N., Consumer Behaviour, *Himalaya Publishing House, Mumbai*
3. Desmond, Consuming Behaviour, *Palgrave MacMillan, Guragaon*
4. Jain, P.C., and Monika Bhatt, Consumer Behaviour In Indian Context, *S.Chand& Company, New Delhi.*
5. Schiffman, L.G., & Kanuk, L. L., Consumer Behaviour, *Pearson Education, New Delhi*

Core Course: MANAGEMENT ACCOUNTING

Instructional Hours: 90 **Credit: 4**

Objective: *To acquaint the students with management accounting techniques for the analysis and interpretation of financial statements and to study the basic framework of financial reporting.*

Module I

Introduction to Management Accounting – Meaning- evolution- Definition- Nature and characteristics- scope- Objectives- Functions- Distinction between financial accounting and management accounting- distinction between cost accounting and management accounting- Tools of management accounting- Limitations of Management accounting **(10 Hours)**

Module II

Financial Statement Analysis - Financial Statements –Nature and limitations of financial statements- Analysis and Interpretation of Financial Statements- Objectives – Importance – Types of Financial Analysis – Internal- External – Horizontal – Vertical – Techniques of Analysis – Comparative Statements – Common Size Statements – Trend Analysis. **(15 Hours)**

Module III

Ratio Analysis –Meaning – Objectives- Importance and Uses – Limitations – Types and classification of Ratios – Liquidity Ratios –Solvency Ratios- Activity Ratios - Profitability Ratios – Preparation of Trading and Profit and Loss Account and Balance Sheet by using Ratios. **(25 Hours)**

Module IV

Fund flow Analysis – Introduction – Meaning and Definition of Fund - Need for Fund Flow Statement – Managerial Uses- Limitations –Schedule of Changes in Working Capital- Funds from operations- Preparation of Fund Flow Statement. **(20 Hours)**

Module V

Cash Flow Statement – Introduction – Meaning – Uses- Comparison between Fund Flow Statement and Cash Flow Statement – Preparation of Cash Flow Statement as per Accounting Standard 3 – Direct Method and Indirect method **(20 Hours)**

Suggested Readings:

1. Manmohan & Goyal, S.N., Management Accounting*, Sahithya Bhawan Publication, New Delhi.*
2. Lal, Jawahar, Corporate Financial Reporting, Theory & Practice*, Taxmann Applied Services, New Delhi.*
3. J Madegowda, Advanced Management Accounting, *Himalaya Publishing House, Mumbai*
4. Arora, M. N., Cost Accounting and Management Accounting*, Vikas Publishing House Pvt. Ltd, New Delhi.*
5. S P Gupta, Management Accounting, Sahityabhavan, Agra
6. Raiyani, J. R., & Lodha, G., International Financial Reporting Standard (IFRS) and Indian Accounting Practices*, New Century Publications*.
7. Pillai R S N and Bagavathi- *Management Accounting- S Chand & Company*
8. Management Accountant (Journal), *Institute of Cost Accountants of India, Kolkata.*

Optional Core Courses
Finance & Taxation

SEMESTER III

Optional – 1- GOODS AND SERVICES TAX

Instructional hours 90 **Credit 4**

Course objective ***: To give the students a general understanding of the GST law in the country with a practical perspective and employability to the students in the commercial tax practices.***

Module I

Stages of Evolution of GST - Methodology of GST - CGST - SGST - IGST - Important concepts and Definitions. GSTN. **(30 Hours)**

Module II

Levy and Collection of Tax - Scope of Supply - Composite and Mixed Supplies- Levy and Collection - Time of Supply of Good s- Time of Supply of Services - Input Tax Credit - Recovery of Credit - Tax Invoice - Unauthorised Collection of Tax - Credit Notes - Debit Notes - Accounts and Records. **(20 Hours)**

Module III

Registration - Returns And Payment of Tax - Persons Liable for Registration - Compulsory Registration - Deemed Registration- Procedure For Registration - Amendment of Registration - Cancellation of Registration - Returns - Furnishing Details of Supplies - Payment of Tax, Interest, Penalty - Tax Deduction At Source - Collection of Tax At Source - Refunds. **(15 Hours)**

Module IV

Assessment - Types - Audit Inspection - Search - Seizure - Inspection of Goods in Movement - Power of Authorities - Demands And Recovery - Fraud and Suppression of Facts - Liabilities - Provisional Attachment. **(15 Hours)**

Module V

Appeals - Appellate Authorities - Powers - Procedure - Appeal to High Court -Supreme Court - Offences and Penalties. **(10 Hours)**

(All the provisions in the Central GST, State GST and Integrated GST Acts and Rules as amended up to date will be applicable)

Suggested Readings:

1) *Indirect Taxes - Vinod K Singania,Taxmann's Publications, New Delhi*
2) *Indirect Taxes - H.C Mehrotra, Sahitya Bhavan Publications, New Delhi*
3) *Bare Act CGST*
4) *Bare Act SGST*
5) *Bare Act IGST*

SEMESTER IV

Optional Core – 2: FINANCIAL SERVICES

Instructional Hours: 90 **Credit: 4**

Objectives: *1. To provide the students with an overall idea of financial services available in the country and to create an understanding about recent trends in financial services sector.*

Module I

Introduction to Financial Services – Meaning – Types- Fund Based Financial Services- Fee Based Financial Services- Introduction to Merchant Banking Services in India- Role and Functions of Merchant Bankers **(15 Hours)**

Module II

Venture Capital and Securitisation - Features and Types of Venture Capital- various Stages of Venture Capital Financing- Factors affecting investment decision- Investment nurturing- Venture capital Exit strategies- Venture Capital Firms in India- Securitisation of Debt- Parties involved- Steps of securitisation - Types of securitisation- Advantages- Limitations – SARFAESI Act 2002- Background- Purpose of the Act- Main provisions **(20 Hours)**

MODULE III

Leasing and Factoring– Leasing- Essentials –Types- Operating and Financial Lease- Sale and Lease back- Other classifications- Advantages and Limitations of Leasing—Leasing Vs Hire purchase- Factoring-Parties involved- Process of Factoring- Functions of a Factor- Different Forms of Factoring Services- Factoring Vs. Bill Discounting – Forfaiting- Mechanism of Forfaiting- Factoring Vs. Forfaiting **(20 Hours)**

MODULE IV

Credit Rating –Meaning, types of Credit Rating- Need for credit rating-Factors affecting credit rating- Advantages and Limitations of Credit rating- Rating process and methodology Credit Rating Agencies in India. **(15 Hours)**

MODULE V

Mergers and Acquisition- Expansion of business firms- Internal and external expansion- forms of combinations- merger, acquisition and take over- Reasons for merger- Types of merger- Legal aspects involved- Valuation methods- Forms of financing mergers-Merger Vs Take over- Types of take over- Defense strategies against hostile takeovers- Mergers in India**-** Recent trends in financial services- Shadow Banking -Angel Funds- Hedge funds **(20 Hours)**

Suggested Readings

1. Bhole, L.M., Financial Institutions and Markets: Structure, Growth and Innovations *Tata Mc-Grow Hill. New Delhi:*
2. Gupta, N. K., Financial Markets, Institutions and Services, *Ane Books Pvt. Ltd. New Delhi*
3. Khan, M.Y., Financial Services - *Tata McGraw Hill New Delhi.*
4. Siddaiah, T., Financial Services Pearson Education New Delhi.
5. VA Avadhani, Financial Services in India, *Himalaya Publishing House, Mumbai*
6. Yogesh, M., Investment Management*, PHI Learning Pvt. Ltd. New Delhi:*
7. Shashi K Gupta and Nisha Agarwal- *Financial Services- Kalyani Publishers*

SEMESTER V

Optional Core-III: INCOME TAX- I

Instructional Hours-90 **Credit-4**

Objective :*To familiarise the students with Income Tax Act 1961 and to enable the students to compute Income taxable under the first three heads of Income.*

Module I

Introduction - Brief History of Income Tax in India - Basic Concepts- Finance Act- Definition of Income- Gross Total Income- Total Income-Assessee- Assessment Year Average Rate of Tax - Maximum Marginal Rate- Previous Year - Accelerated Assessment -Person - Finance Act- Rates of Income Tax-Capital and Revenue **(15 Hours)**

Module II

Residential Status- Incidence of Tax- Income Exempt from Tax- Heads of Income. **(15 Hours)**

Module III

Income from Salary- Chargeability- Definition – Perquisites- Profit in lieu of Salary -Deductions from Salary- Provident Funds and Treatment - Computation of Income from Salary

(25 Hours)

Module IV

Income from House Property - Basis of Charge - Deemed Ownership- Income from House Property Exempt from Tax- Annual Value and its Determination in Various Cases- Deductions Permissible- Unrealised Rent and Recovery of Unrealized Rent and Arrears of Rent- Computation of Income from House Property **(15 Hours)**

Module V

Profit and Gains of Business or Profession - Chargeability - Deductions Expressly Allowed - General Deductions - Depreciation - Expenses/Payments Not Deductible - Expenses Allowed on Actual Payment Basis Only- Deemed Profits U/S 41 - Computation of Profits and Gains of Business or Profession **(20 Hours)**

Suggested Readings

1. Singhania,Vinod, K., & Singhania Monica, Students Guide to Income Tax, *Taxman Publication, New Delhi.*
2. Mehrotra, H.C., Goyal, S. P., Direct Taxes Law and Practice- *Sahithya Bhawan Publications, Agra.*
3. Gaur, V.P, & Narang, D.B., Direct Taxes- *Kalyani Publishers, New Delhi.*
4. Income Tax Act

SEMESTER VI

Optional Core-IV:INCOME TAX -II

Instructional Hours-90 **Credit-4**

Objective- *To have an understanding of determination of Total Income and tax payable and to get an overview regarding returns to be filed by an individual and also assessment procedure*

Module-I

Capital gains - Basis of charge - Capital assets - Kinds- Computation of Short term and Long term Capital Gains- Computation of Capital Gain in following Special Cases - Conversion of Capital Asset into Stock in Trade - Transfer of Capital Asset by a Partner to a Firm, AOP, BOI - Compensation on Compulsory Acquisition of Assets and also Enhanced Compensation - Right Share and Bonus Shares - Converted Shares/Debentures - Capital Gains Exempt from Tax - Capital Gains Account Scheme - Computation of Income from Capital Gain. **(20 Hours)**

Module-II

Income from Other Source- General and Specific Chargeability- Kinds of Securities and Grossing up of Interest- Bond Washing Transaction- Deductions Allowed - Deduction Not permitted- Computation of Income under the head Income from Other Source. **(10 Hours)**

Module-III

Clubbing of Income - Aggregation of Incomes- Set off and Carry forward of Losses - Order of Set off - Computation of Gross Total Income - Deductions under Chapter VI A -Payment or Contribution deductions applicable to individuals from Sec 80C to 80GGC and deduction under Sec 80U- Total income **(25 Hours)**

Module-IV

Assessment of individuals - Agricultural Income - Partly Agricultural Income - Clubbing of Agricultural Income - Computation of Tax **(20 Hours)**

Module-V

Income Tax authorities - Powers and Functions - Assessment- Assessment procedure- Types of Return – E- filing of Return - Return through TRP- PAN - Types of Assessment - Tax Deducted at Source- TCS- TAN - A brief study on areas (a) Advance payment of tax (b) Refund (c) Recovery of tax (d) Tax Clearance Certificate – Tax planning -Tax evasion – Tax avoidance – Tax management (theory only) **(15 Hours)**

Suggested Readings

5. Singhania,Vinod, K, & Singhania Monica, Students Guide to Income Tax, *Taxmann Publication, New Delhi.*
6. Mehrotra, H.C., & Goyal, S. P., Direct Taxes-Law and Practice, *Sahitya Bhawan Publications, Agra.*
7. Gaur, V.P., &Narang, D.B., Direct Taxes, *Kalyani Publishers, New Delhi.*
8. Income Tax Act

Optional Courses- Computer Applications

SEMESTER III

Optional Core I-INFORMATION TECHNOLOGY FOR BUSINESS

Instructional Hours: 90 (54 theory and 36 practical) **Credit: 4**

Objectives: *1. To make the students aware of the role of information technology in business and make them capable of developing web pages for business*

Module I

Introduction to Information Technology -Informatics - Information Technology -E-World -Information Systems–Hardware and Software: Input, Processing, Storage, Output and Communication Hardware– Software: System Software and Application Software – Operating System: WINDOWS, UNIX and LINUX – Versions. Free Software Movement – Futuristic IT – Artificial Intelligence – Virtual Reality. **(16 Hours)**

Module II

Social Informatics - IT and Society –IT Applications in Commerce, Business and Industry – IT Applications in Education, Teaching and Learning – Computer and Health Issues – Proper Usage of Computers and Internet – Cyber Ethics - Cyber Addiction –Cyber Crime -E-waste and Green Computing. **(12 Hours)**

Module III

Network and Communications - Computer Networks – Types of Networks: WAN, MAN, LAN, PAN, CAN- Benefits of Networks, Network Topology –Work Group Computing & Groupware - Telecommuting & Virtual Offices - Network Security –Firewalls. Communication Medium: Wired and Wireless – Generations in Communication. **(15 Hours)**

Module IV

HTML and Webpage - Introduction to HTML – Essentials- Static & Dynamic Web Pages - Structure of a Web Page - Designing Web Pages- HTML Tags -Text Formats- Working with Text- Presenting and Arranging Text-Paragraphs- Animated Effects: Marquee – using White Space - Tables in HTML- Working with Links, E-mail Links, Lists, Images, Thumbnails, Rollover Images, Audio & Video-Forms & Frames - Website Management. **(34 Hours)**

Module V

Internet -Working Concepts -Devices, History, Benefits and Drawbacks - Internet Structure, Internet Protocols: TCP/IP, FTP, HTTP, etc., IP Address, Domain Name System (DNS), URL, Web Browsers, WWW Consortium, Search Engines – Types, Academic Search Techniques - Business Applications of Internet, Internet Access Methods - Intranet and Extranet. **(13 Hours)**

Practical Training:

1. Designing a web page for your Department
2. Designing a web page for a Retail Marketing Firm.
3. Design a web page for a Hotel

Suggested Readings

1. Alexis Leon & Mathews Leon, Fundamentals of Information Technology, *Vikas Publishing House, New Delhi.*
2. Williams &Sawyer, Using Information Technology (6th Edition*), Tata McGraw Hill Company.*

3. Avi Silberschatz Peter Galvin & Greg Gagne, Operating System Concepts (Windows XP update) .Willey *India.*
4. *Uyless Black,*Computer Networks, Protocols, Standards and Interface, *Prentice Hall India Pvt. Ltd.*
5. Nagpal, D.P., Web Design Technology Theory and Techniques on the Cutting Edge, *S.Chand& Company Ltd*

SEMESTER IV

Optional Core II:INFORMATION TECHNOLOGY FOR OFFICE

Instructional Hours: 90 (54 theory and 36 practical) Credit: 4

Objectives- *The objective of this course is to make the students capable of managing the office activities with the help of information technology.*

Module-I

Word Processing Package: MS-Word 2013- Introduction-Features- Word User Interface Elements-Creating New Documents- Basic Editing- Saving a Document- Printing a Document- Print Preview-Page Orientation- Viewing Documents- Setting Tabs-Page Margins- Indents- Ruler- Formatting Techniques-Font Formatting- Paragraph Formatting- Page Setup- Headers &Footers-Bullets and Numbered List-Borders and Shading- Find and Replace-Page Break Page Numbers-Mail Merging-Spelling and Grammar Checking- Thesaurus- Macros- Tables- Side-By-Side and Nested Tables- Formatting Tables- Drawing-Word art- Paint Brush Document Templates – Email Editor. **(18 Hours)**

Module-II

Desktop Publishing- PageMaker 7.0 - Introduction to Desktop Publishing as a Process- PageMaker Tools and Palettes- Working With Objects -Type Styling Options - Working With Text - Formatting Options-Leading, Margins and Indents - Scaling Text-Paragraph Formatting Options -Working With Grids - Creating Frames - Layers**.** **(18 Hours)**

Module-III

Spreadsheet Package: MS -Excel 2013-Introduction-Excel User Interface- Working With Cell and Cell Addresses- Selecting a Range, Moving, Cutting, Copying With Paste-Inserting and Deleting Cells-Freezing Cells- Adding, Deleting and Copying Worksheet Within a Workbook- Renaming a Worksheet-Cell Formatting Options- Formatting Fonts- Aligning-Wrapping and Rotating Text- Using Borders-Boxes and Colors- Centering a Heading, Changing Row/Column Height / Width-Formatting a Worksheet Automatically- Insert Comments- Clear Contents in a Cell- Using Print Preview- Preparing Worksheet for the Printer- Selecting Print Area-Margin and Orientation- Centering a Worksheet- Using Header and Footer- Inserting Page Breaks- Sorting Data. **(22 Hours)**

Module-IV

Advanced Features of Excel: All Functions in Excel- Using Logical Functions-Statistical Functions-Mathematical Functions - Linking Data between Worksheet- Elements of Excel Charts-Categories-Create a Chart- Choosing Chart Type- Edit Chart Axis - Titles, Labels, Data Series and Legend- Adding a

Text Box- Rotate Text in a Chart- Converting a Chart on a Web Page- Saving a Chart- Designing of Templates in Excel. **(20 Hours)**

Module-V

Presentation Package: Ms-Power Point 2013-Advantages of Presentation- Screen Layout- Creating Presentation- Inserting Slides-Adding Sounds and Videos-Formatting Slides -Slide Layout Views in Presentation - Colour Scheme- Background Action Buttons- Slide Transition- Custom Animation- Creating Master Slides- Managing Slide Shows - Using Pen Setting Slide Intervals. **(12 Hours)**

Practical Training:

1. Create a small poster using PageMaker
2. Create a Brochure using PageMaker
3. Prepare Pay rolls in Excel
4. Conditional Cell Formatting
5. Analysis and presentation of data using charts in Excel
6. Usage of Functions in Excel
7. Mail merging feature of Word.

Suggested Readings

1. Gini, Courter & Annette Marquis, Ms-Office *2013, BPB Publications*
2. Patrick Blattner, Louie Utrich. Ken Cook & Timothy Dyck, *Special Edition Ms Excel 2013*, *Prentice Hall India Pvt. Ltd.*
3. Atman Rebecca & Atman Rich, Mastering PageMaker*, BPB Publications*
4. *Building a Foundation with Microsoft Office 2013*
5. *Welcome to Microsoft Office*

SEMESTER V

Optional Core III: COMPUTERIZED ACCOUNTING

Instructional Hours: 90 (54 theory and 36 practical) **Credit :4**

Objectives:

1. *To equip the students to meet the demands of the industry by mastering them with industry sought after computerized accounting packages.*
2. *To expose the students to computer applications in the field of accounting.*
3. *To develop practical skills in the application of Tally Accounting Package.*

Module I

Introduction to Computerized Accounting**-** Computerized Accounting Vs. Manual Accounting- Merits of Computerized Accounting –Tally ERP 9-Features of Tally ERP 9– Screen Components-Creation of Company- Selecting a Company – Altering/ Modifying Company Creation Details – Deleting a Company – F 11 Features – F 12 Configuration. **(6 Hours)**

Module II

Accounts and Vouchers– Account Groups – Pre-Defined Groups – Creating Single& Multiple Groups – Creation of Primary Account Groups – Creating Ledger Accounts in Single & Multiple – Displaying-Altering and Deleting Account Groups and Ledgers –Accounting Vouchers- Entering Transactions in Accounting Vouchers – Bill Wise Details -Altering and Deleting a Voucher Entry – Creating New Voucher Types – Modifying an Existing Voucher – Duplicating a Voucher – Optional Vouchers – Post-Dated Vouchers – Reverse Journal – Bank Reconciliation Statement - Creating Budget - Generating Reports - Configuring Reports Balance Sheet – Profit and Loss Account – Trial Balance – Day Books – Account Books –Statement of Accounts – Ratio Analysis - Cash Flow - Fund Flow – List of Accounts – Exception Reports. (**20 Hours)**

Module III

Accounts With Inventory– Enabling F 11 and F 12 - Stock Category – Stock Group Single/Multiple Creation of Stock Category and Stock Group – Creation of Units of Measurement – Creating Single/Multiple Stock Items – Creating Godowns - Displaying, Altering and Deleting Stock Groups, Units, Items and Godowns – Cost Categories- Cost Centres – Creating Cost Categories and Cost Centres - Displaying, Altering and Deleting Cost Categories and Cost Centres – Purchase / Sales Orders - Inventory Vouchers - Using Inventory Vouchers – Using Accounting Vouchers With Inventory Details (Invoice Mode) - Tally Security - Tally Vault –Tally Audit – Advanced Security Control – Back-Up and Restore – Inventory Reports – Stock Summary - Inventory Books – Statement Of Inventory. **(22 Hours)**

Module IV

Accounting With Tax– F 11 &F 12 Settings For Taxation – TDS – Ledgers Related to TDS – Creating TDS Voucher Types - TDS Reports – TCS – Service Tax - VAT –VAT Terminologies – Computing VAT – Ledgers and Vouchers Pertaining to VAT – VAT Reports – VAT Forms – Interstate Trade and CST. **(20 Hours)**

Module V

Payroll: Enabling Payroll – Creating Pay Heads – Single/Multiple Creation of Employee Groups - Single/Multiple Creation of Employee Head – Salary Details – Configuration of Salary Details - Creating Units of Work – Managing and Creating Attendance / Production Types – F 12 Payroll Configuration – Payroll Vouchers – Creating Payroll Voucher Types -Displaying, Altering and Deleting Payroll Documents – Payroll Reports (Full) – Configuring All Payroll Reports – Statutory Deductions – PF – Employers Contribution to PF – PF Ledger Heads– PF Related Heads in Pay Structure –Gratuity Calculation, Creation and Accounting - Generating a Sample Pay Slip – Employee Loan & Salary Advance Management. **(22 Hours)**

Practical Training

- Prepare final accounts of a Company in Tally ERP 9 with Inventory
- Prepare final accounts of a company in Tally ERP 9 incorporating VAT and TDS
- Preparation of payroll

Suggested Readings

1. Roopa, Tally for Every one - *ATC Publishing Chennai*.
2. Nadhani, A.K. Implementing Tally ERP 9
3. A Comprehensive Guide to Tally ERP 9, Tally Manual

SEMESTER VI

Optional Core IV: SOFTWARE FOR BUSINESS AND RESEARCH

Instructional Hours 90 (54 theory and 36 practical) Credit 4

Objectives:

- *To impart knowledge to use IT in business research analysis.*
- *To develop practical skills in the applications of business software.*

Module I

Data Analysis: Data – Meaning and Definition – Sources of Data – Data Life Cycle – Processing – Methods and Types- EDP – Information – Value of Information in Decision Making - Information and Analysis of Business Research – Data Processing Software. **(6 Hours)**

Module II

Introduction to SPSS: Menus, tool bar – SPSS layout- Variable View – Data View – Output View – Terminology - Basic Steps for Performing any Statistical Procedure – Creating a Data file- Defining Variables- Variable Characteristics- Default Values - Entering the Data – Inserting Variable and Cases – Selecting Cases - Listing Cases – Identifying Duplicate Cases and Unusual Cases- Sorting Cases.

(24 Hours)

Module – III

Data Transformation: Computing New Variables – Recoding Variables – Automatic Recode – Visual Binning – Rank cases – Types of Measurement Scales – Summary Measures - Frequency, Explore and Cross Tabs – Describing Data Graphically - Descriptive Data Analysis- Number of cases, Minimum, Maximum, Sum, Mean, Standard Deviation, Variance, Kurtosis, Skewness - Bivariate Correlation.

(20 Hours)

Module – IV

Libre Office Writer: Free Software – Libre Office - Writer – User Interface – Creating new Document – Page setup - Saving Documents – Basic Editing – Find and Replace - Formatting Text – Copying and Moving Text – Indenting and Spacing – Headers and Footers – Bulleted and Numbered lists – Tables - Previewing and Printing. **(20 Hours)**

Module – V

Libre Office Calc: Spread Sheet – Features – User Interface – Cells – Selecting – Moving and Copying – Text Alignment – Formatting Text – Inserting and Deleting Columns and Rows – Adding and Renaming Worksheets – Borders, Boxes and Colors – Formatting Worksheet – Entering Formulae – Functions – Charts – Previewing and Printing. **(20 Hours)**

Practical Training

- List out frequency table, cross tab and graphs related with the marks and details of students in a class.
- Prepare a report on descriptive analysis of any relevant Socio demographic details related with social issue.
- Prepare a letter using Writer
- Prepare a mark sheet using Calc

Suggested Readings

1. Tutorial of IBM SPSS Statistics.

2. Kiran Panya, Smruti Bulsari & Sanjay Sinha., *SPSS in Simple Steps,* First edition, Durga Enterprises, Delhi.
3. Field A., *Discovering Statistics Using SPSS,* Fourth Edition, SAGE Publishers, 2013
4. Libre Office Handbook
5. Keith Gordon, Principles of Data Management, BCS Publications, UK

Optional Courses- TRAVEL & TOURISM

SEMESTER III

Optional Core I: FUNDAMENTALS OF TOURISM

Instructional Hours-90 **Credit-4**

Objectives- *To provide the basic knowledge of tourism as a growing industrial branch of the Indian Economy*

Module-I

Introduction to Tourism Industry- Meaning and Definition of Tourism- Nature and Scope- Historical Perspective of Tourism Industry in India- Growth of Indian Tourism- Ministry of Tourism (GOI)-Aims and Functions. **(15 Hours)**

Module-II

Types of Tourism- Pilgrimage- Cultural-Folklore-Farm-Eco-Business- Adventure Rural- Cuisine-Monsoon- Community-Based Tourism- Sports Tourism- Health Tourism- Responsible Tourism -Main Characteristics and Activities Involved. **(15 Hours)**

Module-III

Tourism Products- Meaning And Concept- Components- Art And Architecture -Archaeological Sites-Monuments- Forts And Palaces Museums-Traditions And Festivals- Nature-Based Tourism- Wild-Life Sanctuaries-National Parks- Hill-Resorts- Desert Safari- Indian Beaches And Backwaters- Indian Folk-Culture-Customs- and Costumes. **(20 Hours)**

Module-IV

Tourism Planning and Development-General concepts of Planning- Major Types of Planning-Need for Tourism Planning-Different Types of Tourism Planning-Ten Main Steps or Phases in the Planning Process- Sustainability and Sustainable Tourism Development **(20 Hours)**

Module-V

Impact of Tourism: - Meaning, Positive and Negative Impacts of Tourism: - Social, Cultural, Economic and Environmental. Tourism Economic Multiplier- Employment Multiplier- The WTO Conference- The Manila Declaration **(20 Hours)**

Suggested Readings

1. Bhatya, A.K., Tourism Development Principles and Practices, *Kalyani publishers West Bengal.*

2. Kamra, K.K., & Mohinder Chand Basics of Tourism, *Sterling Publicatioin, New Delhi.*
3. Ratandeep Singh, Dynamics of Modern Tourism –*Kanishka Publication New Delhi*
4. Tewari, S.P., Tourism Dimensions, *Atma Ram and Sons Publication,New Delhi.*
5. Sinha, P.C., Tourism Impact Assessment, *Anmol Publications Pvt. Ltd. New Delhi.*

SEMESTER – IV

Optional Core II: TRAVEL AND TOURISM INFRASTRUCTURE

Instructional Hours: 90 **Credit-4**

Objective- *To introduce the role of travel and infrastructure in the development of tourism industry.*

Module-I
Tourism Infrastructure - Meaning and Scope of Tourism Infrastructure- Transport- Roads and Canals- Building for Residential Accommodation- Recreation Centres- Amusement Parks- Relationship between Tourism Infrastructure and the Arrival of the International Tourists - Role of Government in Improving and Preserving Tourism Infrastructure- National Policy of the Government for Promoting Infrastructural Facilities**.** **(20 Hours)**

Module-II
Historical Growth and Development of Travel Agency and Tour Operation Business **-** Travel Agency- Meaning- Definition- Importance- Types of Travel Agency- Functions of Travel Agency -Tour Operators-Features of Tour- Operators-Types of Tour Operators - Functions of Tour Operators - Role of Tour Operators and Travel Agencies in the Growth of Tourism Industry. **(15 Hours)**

Module-III
Setting up of Travel Agency and Tour Operation Business - Travel Agency and Tour Operation Business- Approval Formalities-Setting Procedure and Process- Ministry of Tourism, Govt. of India and IATA Guidelines - Revenue Sources of Travel Agency and Tour Operation - Financial Incentives Available for Travel Agency and Tour Operator in India **(20 Hours)**

Module-IV
Tourism Demand - Concept of Demand and Supply in Tourism - Unique Features of Tourist Demand - Determinants of Demand for Tourism- Measuring Demand for Tourism - Importance of Measurement of Demand- Tourist Statistics-Volume Statistics- Value (Expenditure) Statistics-Visitor Profile (Characteristics) Statistics. **(15 Hours)**

Module-V
Travel Formalities and Regulations-Concept- Meaning and Scope- Issues of Passports- Visa- Foreign Exchange- Customs and Immigrations- Air Cargo Documentation- Domestic and International Rate-

Departure and Arrival Formalities- Nature of Cargo- Security of Cargo and its Clearance- Information Technology and Travel Formalities. **(20 Hours)**

Suggested Readings:

1. Jagmohan Negi, Travel Agency and Tourism Operations and Concepts and Principles, *Kanishka Publishers*.
2. Sinha,P.C., Encyclopedia of Tourism Management, *Anmol Publications*.
3. Sunetra Roday, Archana Biwal & Vandana Joshi, Tourism Operations and Management *Oxford University Press.*
4. Manjula Chaudhary, Tourism Marketing, *Oxford University Press.*
5. Jha,S.M, Services *Marketing*, *Himalaya Publishing House*

SEMESTER V

Optional Core III: HOSPITALITY MANAGEMENT

Instructional Hours: 90

Credit: 4

Objective*- To Understand the Essentials of Hospitality Management for Taking up Hospitality Business.*

Module I

Introduction to Hospitality Management- Concept of Hospitality-Meaning-Definition and Nature of Hospitality- Hospitality in the Cultural Settings of India- Inducting Management in Hospitality Industry-Historical Perspective of Hospitality Management- Objectives of Hospitality Management- Prerequisites of Hospitality Management- Hospitality Management in the Indian Scenario. **(10 Hours)**

Module II

Organization and Function of Hotel Industry-Hotel Industry - Concept- Meaning and Scope- Functional Departments of Hotel Industry- Functions of Front Office-Management of Front Office-House-Keeping functions-Nature and Dimensions- Food and Beverages- Managements of Food Services- Restaurant Infrastructure and Management- Food Production Infrastructure- Supporting Services- Purchase- Storage and Sales **(15 Hours)**

Module III

Accommodation Marketing- Role of Accommodation in Tourism- Types of Accommodation- Grouping and Categorization of Hotels- Registration Forms of Hotel Ownership- Pricing Strategies of Hotels-Price-offs as Sweep Takers in the Competitive Economy- Promotion of Hotel Accommodation- Domestic and Overseas Promotion- Emerging Trends in Promotion of Hotel Accommodation - Public Relation and Hotel Industry. **(25 Hours)**

Module IV

Managerial Issues in Hospitality Management.-Concept of Managerial Issues Ethical, Cultural and Social Issues- Threats and Challenges of Managing Hotel-Human Resources Management of Hotels Interface between Travel Agencies and Hotelier's- Catering - Types - Railways - Airways - Role of Private and Public Agencies in Catering for Tours. **(20 Hours)**

Module V

Emerging Trends in Hospitality Management- Changing Scenario of the Hospitality Industry-Eco-friendly Accommodation-Heritage Accommodation - Seasonality and Promoting Domestic Market for Hotel Industry- Multi-Purpose Accommodation- Seminar- Conference- Business Meet- Independent Guest Houses- Private Agencies in Guest House Accommodation- Government and Hotel Industry-Fiscal and Non-Fiscal Incentives- Challenges of Hospitality Industry in India **(20 Hours)**

Suggested Readings:

1. John, R., Warker, Introduction of Hospitality, *PHI, New Delhi.*
2. Zeithaml, V.A., Service Marketing, *McGraw Hill, London*
3. Gray & Ligouri, Hotel and Motel Management and Operations, *PHI, New Delhi*
4. Andrews, Hotel Front Office Training Manual, *Tata McGraw Hill, Mumbai*
5. Negi, Hotels for Tourism Development, *S.Chand, New Delhi.*

SEMESTER VI

Optional Core IV: TOURISM AND CULTURAL HERITAGE OF INDIA

Instructional Hours-90 **Credit-4**

Objective- *To provide the students an insight of the relevance of Indian culture and heritage for the development of tourism industry.*

Module I

Introduction to the Indian Culture - Definition of Culture- Heritage and Civilization- Culture and its Determinants- Culture Society and History- Political Structure and their Impact on Culture- Outside Influences and Culture- Cultural Awareness and History- Indian Culture-Perspectives for Tourism.

(15 Hours)

Module II

Historical Evolution- Harappan Period- Vedic Civilization- Early Vedic Period- Later Vedic Period-Post Vedic Period – Social and Structural Change- Family-Lineage and Caste- Buddhist Epoch- Gupta Period-Post Gupta Period – Medieval Period – Changes in Hindu and Muslim Caste-Colonial Period-Post Colonial Period- Contemporary Period. **(15 Hours)**

Module III

Conservation of Culture-Culture of Tourism Versus Tourism of Culture- Conservation and Significance-Conservation of Natural Heritage-Conservation of Historical Heritage- Archaeological Sites and Monuments-

World Heritage List- Main Problems of Conservations of Monuments- Organization of Enterprise-Conservation and Preservation of the Artistic and Cultural Heritage- Tourism and Culture the Views in Indian Context. **(20 Hours)**

Module IV

Features of Indian Culture-Assimilation-Unity in Diversity-Patriarchy and Women- Syncretic Tradition-Religious Tolerance-Cultural Tolerance of Elite and Masses- Contribution of Mughals to the Indian Culture – Art and Architecture Under Mughals- The British – Birth of Indian Nationalism– Factors favouring Growth of Nationalism– Independent India. **(20 Hours)**

Module-V

Emergence of Political Struggle for Responsible Govt. (Kerala) - Anti Colonial Movement- Modern Kerala's Political and Cultural Changes - Educational Progress and Trends in Kerala Tourism **(20 Hours)**

Suggested Readings

1. Jha, D.N., Ancient India – An introductory out line ,*Rupa& Co. New Delhi*
2. Pandey, A.B., *The Medieval India (Mughal period), Vol.II*
3. Kosambi, D.D., Culture and Civilization of Ancient India in Historical Outline
4. Sharma, R.S., Aspects of Ancient Indian Political Ideas and Institutions- *1959, Delhi.*
5. Sharma,R.S., Indian Society, Historical Probing,

Optional Courses- MARKETING

SEMESTER III

Optional Core I: CUSTOMER RELATIONSHIP MANAGEMENT

Instructional Hours – 90 Hours **Credit -3**

Objectives: *The purpose of this course is to familiarize the students with the concepts and strategies involved in Customer Relationship Management*

Module I

Customer Relationship Management – Introduction – Definition-Need for CRM - Concepts - Customer Loyalty and Optimizing Customer Relationships - Strategic Framework for CRM - Origin and Role of CRM - Components of CRM-CRM Processes. **(20 Hours)**

Module II

Customer Satisfaction- Product Marketing- Direct Marketing- Customer Learning Relationship- Key Stages of CRM-Forces Driving CRM- Benefits of CRM-Growth of CRM Market in India- Key Principles of CRM. **(20 Hours)**

Module III

CRM Strategy- CRM Strategy Development Process-CRM Value Creation Process- Customer Profitability-Customer Acquisition and Retention - Customer Strategy **(15 Hours)**

Module IV

CRM Process Framework- Governance Process- Performance Evaluation Process- Monitoring System- Key Performance Indicators- CRM Budget and CRM Return on Investment **(15 Hours)**

Module V

Use of Technology in CRM- Call Centre Process- CRM Technology Tools -Implementation- Selection of CRM Package- Reasons for Failure of CRM **(20 Hours)**

Suggested Readings

1. Peelen, E.D., Customer Relationship Management, *Pearson Education, Mumbai.*
2. Francis, Buttle & Stan Maklan, Customer Relationship Management Concepts and Technologies, *Taylor and Francis , UK.*
3. Bhat, G.K., Customer Relationship Management, *Himalaya Publishing House, Mumbai.*
4. Peeru, H., Mohamed & Sagadevan, A., Customer Relationship Management, *Vikas Publishing House,Noida.*
5. Sontakki,C.N., Marketing management,10th revised edition (2013), *Kalyani Publishers, New Delhi.*

SEMESTER – IV

Optional Core II: SERVICE MARKETING

Instructional Hours: 90 **Credit -4**

Objective: *To develop insights into emerging trends in the service sector and tackle issues involved in the management of services.*

Module-I

Concept of Service – Meaning – Definition - Components and Tangibility-Growth of Service Sector-Challenges and Strategies-Classification of Services- Marketing Triangle-Marketing of Services.

(16 Hours)

Module -II

Marketing Mix in Service Marketing-7 Ps- Product Decision- Pricing Strategies-Promotion of Services-Placing or Distribution of Services -Additional Dimensions – People-Physical Evidences-Process.

(**20 Hours)**

Module -III

Consumer Behaviour in Services- Behavioural Profile of Consumers-Customer Satisfaction and Expectation Gap Analysis-Quality Perceptions in Service- Measurement of Service Quality-SERVQUAL Dimensions-Service Recovery and Problem Solving-Employees Role in Service Marketing-Role of Technology.

(**20 Hours)**

Module -IV

Service Market Segmentation - Bases – Positioning-Differentiation and Retention Strategies Applicable to Service Marketing- Relationship Marketing. **(16 Hours)**

Module –V
Marketing of Services with Reference to Tourism - Financial Services and Health-Trends in Service Marketing. **(18 Hours)**

Suggested Readings:

1. Christopher Lovelock, Service Marketing, *Pearson, Mumbai.*
2. Helen Woodruffle, Service Marketing, *Macmillaian India.*
3. Rao, Service marketing, *Pearson, Mumbai.*
4. Roland Rust and Anthony Timothy, Service Marketing, *Haper Collins College Publishers.*
5. *Indian Journal of Marketing (ISSN 0973-8703),New Delhi-110016*

SEMESTER V

Optional Core III: MARKETING RESEARCH

Instructional Hours: 90 **Credit: 4**

Objective*: To acquaint the students with the method and techniques of marketing research.*

Module-I
Research-Types-Marketing Research-Definition-Significance-Areas Covered by Marketing Research-Market and Marketing Research-Outside Agencies and Research-Reliable Information Sources in India-Limitations of Marketing Research. **(14 Hours)**

Module-II
Research Design-Exploratory-Descriptive-Diagnostic-Experimental-Before only - Before and After-After Only with Control-Before and After With Control Independent and Extraneous Variable-Treatment **(16 Hours)**

Module-III
Collection of Data-Primary and Secondary-Sampling and Sampling Design-Probabilityand Non Probability Sampling-Collection of Data-Methods for Collection of Both Primary and Secondary Data-Scale of Measurement and its Basics **(18 Hours)**

Module-IV
Data Processing-Coding-Editing-Tabulation-Testing of Hypotheses- Steps –Parametric and Non Parametric Tests(Theory only) - MANAOVA-ANCOVA-Chi-square Test-Use of SPSS **(30 Hours**)

Module-V
Reporting- Report of Research Findings-Types of Report-Report Format-Contents **(12 Hours)**

Suggested Readings

1. Kotler, Philip, Armstrong, Gary, Prafulla Y Agnihotri& Khsanul Haque, Principles of Marketing, *Pearson Education Inc, South Asia*.
2. Kotler, Philip, Kerin Lave, Koshy, Abraham, & Jha, Mitheleswar, Marketing Management, *Pearson Education Inc., South Asia.*
3. Stanton, J.W., Fundamentals of Marketing, *McGraw Hill, New York.*
4. Pillai, R.S.N., & Bagavathy, V., Modern Marketing, Principles and Practices, *S Chand Company Private Ltd, New Delhi*.
5. Nair, Rajan Marketing Management, *S Chand Company Private Ltd, New Delhi*.

SEMESTER VI

Optional Core IV: INTERNATIONAL MARKETING

Instructional Hours-90 **Credit-4**

Objective-*To equip the students with environmental, procedural, institutional and decisional aspects of international marketing.*

Module I

International Marketing-Definition-Nature-Benefits-Special Problems-Features of International Marketing vis-a vis Domestic Marketing-Internationalisation Stages-International Marketing Orientation-Planning for International Marketing **(20 Hours)**

Module II

International marketing Research-Objectives of Marketing Research-Features, Advantages and Limitations of Marketing Research-Steps In Marketing Research Process-Importance of International Marketing Research-Research Agencies-Market Entry and Operating Strategies **(15 Hours)**

Module III

International Marketing Environment- Economic, Political, Legal, Demographic and Cultural Environment, International Institutions-Free Trade Zone- Globalisation –Positive and Negative Effects of Globalization- Globalisation and Its Impact on International Marketing-Marketing Barriers-Tariff and Non-Tariff Barriers **(20 Hours)**

Module IV

Foreign Trade Strategy of India-Foreign Trade Policy-India and World Trade-Export and Import Policy-Major Problems of India's Export Sector-Procedure and Documentation on Exporting-Export Promotion Council-Export Finance **(20 Hours)**

Module V

International Marketing Mix-Product Strategies-International Marketing and PLC-Pricing Strategies-Promotion Strategies-Distribution Strategies **(15 Hours)**

Suggested Readings

1. Keegen, Global Marketing Management, *Pearson, Mumbai*
2. Cateora Philip, John Graham & Mary Gilly, International Marketing, *McGraw Hill/Irwin.*

3. Sak Onkvisit & John J Shaw, International marketing analysis and strategies, *Routledge Taylor and Francis group,UK*
4. Cherunilam, Francis, International Marketing Text and cases, *Himalaya Publishing House,Mumbai*
6. Indian Journal of Marketing (ISSN 0973-8703*), New Delhi-110016*

Optional Courses- LOGISTICS MANAGEMENT

SEMESTER III
Optional Core I: INTRODUCTION TO LOGISTICS MANAGEMENT

Instructional Hours: 90 **Credit: 4**

Objective: *The aim of the paper is to know how a logistic strategy fits into an organisation's broader decisions, understand the role of logistic providers, and realize the meaning of customer service and understand its importance to logistics management.*

Module I
Logistics- Definition - History and Evolution- Objectives-Elements-activities importance- The work of logistics-Logistics interface with marketing-retails logistics **(18 Hours)**

Module II
Logistics Management- Definition- Evolution of the concept- model - process-activities. Achievement of competitive advantage through logistics Framework-Role of Logistics management-Integrated Logistics Management **(18 Hours)**

Module III
Logistics Strategy-Strategic role of logistics-Definition-role of logistics managers in strategic decisions-Strategy options, lean strategy, Agile Strategies & Other strategies- Designing & implementing logistical strategy Emerging concept in logistics. **(20 Hours)**

Module IV
Outsourcing logistics-reasons-Third party logistics provider-Fourth party Logistics providers (4 pl)-Stages-Role of logistics providers). **(18 Hours)**

Module V
Quality customer service & integrated logistics-customer service-importance elements- the order cycle system-distribution channels-Functions performed-Types designing. (**16 Hours)**

Suggested Readings
1. Bloomberg, David J., & LeMay, Stephen Logistics, *Prentice-Hall of India Pvt. , Joe B. Hanna Ltd., New Delhi.*
2. Donald J. Bowersox & David J. Closs , Logistical Management, *Tata McGraw Hill Publishing Co. Ltd, New Delhi.*
3. Satish C. Ailawadi & Rakesh Singh, Logistics Management, *Prentice-Hall of India Pvt Ltd., New Delhi.*
4. Donald Waters, Logistics, *Palgrave Macmillan, New York, 2004*

5. Krishnaveni Muthiah, Logistics Management & World Sea borne Trade, *Himalaya Publishing House, Mumbai*

SEMESTER IV

Optional Core II: PRINCIPLES OF LOGISTICS INFORMATION

Instructional Hours: 90 **Credit: 4**

Objective: *The paper aims to teach the forms of logistics information, Information functionality, Information forecasting, and application of information technology in logistics*

Module I

Information Technology & Logistics- Electronic- Data Interchange-Personal Computers-Artificial Intelligence/Expert system-Communications Bar coding & Scanning- Electronic Data Interchange standards- Communication, Information & Future directions **(18 Hours)**

Module II

Information Technology for supply chain management - Bull whips Effect- IT in supply chain-Business Process Reengineering- Enterprise Resource Planning- EDI Problems with EDI-Impact of Internet on SCM. **(24 Hours)**

Module III

Logistics Information-Meaning & Need Forms-LIS-Definition-Information functionality - activities involved in transaction system-Principles of designing or evaluating LIS applications. **(16 Hours)**

Module IV

LIS Architecture-components-Two forms of activities; Planning & co-ordination flows & operating flows - Flow and use of integrated logistics information. **(16 Hours)**

Module V

Information forecasting- Definition-Process- component-characteristic of forecast compound-approaches-forecast techniques-Forecast error **(16 Hours)**

Suggested Readings

1. David J. Bloomberg, Stephen LeMay , Logistics*, Prentice-Hall of India Pvt Ltd.,Joe B. Hanna New Delhi.*

2. Donald J. Bowersox & David J. Closs, Logistical Management*, Tata McGraw Hill Publishing Co. Ltd, New Delhi.*

3. Satish C. Ailawadi & Rakesh Singh, Logistics Management*, Prentice-Hall of India Pvt Ltd., New Delhi.*

4. Donald Waters, Logistics. *Palgrave Macmillan, New York.*

5. Krishnaveni Muthiah , Logistics Management & World Sea borne Trade*, Himalaya Publishing House, Mumbai.*

6. Sarika Kulkarni , Supply Chain Management*, Tata Mc- Ashok Sharma Graw Hill Publishing Co Ltd., New Delhi.*

71

SEMESTER V

Optional Core III: AIR CARGO LOGISTICS MANAGEMENT

Instructional Hours: 90 **Credits: 4**

OBJECTIVES: *This paper has been designed to provide participants with a good understanding of airfreight operations, services and management that can support them in various business functions and roles such as operations, customer service, account management and sales.*

Module I

Introduction to Air Cargo: Aviation and Airline Terminology - IATA Areas - Country – Currency– Airlines - Aircraft Layout - Different Types of Aircraft - Aircraft Manufacturers - ULD - International Air Routes - Airports - Codes – Consortium –Hub & Spoke – Process Flow **(18 Hours)**

Module II

Introduction to Airline Industry - History - Regulatory Bodies - Navigation systems - Air Transport System – Functions – Customers – Standardization – Management – Airside - Terminal Area - Landside Operations – Civil Aviation - Safety and Security - Aircraft operator's security program - Security v/s Facilitation - – ICAO security manual - Training and awareness – Rescue and fire fighting - Issues and challenges - Industry regulations - Future of the Industry. **(18 Hours)**

Module III

Airline Marketing and Customer Service Standardization in Logistics - Air freight Exports and Imports - Sales & Marketing – Understanding Marketing, Environment, Marketing Research, Strategies and Planning, Audits, Segmentation, SWOT, Marketing Management Control, Consignee Controlled Cargo –Sales Leads – Routing Instructions - Customer Service, Future trends. **(22 Hours)**

Module IV

Air Freight Forwarding- Air freight Exports and Imports - Special Cargoes - Consolidation - Documentation - Air Way Bill (AWB) – Communication – Handling COD shipments – POD – Conditions of Contract - Dangerous (DGR) or Hazardous goods. **(16 Hours)**

Module V

Advices – Booking - SLI – Labelling – Volume/ Weight Ratio – Shipment Planning - TACT – Air Cargo Rates and Charges - Cargo operations- Customs clearance **(16 Hours)**

Suggested Readings

1. Simon Taylor, *Air transport logistics, Hampton*

2. Paul Jackson & William Brackenridge, Air Cargo Distributions: a Management Analysis of its Economic and Marketing Benefits*, Gower Press*

3. Peter S. Smith, Air Freight: Operations, Marketing and Economics*, Faber*
4. Sung Chi-Chu , 4th Party Cyber Logistics for Air Cargo, Boston *: Kluwer Academic Publishers*
5. P.S. Senguttavan, Fundamental of Air Transport Management*, Oxford Atlas-Oxford Publishing*

SEMESTER VI

Optional Core IV: SHIPPING AND OCEAN FREIGHT LOGISTICS MANAGEMENT

Instructional Hours: 90 **Credit: 4**

OBJECTIVES: *This paper has been designed to provide participants with a good understanding of ocean freight operations, services and management that can support them in various business functions and roles* such as operations, customer service, account management and sales.

Module I
Shipping Industry and Business - Description of a Ship- Uses of a Ship or a Floating Vessel- Classification of Ship (route point) (cargo carried) - Superstructure - Tonnages & Cubic - Drafts and Load Lines - Flag Registration - Different Types of Cargo. (packaging, utility or value) Trimming - Cleansing -Unitized Cargo **(18 Hours)**

Module II
Operations - Volume / Weight Calculations - Shipment Planning Basics – Preparing & Loading Containers– Types of Container Services - FCL - Consolidation –LCL - Advanced Scientific Shipment Planning –Container De-stuffing**.** **(16 Hours)**

Module III
Documentation - Bill of Lading basics – MBL - HBL – CY – CFS - Advanced learning in Bills of Lading - Sea Way bill - Combined transport - MTO – Multimodal Transport Document (MTD) - Invoicing - Information Flow - Release of cargo - Cross Trade & Documentation - Conditions of Contract – Managing Key Accounts – Trade Lane Development – Consortium. (**16 Hours)**

Module IV
Stevedoring, Lighter age Services and Security - Port Trusts - Operational Unit - Services – Seaports – Vessel Operations – Pilotage - Stevedoring - Dock Labour Boards - Charges –Automated Container Handling - Security at Ports and Harbours- Role of Security Agencies - Lighterage Services. **(16 Hours)**

Module V
Sales and Customer Service- Shipping Lines - Hub & Spoke - Process flow - Advices – Booking - Containerization –Containers – Container Numbering - Process Flow - Shipping Sales – Leads – Quotations – Customer Service **(24 Hours)**

Suggested Readings

1. Sung Chi-Chu , 4th Party Cyber Logistics for Air Cargo, Boston, *Kluwer Academic Publishers*
2. Mark Wang , Accelerated Logistics, Santa Monica CA
3. John Walter wood, Airports- Some Elements of Designs and Future Development
4. Senguttavan, P.S., Fundamental of Air Transport Management*, Oxford Atlas-Oxford Publishing*
5. Ratandeep singh, Aviation Century- Wings of Change- A Global Surve*, Jain book.*

OPEN COURSES

FUNDAMENTALS OF BANKING AND INSURANCE

Instructional Hours: 72

Credit: 4

Objective: *To familiarize the students with the basic concepts and practice of banking and the principles of Insurance*

Module I

Introduction to Banking - Origin and Evolution of Banks – structure of banking system -Types of Banks – Functions of Commercial Banks- Primary and Secondary- Credit Creation -Reserve Bank of India- Functions of RBI **(16 Hours)**

Module II

Banking Practice – Banker – Customer – relationship between banker and customer – general and special relationship – Cheque – essentials of a valid cheque – crossing – dishonour of cheque – liabilities of wrongful dishonour – opening and operation of accounts by special types of customers – minor, married woman, firm, company. **(16 Hours)**

Module III

Innovations in Banking – Social Banking- E-Banking – CORE – ECS – EFT – RTGS – NEFT – SWIFT – Mobile banking – Precautions in mobile banking – internet banking - Credit and Debit Cards- Banking Ombudsman Scheme **(18 Hours)**

Module IV

Insurance- Evolution of insurance – Role and Importance - Insurance Contract- Principles of Insurance - Insurance and Assurance **(10 Hours)**

Module V

Types of Insurance (Overview only) - Life insurance – Distribution system of life insurance – life insurance plans - General insurance - Marine insurance - Fire insurance - Health Insurance - Motor Insurance - Burglary insurance - Personal Accident Insurance. **(12 Hours)**

Suggested Readings

1. Shekhar, K.C, Banking Theory and Practice, *Vikas Publishing House*, *New Delhi*
2. Maheswary, S.N., Banking Law and Practice, *Kalyani Publishers*, *New Delhi*
3. Sundharam,Varshney, Banking Theory Law & Practice, *Sulthan Chand & Sons*, *New Delhi.*
4. Agarwal, O.P., Banking and Insurance*, Himalya Publishing House, Mumbai*
5. Saxena, G.S., Legal Aspects of Banking Operations*, Sultan Chand and Sons, New Delhi*
6. Tripati, Nalini & Prabil Pal., Insurance: Theory and Practice, *PHI Pvt Ltd, New Delhi*
7. Gupta, P.K., Insurance and Risk Management, *Himalaya Publishing House, Mumbai*
8. Mishra, M.N., Principles and Practices of Insurance, *S. Chand and Sons, New Delhi*

CAPITAL MARKET AND INVESTMENT MANAGEMENT

Instructional Hours-72 **Credit-3**

Module-1

Financial Systems – Indian financial System - Components - Role and Functions - money market and capital market - characteristics of capital market in India- Instruments in capital market: equity shares, preference shares, debentures, bonds, Govt. securities, and new instruments – SEBI- Objectives and functions- Recent developments in the Indian Capital market. **(15 Hours)**

Module-II

Primary and secondary markets: Primary market: Definition and functions - Methods of New issues, Right issue - Operators in the new issue market: Managers to the issue, underwriters, brokers to the issue - Merchant bankers - Minimum subscription - Types of issue - Allotment - Listing. Secondary Market: Stock exchanges in India - role and functions- membership - Trading and settlement – Speculators- Bulls, bears, stags and lame duck - Dematerialized securities - On-line trading - Depositories - Stock Market indices – **(20 Hours)**

Module-III

Derivatives- Features of Derivatives -Types of Derivatives– Forwards – Futures- Options-Swaps **–** (Brief study only) **(12 Hours)**

Module-IV

Investment Management – Process- Investment, Speculations and Investment, Gambling and Investment, Investment Objectives- Investment process- Meaning of portfolio **(15 Hours)**

Module-V

Investment Avenues: Corporate Securities - Government bonds - Post office saving certificate and deposits - Public Provident Fund scheme, Mutual Fund schemes, Bank deposits - Insurance - Real Estate- Other Investment Avenues. **(10 Hours)**

Suggested Readings

1. Khan, M.Y., Indian Financial System, *Tata McGraw Hill, New Delhi.*
2. Singh, Preethi, Dynamics of Indian Financial System, *Ane Books, New Delhi*
3. Guruswami, S., Capital Markets, *Tata McGraw Hill, New Delhi*
4. Avadhani, V. A., Investment and Securities Market in India, *Himalaya Publishing House.*

Journals

SEBI and Corporate Laws - Taxmann, New Delhi
SEBI Monthly Bulletins

. FUNDAMENTALS OF ACCOUNTING

Instructional Hours-72 **Credit-3**

OBJECTIVE- *To familiarise the students with the basic accounting principles and practices in business.*

Module-I Accounting – Introduction- meaning- Book keeping and Accounting –Objectives of Accounting - Accounting Principles- Concepts and Conventions- Double Entry System- Books of Accounts- Accounting Equation- Golden Rule of Accounting **(15 hours)**

Module-II Journal- Meaning – Journalising- Journal Entry- Simple and Compound Entries- opening Entry . **(15 Hours**)

Module-III Ledger - Form of an Account -Posting - Balancing of Accounts-Subdivision of Journals- Purchase book- Sales Book - Cash book (simple, triple column)-Petty Cash book. **(22 hours)**

Module-IV Trial Balance - Meaning - Objects-Preparation- **(8 Hours)**

Module-V Final Accounts-Trading and Profit and Loss Account- Balance Sheet (without adjustments) **(12 Hours)**

Suggested Readings

1. R L Gupta and M Radhaswamy - Advanced Accountancy-.Sultan Chand Publishers
2. P C Tulsian. Advanced Accountancy- S Chand Publications-
3. S Kr. Paul- Fundamentals of Accounting - New Central Agency
4. M.C.Shukla and T.S.Grewal- Advanced Accounting, S Chand Publication
5. Jain and Narang- Fundamentals of Accounting, Kalyani Publishers
6. B S Raman – Financial Accounting- United Publishers

Guidelines for Practical Examinations , Project and Viva and

Industrial Visit/Study Tour

Practical Examination
Practical examinations will be conducted only at the end of even semesters.

Project Report
All students are to do a **project in the area of core course.**

This project can be done individually or in groups (not more than five students) which may be carried out in or outside the campus.

The report of the project in duplicate is to be submitted in English with not less than 30 pages (Printed in A4 size paper) to the Department at the sixth semester and are to be produced before the examiners appointed by the University.

External Project Evaluation and Viva / Presentation are compulsory and will be conducted at the end of the Programme.

Structure of the Report

- Title Page
- Declaration by the student
- Certificate from the guide
- Acknowledgements
- Contents
- Chapter I: Introduction (Research problem, Objectives of the study, methodology etc)
- Chapter II: Review of Literature/Conceptual Framework
- Chapter III: Data Analysis
- Chapter IV: Summary /findings/ Recommendations
- Appendix (Questionnaire, Specimen copies of forms, other exhibits etc).
- Bibliography

Evaluation of the Project Report.

The project report shall be subject to **Internal and External Evaluation** followed by a **Viva-voce**.

- Internal Evaluation is to be done by the supervising teacher and external evaluation by an examiner appointed by the University and the Head of the Department or his nominee.

- A viva voce related to the project work will also be conducted by the external evaluation board consisting of an examiner appointed by the University as chairman and the Head of the Department or his nominee as member. The students have to attend the viva voce individually. Grades are to be awarded to the students combining the internal evaluation, external evaluation and viva voce.

Components of External Evaluation of Project / Dissertation (External)	**Marks** **50**
Relevance of Topic	10
Statement of Objectives	5
Methodology	10
Presentation of Facts and Figures	5
Quality of Analysis and Findings	15
Bibliography	5
Viva-Voce (External) -	**30**
Total	**80**

Components for Internal Evaluation of Project (20 marks)

Punctuality	5
Experimentation/Data Collection	5
Knowledge(Based on individual assessment)	5
Report	5
Total	**20**

Industrial Visit /Study Tour

An industrial visit cum tour for three to five days form part of the course of study for regular students during the programme and a report of the same shall be prepared and submitted to the department.

Note

Only Commerce Teachers whose appointments are approved by the University and Commerce Teachers of Government Colleges should be entrusted with the setting of Question Papers, Valuation of Answer Scripts of Common, Core, Complementary, Open and Choice Based Core elective Courses and the conduct of Practical Examinations

POST GRADUATE AND RESEARCH DEPARTMENT OF COMMERCE TIME TABLE 2021-2022

MONDAY

I B.COM (T)	S. Lang	M.Geetha	Anupama	English	Haripriya
II B.COM (T)	English	Soumya	Treesa	Rekha	Rekha
III B.COM (T)	Rajani	Unni	M.Geetha	Lakshmi	Anu
I B.COM (M)	Lakshmi	S. Lang	Soumya	Unni	English
II B.COM (M)	Ranju	Anu	English	Treesa	Saumya
III B.COM (M)	Anupama	Liance	Rekha	Haripriya	Soumya
II M.COM	Rekha	Haripriya	Rajani	Anu	Anupama
II MCM	Liance	Shilpa	Shilpa	Rajani	Shilpa
I MCOM	Unni	Lakshmi	Ranju	M.Geetha	Treesa
I MCM	Saumya	Ranju	liance	Saumya	Unni

TUESDAY

CLASS	1	2	3	4	5
I B.COM (T)	Haripriya	English	Ranju	S. Lang	Anupama
II B.COM (T)	Ranju	Rekha	Soumya	Rajani	Treesa
III B.COM (T)	Unni	Rajani	M.Geetha	Lakshmi	Anu
I B.COM (M)	English	Soumya	S. Lang	Unni	Lakshmi
II B.COM (M)	English	Liance	Anu	Saumya	Ranju
III B.COM (M)	Treesa	Anupama	Rekha	Haripriya	Rekha
II M.COM	Anupama	Anu	Haripriya	Ranju	Haripriya
II MCM	Lakshmi	Shilpa	Rajani	Liance	Soumya
I MCOM	M.Geetha	Unni	Saumya	Treesa	Liance
I MCM	Shilpa	Saumya	Shilpa	Soumya	M.Geetha

WEDNESDAY

Class	1	2	3	4	5
I B.COM (T)	English	Anupama	Ranju	Haripriya	S. Lang
II B.COM (T)	Rekha	Treesa	Soumya	Rajani	Ranju
III B.COM (T)	Lakshmi	Rajani	M.Geetha	Anu	Unni
I B.COM (M)	Soumya	English	Lakshmi	S. Lang	M.Geetha
II B.COM (M)	Treesa	Saumya	Anu	Liance	English
III B.COM (M)	Anupama	Haripriya	Rekha	Treesa	Liance
II M.COM	Rajani	Anu	Haripriya	Anupama	Rekha
II MCM	Shilpa	Soumya	Shilpa	Shilpa	Rajani
I MCOM	M.Geetha	Unni	Liance	Saumya	Lakshmi
I MCM	Unni	Ranju	Saumya	M.Geetha	Saumya

THURSDAY

Class	1	2	3	4	5
I B.COM (T)	Anupama	Ranju	Haripriya	M.Geetha	English
II B.COM (T)	Rajani	English	Ranju	Rekha	soumya
III B.COM (T)	Anu	Rajani	M.Geetha	Unni	Lakshmi
I B.COM (M)	M.Geetha	S. Lang	unni	lakshmi	English
II B.COM (M)	Liance	Anu	English	Liance	Anu
III B.COM (M)	Haripriya	Treesa	Rekha	Soumya	Anupama
II M.COM	Rekha	Anupama	Anu	Rajani	Haripriya
II MCM	lakshmi	Soumya	Shilpa	Shilpa	Shilpa
I MCOM	Treesa	Lakshmi	Saumya	Liance	Unni
I MCM	Saumya	Saumya	Liance	Treesa	Ranju

FRIDAY

Class	1	2	3	4	5
I B.COM (T)	Ranju	S. Lang	English	M.Geetha	Anupama
II B.COM (T)	Rajani	English	Soumya	Rekha	Treesa
III B.COM (T)	Lakshmi	Anu	Anu	Unni	Rajani
I B.COM (M)	S. Lang	Unni	English	Lakshmi	M.Geetha
II B.COM (M)	English	Liance	Liance	Ranju	Saumya
III B.COM (M)	Anupama	Soumya	Rekha	Treesa	Haripriya
II M.COM	Rekha	Anupama	Anupama	Rajani	Anu
II MCM	Shilpa	Shilpa	Haripriya	Haripriya	Liance
I MCOM	Unni	Saumya	Ranju	Saumya	Lakshmi
I MCM	Treesa	Treesa	M.Geetha	Soumya	Shilpa

MAHATMA GANDHI UNIVERSITY

KOTTAYAM- KERALA STATE

CHOICE BASED CREDIT

SEMESTER SYSTEM

SYLLABI

For

Undergraduate Programme

In

ECONOMICS

Mahatma Gandhi University
Kottayam

CONTENTS

1. Content
2. Preparation
3. Acknowledgement
4. Introduction
5. Design of the Course
6. Syllabi – Model I - Coré Courses, Open course, Choice Based Courses
7. Complementary course
8. Syllabi – Model II
9. Syllabi – Model III

Prepared by

The Board of Studies (Economics) and The Faculty of Social Sciences with the core team of Economics

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Dean –Faculty of Social Science (Economics)
Mahatma Gandhi University ,
Kottayam

Introduction

MAHATMA GANDHI UNIVERSITY KOTTAYAM
B.A. ECONOMICS PROGRAMME
CHOICE BASED CREDIT AND SEMESTER SYSTEM
(2017 Admissions onwards)
AIMS AND OBJECTIVES OF THE PROGRAMME

In the present global scenario, Economics has emerged as one of the most 'sought after' subjects of study in Social Sciences as it immediately communicates with the changing societal priorities and needs. Many insights have been taken which are highly expedient in studying Economics and the behaviour of economic agents and their adaptations to economic policy and analysis of such behaviour in the present context of highly volatile markets and asymmetric information. In this context Economics as emerged as one of the most important subjects of study among the group of social sciences. In the past 50 years or so, many new insights have taken root and become important in economic theory and policy. In the light of the expanding horizons of knowledge, constant endeavours have been made to review the curriculum in many of the universities in the world to make Economics a vibrant and meaningful subject. The curriculum merits better pondering so as to make it practically more competitive and student cantered in the multidimensional environment. *Major aims and objectives of the BA Economics programme are listed hereunder.*

1.To provide students a well-founded education in Economics;

2.To provide structured curricula which support the academic development of students;

3.To provide and adapt curricula that prepare our graduates for employment and further study as economists;

4.To provide the students with the opportunity to pursue courses that emphasize quantitative and theoretical aspects of Economics;

5.To provide students with the opportunity to focus on applied and policy issues in Economics;

6.To provide programmes that allow the students to choose from a wide range of economic specialization;

7.To provide a well-resourced learning environment for Economics.

COURSES

The restructured programme contains Sixteen Core Courses, including one Open course Elective (Semester V) and one Choice Based Elective (Semester VI) from the frontier area of the Programme and a Project Evaluation, four Complementary Courses from the relevant subjects for complementing the core of the study. There are ten Common Courses which include the First and Second Languages of study.

Teaching, setting question papers and valuing answer scripts in respect of the core and complementary courses (including Open course) and choice based courses inducted in this curriculum must be done by the faculty members from the Department of Economics.

*Generic Elective Course can be from the core area or other area as the case may be.

Course Coding

A course code has 8 letters/digits which show the programme, semester, type of course, theory or practical and the serial order of the course as tabled below.

EC	1/2/3/	CR/GE/CB/CM/VO/PR/C	T/P	XX
Econo	Sem	Type of Course	Theory Practic	Serial order o type of cours

CC- Common Course/CR-Core Course/OP – Open Course /CB-Choice Based Elective/CM-Complementary Course/VO- Vocational Course/PR-Project/OJ-On the Job Training/VV-Viva Voce etc.

Detailed Distribution of Courses

Sem	Title of the Course	H	C	Distribution of M	
				In	Exte
1	English 1				4
	English Common 1				4
	Second Language 1				4
	Perspectives &Methodology of Economics				4
	Complementary 1				4
2	English 2				4
	English Common 2				4
	Second Language 2				4
	Micro Economic Analysis-I				4
	Complementary 2				4
3	English 3				4
	Second Language common 1				4
	Micro Economic Analysis -II				4
	Economics of Growth and Development				4
	Complementary 3				4
4	English 4				4
	Second language Common 2				4
	Macro Economics-I				4
	Public Economics				4
	Complementary 4				4
5	Quantitative Techniques				4
	Macro Economics-II				4
	Open course**				4
	Environmental Economics				4
	Introductory econometrics				4
6	Quantitative Methods				4
	International economics				4
	Choice-based course**				4
	Money &financial Markets				4
	Indian Economy				4
	Project*				4
	Total				4

* Project internal and external evaluation should be done only in the 6th semester.

** One course to be selected from the list of Open Courses for semester V & One course from the list of Choice Based Electives for Semester VI. It is common to Model II & III.

B.A. Economics Programme– Model - I
Core, Complementary, Open and Choice-Based Courses

	Core Paper	**Course C**	**I**			**Total m**	
						10	
							I
	Perspectives and Methodology of Economics	EC1CRT					
	Complementary	EC1CMT					
	Core 2- Micro Economic Analys	EC2CRT					
	Complementa	EC2CMT					
	Core 3- Micro Economic Analys	EC3CRT					
	Core 4-Economic Growth & Devel	EC3CRT					
	Complementary	EC3CMT					
	Core 5-Macro Economics-I	EC4CRT					
	Core 6-Public Economics	EC4CRT					
	Complementary4	EC4CMT					
	Core 7-Quantitati Techniques	EC5CRT					
	Core 8-Macro Economics-II	EC5CRT					
	Open course	EC5OPT0					
	Core9-Enviornm Economics	EC5CRT					
	Core10- Introduc Econometrics	EC5CRT					
	Core 11 –Quantit Methods	EC6CRT					
	Core 12-Internati Economics	EC6CRT					
	Choice based E	EC6CBT					
	Core-13 Money & Financial markets	EC6CRT					
	Core-14 Indian Economy	EC6CRT					
	Project	EC6PR					

Broad Title of Courses *T.H- Teaching Hours per week, Cr.-Credits, Int.-Internal Evaluation and Ext.-External Examination

Distribution of Credits

Broad Title of Courses	No. of Courses	Credit
Common Cours	10	38
Core Courses	14	58
Choice Based C Course	1	3
Complementary Courses	4	16
Choice Based C	1	3
Project	1	2
Total	31	120

Total credits for core and complementary courses and project - 79

Total credit for Choice based Elective 3

Total Credit **82**

List of Complementary Courses

The following Complementary courses are suggested with the option for choice (***two*** **semester courses for each subject**)

1. History
2. Political Science
3. Psychology
4. Sociology
5. Mathematics
6. Mathematics for Economic Analysis
7. Logic

From among the above choices, Colleges can choose any ***two*** courses offered by the University without affecting the existing work load. Course code for the complementary courses to the first semester and second semester i.e. EC1CMT01 & EC2CMT02 and course code to the third semester and fourth semester i.e. EC3CMT01 & EC4CMT02.

CORE-CHOICE BASED OPEN COURSE- Semester-V

One open course should be chosen from among the following ***three*** courses.

Sl.	Name of Course	Course Code
1	Foundations of Economics	EC5OPT01
2	Economics of Population	EC5OPT02
3	Gender Economics	EC5OPT03

CHOICE BASED -Elective - Semester –VI

One course can be chosen from among the following ***Three*** courses.

Sl. No	Name of Course	Course Code
1	Mathematical Economics	EC6CBT01
2	Business Economics	EC6CBT02
3	History of Economic Thought	EC6CBT03

COMPLEMENTARY COURSES (Economics) FOR OTHER BA PROGRAMMES

Sl. No	Name of Course	Course Code
1	**Principles of Economics (Formerly *General Economic Principles*)**	EC 1/3CMT01
2	**Basic Economic Studies**	EC 2/4CMT02

*Note: the first course may be chosen in 1st or 3rd semester and the second course in 2nd or 4th semester as the requirements of different colleges and courses.

COMPLEMENTARY COURSE FOR BA ECONOMICS

	Name of Course	Course Code
	Mathematics for Economic Analysis	EC1CMT03

*****This course may be chosen any of the first four semesters depending on the requirement of the colleges or courses.

Note: Colleges which choose this course as complementary shall not opt 'Mathematics for Economic Analysis' as the Choice Based Elective in semester VI.

SYLLABI OF THE COURSES

Model I

Semester I				
Core Course No	**Course Code**	**Course Title**	**No. of Credit**	**No. of Teaching Hours**
	EC1CRT01	**Perspectives and Methodology of Economics**	**4**	**108**

Course Objective

The course intends to familiarize the students with the broad contours of Social Sciences, specifically Economics and its methodologies, tools and analysis procedures. The course also aims to create an enthusiasm among students about different schools of Economic thought and various aspects of social science research, methodology, concepts, tools and various issues.

MODULE I: Methodology of Social Science

Science-Different branches of science-Evolution of a scientific approach Social science Disciplines - Need for interdisciplinary approach - Objectivity and subjectivity in social Science - Limits to objectivity in social science. (25hrs)

MODULE II: Methodology, Concepts and tools of Economics

Economics as a social science –Subject matter and scope of Economics, Importance of the study of economics with other social sciences like history, political science, psychology, law and Sociology. Positive and Normative Economics, Economic theory and Economic laws, Micro and Macro Economics, Role of assumptions in Economics, Method and Methodology - Deductive and inductive methodology, Economic Models

Various Concepts: Function, Variable, Equilibrium-Partial and General, Static, Comparative static and Dynamic ; Marginal and Total; Nominal and Real; Value; (30 hrs)

MODULE III: Major Schools of Economic Thought

Mercantilism(Thomas Mun, William Petty) and Physiocracy (Francis Quesnay and Turgot), Basic postulates of Classical and Neo-Classical economic thought (Adam Smith, Ricardo, J.B.Say, Malthus, J.S.Mill, Jeremy Bentham, Alfred Marshall, A.C.Pigouand Walras,) Socialist and Marxist Economic Thought(Saint Simon, Sismondi and Karl Marx,

Keynesianism(keynes as a critique of classical Economics and Monetarism(Milton Friedman). Contribution of Indian Economicsts-Kautilya, Dadabhai Naoroji, Amartya Sen and J.N..Bhagwthi). (27hrs)

MODULE IV: Research Methodology

Meaning and objectives of research – Types of research - Steps in research Data - Primary and secondary . Undertaking a research study - Conceptualization of research issues, reviewing the literature, Hypothesis, analysis and presentation of data, writing a research report. (30hrs)

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Semester 2				
Core Course No	**Course Code**	**Course Title**	**No. of Credit**	**No. of Teaching Hours**
2	**EC2CRT02**	**Micro Economic Analysis I**		**108**

Learning Objectives

This is an introductory course that teaches the fundamentals of microeconomics. It gives the foundation for economic analysis and problem solving. This course provides an introduction to supply and demand and the basic forces that determine equilibrium in a market economy. It introduces a framework for learning about consumer behaviour and analyzing consumer decisions. The course also attends to firms and their decisions about optimal production. By the end of the course, we will be able to understand introductory microeconomic theory, solve basic microeconomic problems, and use these techniques to think about a number of policy questions related to the operation of the real economy.

Module I - Introduction to Microeconomics

Definitions of Economics-Problem of scarcity and choice – Central problems of Economy-production possibility frontier - microeconomic policy goals – efficiency and equity.– functions of an economic system -short run and long run analysis, partial and general equilibrium analysis (concepts only) – Marginal concept in micro Economics – (15 Hrs)

Module II –Demand and Supply Analysis

Concepts of demand- Factors affecting demand- Law of demand- exceptions-demand for normal, inferior, substitute and complementary goods- Shifts of demand versus movements along a demand curve – elasticity of demand – Degrees- price elasticity of demand – determinants- methods of estimation – Total outlay, Point, and arc method – income elasticity of demand and cross elasticity of demand – Concepts of supply- Factors affecting supply-Law of supply- shifts of supply versus movements along a supply curve - elasticity of supply – uses of elasticity – market equilibrium and impact of changes in demand and supply – dynamic demand and supply model: cobweb model –– demand forecasting – objectives and methods of demand forecasting - seller's view. (23Hrs)

Module III – Theory of Consumer Behaviour

Concepts of Total and Marginal utility- Consumer preferences and choice-consumer's equilibrium – cardinal utility and ordinal utility – law of diminishing marginal utility –

consumer equilibrium under cardinal utility – derivation of demand curve - law of equimarginal utility – water-diamond paradox – criticisms of cardinal utility approach - indifference curve analysis – characteristics – MRS - budget line – consumer's equilibrium – income effect and Engel curve – price effect, income effect and substitution effect- derivation of demand curve – splitting price effect into income effect and substitution effect: Hicksian and Slutsky's approaches - criticisms of ordinal utility approach – revealed preference theorem – derivation of demand curve – distinction between weak and strong ordering – consumer's surplus – Marshallian and Hicksian approaches. New approaches to consumer theory - Pragmatic approach & Linear Expenditure System (LES) (Concepts only). (35Hrs)

Module IV – Theories of Production and Cost

Production function – total, average & Marginal product- time element in production function – law of variable proportions (modern approach)– isoquants – properties – MRTS - ridgelines and economic regions of production– Isocost lines – optimal input combination – producer's equilibrium – expansion path – elasticity of factor substitution - laws of returns to scale – economies and diseconomies of scale – empirical production function: Cobb-Douglas production function – properties – cost functions - cost concepts - explicit and implicit costs, economic and accounting costs, sunk cost, opportunity cost ,real cost, social cost- traditional theory of costs - short run and long run analysis of costs – envelope curve – modern theory of cost – short run and long run- L-shaped and saucer-shaped cost curves. (35 Hrs)

Readings

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Semester 3				
Core Course No	**Course Code**	**Course Title**	**No. of Credit**	**No. of Teaching Hours**
3	**EC3CRT03**	**Micro Economic Analysis II**	**5**	**72**

Learning Objectives

This course helps the students to develop skills enabling them to understand economic concepts and use those concepts to analyze specific questions. By the end of this course, students should be able to understand consumer and firms' behaviour and to analyze different types of market structures. It also analyzes the behaviour of firms in a monopoly or oligopoly, and calculates the resulting changes in producer or consumer surplus. It helps students to use economic tools to analyze economic policies.

Module I – Market Structure:

Meaning of market- Market structure- Perfect Competition –characteristics - short run and long run equilibrium of a firm and industry – role of time element in the determination of value -derivation of supply curve – shut down point – producer's surplus – imperfect markets –Monopoly – sources - features – short run and long run equilibrium - discriminating monopoly- price and output determination under discriminating monopoly - degrees and types of price discrimination – dumping – Monopsony- Bilateral monopoly –- social costs of monopoly power – regulation of monopoly. (17 Hrs)

Module II – Monopolistic Competition and Oligopoly

Monopolistic competition – characteristics - non-price competition and selling costs - short run and long run (group) equilibrium - ideal output and excess capacity – limitations of monopolistic competition - oligopoly – characteristics – Price stickiness - Kinked demand curve – Sweezy model - Non-Collusive oligopoly – Duopoly (concept only) –competition Vs collusion - collusive oligopoly – cartels and price leadership – low-cost, dominant and barometric price leadership models – concept of limit pricing and cost plus pricing. (20 Hrs)

Module III - Income Distribution and Factor Pricing

Functional versus personal distribution - concepts of total physical product (TPP), average physical product (APP) and marginal physical product (MPP) - Marginal productivity theory of distribution – factor price determination under perfect competition and imperfect competition – Ricardian and modern theories of rent - quasi-rent – money and real wages - wage differentials - effect of labour unions on wages – theories of interest – classical,

neo-classical and Keynesian theories of interest – theories of profit- dynamic theory, risk-bearing theory – innovation theory of profit (20 Hrs)

Module IV - Welfare Economics

Welfare economics – nature, concepts and scope- problems of measuring social welfare - Edgeworth box diagram – contract curve - criteria of social welfare – role of value judgement- growth of GNP criterion – Bentham's criterion – Cardinalist criterion - Pareto optimality criterion. (15 Hrs)

Readings

1. A. Koutsoyiannis. (1979). Modern microeconomics. Palgrave McMillan.

2. Dominick Salvatore. Micro economics Theory and application. 4th ed. New Delhi: Oxford University Press.

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Semester 3				
Core Course No	**Course Code**	**Course Title**	**No. of Credit**	**No. of Teaching Hours**
	EC3CRT04	**Economics Of Growth & Development**		**90**

Learning Objectives

This course enables the student to acquaint with the basic concepts and issues of growth and development from Adam Smith. It makes a student more insightful about the modern approaches to development presented by D Goulet and Amartya Sen.

Module I: Introduction to Economics of Growth and Development

Growth and Development – meaning – features – distinction – determinants and indicators – features of underdevelopment – measurement of development - income and non-income indices – GDP, PCI, PQLI, HDI, HPI, GEM – (GDI, GNH) – Development redefined – Development as a total social process – Development as freedom – Development as Liberation – Sen's capability approach – poverty as capability and Entitlement failure – multidimensional poverty index – Quality of life – Education – Health and Nutrition – poverty – absolute and relative – inequality of income and wealth – Gini coefficient – Kuznet's inverted 'U'- Hypothesis – Development gap (22hrs)

Module II: Approaches to Development

Approaches to Economic Development: Structuralist – dependency - market- friendly approaches (concepts only) – vicious circle of poverty – Stage theories Rostow – low level equilibrium trap – Critical minimum effort thesis – Big push – Lewis model – balanced vs unbalanced growth strategy – Dualistic theories. (23hrs)

Module III: Theories and Factors in the Development Process

Classical – Marxian – Schumpeterian. Economic Development – role of agriculture – capital – technology – choice of technique - Trade and economic development – process of cumulative causation. (20 hrs)

Module IV: Human Resource and Development

Human Resource and Development – man power planning – concept of intellectual capital and its size – role of education and health in economic development – Education and health as joint investment for development – Gender and development – women in the labour force – missing women population and economic growth – optimum theory of population – theory of demographic transition – ageing and younging of population. (25hrs)

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3. Meier G.M. (2007) Leading Issues in Economic Development, Oxford University Press, New Delhi.
4. Todaro and Smith, Economic Development, Pearson Education, New Delhi.
5. Debraj Ray, Development Economics. Oxford University Press, New Delhi.
6. Felix Raj and et. al, Contemporary Development Economics, New Central Book Agency (p) Ltd.

Semester 4				
Core Course No	**Course Code**	**Course Title**	**No. of C**	**No. of Teaching Hours**
	EC4CRT05	**Macro Economics I**		**90**

Module I: Introduction to Macroeconomics

Micro and Macroeconomics-Main issues in Macroeconomics- Macro statics and macro dynamics-circular flow of economic activity in atwo sector economy- National Income-concepts and their interrelationships- methods of measurement of national income- value added, income and expenditure methods-social accounting method-estimation of national income in India-Environmental concerns in national accounts- green accounting- Net Economic Welfare (20 Hrs)

Module II: Classical Macroeconomics

Main postulates of classical macroeconomics- Say's Law of Markets –Classical theory of employment and output determination – wage price flexibility and full employment equilibrium-classical theory of interest- quantity theory of money- Cash transactions and Cash balances approaches - -Classical dichotomy and neutrality –Pigou effect- Keynes criticism of classical theory. (25 Hrs

Module III: Keynesian Macroeconomics

Keynesian Revolution –Main postulates of the general theory- Consumption function-Psychological law of consumption- Savings function- graphical, algebraic and numerical illustrations of APC, MPC, APS, MPS-factors determining consumption-investment demand Function-determinants of investment- MEC and MEI and the role of expectations- principle of effective demand (20 Hrs)

Module IV: Orthodox Keynesian Models

Two sector Keynesian cross model of income determination - Algebraic derivation-Under employment equilibrium-The effects of changes in autonomous investment on income-multiplier analysis-static and dynamic multiplier- three sector Keynesian Cross model-The effects of changes in taxes and public expenditure on income-Balanced budget multiplier-Four sector Keynesian Cross model-foreign trade multiplier(concept only).Two sector IS-LM model of income determination (model only). (25 Hrs)

Readings

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2. Richard T. Froyen (recent edition), Macro Economics - Theories and Policies, Pearson Education
3. Eugene Diulio (2004), Macro Economics – Schaum's Outline Series, Tata McGraw Hill, New Delhi.
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9. Macroeconomics Simplified-"An introduction to keynesian and Classical macroeconomic systems" by Nicoli Natrass and G.Visakh Verma,Published by Sage,New Delhi.2014

Semester 4				
Core Course No	**Course Code**	**Course Title**	**No. of Credit**	**No. of Teaching Hours**
6	**EC4CRT06**	**Public Economics**	**4**	**72**

Learning Objectives

Public finance analyzes the impact of public policy on the allocation of resources and the distribution of income in the economy. In modern times, the activities of State have considerably increased and the theoretical understanding of different State activities through the budgetary mechanism is essential. The objective of the course is for students to learn about the working of the public finance system and to gain knowledge about the working of the Indian public finance.

Module I- Introduction to Public Finance

Meaning and subject matter of Public Finance – Public and Private Finance – Fiscal Functions-Allocation, distribution and stabilization- Principles of Maximum Social Advantage: Dalton, Musgrave – Public Goods: Pure and Impure Public Goods, Free rider problem. Private Goods, Mixed Goods and Merit Goods, -Market failure and role of government. (14 Hrs)

Module II- Public Revenue

Sources of public revenue -Classification of Taxes - Canons of Taxation, Principles of Taxation-Ability, Benefit and cost of service- Impact, Incidence and shifting of Tax Burden – – Effects of Taxation – Measurement of Deadweight loss -Taxable Capacity- Laffer curve- Major Taxes in India and its impact- Value Added Tax in India –Goods and Service Tax (GST-brief history, legislation and impact)- Budget and its role– Classification of budget Concepts :Revenue Account, Capital Account, Fiscal Deficit, Revenue Deficit, Primary Deficit,– Zero Base Budgeting-Budgetary Procedure in India (introduce the recent Central Budget to the students)- Gender Budgeting-Fiscal Policy –Deficit financing (22 Hrs)

Module III- Public Expenditure

Meaning— Canon's of Public Expenditure-Plan and Non-plan Expenditure-Developmental and Non-developmental expenditure- Wagner's Hypothesis, Peacock - Wiseman Hypothesis, critical limit hypothesis– Effects of Public Expenditure- Public expenditure in India: Its pattern and growth -Public Debt- Types- debt redemption –burden of public debt – public debt in India (18 Hrs)

Module IV- Federal Finance

Meaning – Principles of Federal Finance- vertical and horizontal equity in fiscal federalism - fiscal federalism in India – Finance commission – Current Finance Commission- Theory of grants – resource transfer from union to states – criteria for transfer of resources – State Finance Commission and Panchayati Raj institutions.

(18 Hrs)

References

1. Musgrave, R.A. and P.B. Musgrave. (1989). *Public finance in theory and practice*. Mc-Graw Hill.

2. John Cullis, Philip Jones. *Public finance and public choice*. (1st edition). New Delhi: Oxford University Press.

3. Stiglitz, Joseph E. (Third edition). *Economics of public sector*. New York: Norton.

4. Harbar, Bernard. P. (Fifth edition). *Modern public finance*. Richard Irvin Inc.

5. Bagchi, Amaresh (ed.). *Readings in public finance*. New Delhi: Oxford University Press.

6. Ulbrich, Holley H. *Public Finance in Theory and Practice*. Thomson South-Western.

7. Singh.S.K. (Ninth edition) *Public Finance in Theory and Practice*. New Delhi: S Chand Publications.

8. Dalton. H. (eleventh edition). *Principles of Public finance*. Routledge Library Editions.

9. Taylor, Philip E. *Economics of public finance*. MacMillan.

10. Bhatia. H.L. (twenty-sixth edition). *Public finance*. New Delhi: Vikas Publishing House Pvt. Ltd.

11. Gupta, Janak. (2nd Revised & Enlarged edition). *Public economics in India: Theory and practice*. Atlantic.

Semester 5				
Core Course No	**Course Code**	**Course Title**	**No. of Cr**	**No. of Teaching Hours**
7	**EC5CRT07**	**Quantitative Techniques**	**4**	**108**

Learning Outcome:

This is the first of the compulsory two-course sequence of Quantitative Techniques. Mathematical skills have become an essential tool for higher education. The objective of the first sequence is to introduce the body of mathematics to enable the study of economic theory including micro economic theory, macro economic theory, statistics and econometrics at the undergraduate level.

Module I

Basic Mathematics for Economic Analysis – Basic concepts: variables, constants, parameters, equations, exponents and logarithms, sequences and progressions - arithmetic and geometric. Applications of progressions in economics: problems relating to simple interest, compound interest, depreciation of assets and Net Present value. The real number system: properties of real numbers and types of numbers –limitations. (28hrs)

Module II

Calculus- Limits & Continuity, Derivatives: Meaning and significance - Rules of differentiation – First order and second order derivatives – Maxima and Minima of functions. Applications in economics. (20hrs)

Module III

Set theory - types of sets -set operations – Venn diagrams. Relations and functions: ordered pairs and Cartesian product. Functions: Types - Important economic functions. Linear and Quadratic-Solution to system of equations up to three unknowns- Matrices-Types, Matrix manipulations and their rules, Order of Matrix, Transpose of Matrix-Determinants up to order 3x3- Properties and Value of determinant, Minor and Cofactor, Inverse and Cramer's Rule.

(30hrs)

Module IV

Theory of Probability - Scope of probability in Economics- the case of uncertainty - Concepts – Rules of probability (addition and multiplication theorem – statement only) – Different approaches – Important terms related to probability (Random experiments, sample space, events) – Simple economic problems based on probability theorems – Probability distributions – binomial and normal – estimation of probabilities using binomial theorem standard normal table - their properties and uses and applications in Economics. (30hrs)

Readings:

1. Gupta S.P. *Statistical methods*. New Delhi: Sultan Chand & Sons.
2. Sharma J.K. *Business statistics*. Noida, India: Pearson Education.
3. Richard I Levin et.al. *Statistics for management.* India: Pearson Education.
4. Srivastava U.K et.al. *Quantitative techniques for managerial decisions*. New Delhi: New Age International Publishers.
5. Chiang A.C. (2005). *Fundamental methods of mathematical Economics.* McGraw Hill.
6. Allen R.G.D. *Mathematical analysis for economists.* Palgrave Mac Millan.
7. Monga G.S. *Mathematics and statistics for economists*. New Delhi: Vikas Publishing House.
8. Bradley Terasa. *Essential mathematics for economics and business.* New Delhi Wiley India Edn.

Semester 5				
Core Course No	**Course Code**	**Course Title**	**No. of Credit**	**No. of Teaching Hours**
	EC5CRT08	**Macro Economics II**	**5**	**108**

Module I- Theories of Consumption and Investment

Kuznets's consumption puzzle-Conflict between short-run and long run consumption functions- relative income hypothesis– permanent income hypothesis- life-cycle hypothesis Theory of capital and theory of investment- Present Value Criterion- Accelerator theory of Investment- Tobin's q theory (25 Hrs)

Module II- Money, Inflation and Unemployment

Money-classical approach –Keynesian liquidity preference theory and interest rate determination-liquidity trap-Keynes effect-supply of money-sources- high-powered money-money multiplier- measures of money supply in India. Inflation: types – Demand-pull and cost-push inflation – inflationary and deflationary gap-causes and effects of inflation – control of inflation-types of unemployment- Oakun's law-inflation and unemployment- the Phillips curve-Stagflation- long run Phillips curve-Natural rate of unemployment (38 Hrs)

Module III- Fluctuations, Monetary and Fiscal Policies

Trade cycles- Types and phases- Stabilization policies-Active or passive; monetary policy objectives and targets; Fiscal and Monetary policy in the IS-LM context(closed economy only)-Financial Crises & Regulatory response. (20 Hrs)

Module IV- Post Keynesian Schools of Macroeconomic Thoughts

Monetarism- Monetarist propositions and the Quantity Theory Restatement New Classical Economics- Rational Expectations(concept)- Lucas'Critique(Policy ineffectiveness proposition) Supply Side Economics- Tax cut policy and the Laffer Curve Analysis New Keynesian School – Nominal Wage Rigidity model (Overview) (25Hrs)

Readings

1. B Snowdon & Howard Vane. A Modern Guide to Macro Economics. Edward Elgar
2. R T Froyen . (Recent Edition)Macroeconomics – Theories and Policies. Pearson Education
3. N Gregory Mankiw. Macroeconomics. New York; Worth Publications
4. R Dornbusch, S Fisher. Macroeconomics. Tata McGraw Hill
5. Arthur O' Sullivan et al. (2015). Macroeconomics principles, applications and Tools. New Delhi: Pearson Education South Asia.

   Macroeconomics Simplified-"An introduction to keynesian and Classical macroeconomic systems" by Nicoli Natrass and G.Visakh Verma,Published by Sage,New Delhi.2014

6. C Ram Manohar Reddy (2017) De monetisation and Black Money, Orient Black Swann.
7. G Omkarnath (2012) Economics – A primer for India, Orient Black Swann.

Semester 5				
Core Course No	**Course Code**	**Course Title**	**No. of Credit**	**No. of Teaching Hours**
09	**EC5CRT09**	**Environmental Economics**	**4**	**90**

Learning objectives :

The importance of environmental science and environmental studies cannot be disputed. The need for sustainable development is a key to the future of mankind. Continuing problems of pollution, loss of forget, solid waste disposal, degradation of environment, issues like economic productivity and national security, Global warming, the depletion of ozone layer and loss of biodiversity have made everyone aware of environmental issues. The United Nations Coference on Environment and Development held in Rio de Janerio in 1992 and world Summit on Sustainable Development at Johannesburg in 2002 have drawn the attention of people around the globe to the deteriorating condition of our environment. It is clear that no citizen of the earth can afford to be ignorant of environment issues. Environmental management has captured the attention of health care managers. Managing environmental hazards has become very important.

Human beings have been interested in ecology since the beginning of civilization. Even our ancient scriptures have emphasized about practices and values of environmental conservation. It is now even more critical than ever before for mankind as a whole to have a clear understanding of environmental concerns and to follow sustainable development practices.

India is rich in biodiversity which provides various resources for people. It is also basis for biotechnology.

Only about 1.7 million living organisms have been diescribed and named globally. Still manay more remain to be identified and described. Attempts are made to II conserve them in ex-situ and in-situ situations. Intellectual property rights (IPRs) have become importanat in a biodiversity-rich country like India to protect microbes, plants and animals that have useful genetic properties. Destruction of habitats, over-use of energy resource and environmental pollution have been found to be responsible for the loss of a large number of life-forms. It is feared that a large proportion of life on earth may get wiped out in the near future.

Inspite of the deteriorating status of the environment, study of environment have so far not received adequate attention in our academic programmes. Recognizing this, the Hon'ble Supreme Court directed the UGC to introduce a basic course on environment at every level in

college education. Accordingly, the matter was considered by UGC and it was decided that a six months compulsory core module course in environmental studies may be prepared and compulsorily implemented in all the University/Colleges of India.

The experts committee appointed by the UGC has looked into all the pertinent questions, issues and other relevant matters. This was followed by framing of the core module syllabus for environmental studies for undergraduate courses of all branches of Higher Education. We are deeply conscious that there are bound to be gaps between the ideal and real. Geniune endeavour is required to minimize the gaps by intellectual and material inputs. The success of this course will depend on the initiative and drive of the teachers and the receptive students.

Module I Unit 1 : Multidisciplinary nature of environmental studies

Definition, scope and importance (2 hrs)

Need for public awareness.

Unit 2 : Natural Resources :

Renewable and non-renewable resources : Natural resources and associated problems.

a) Forest resources : Use and over-exploitation, deforestation, case studies.

Timber extraction, mining, dams and their effects on forest and tribal people.

b) Water resources : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

c) Mineral resources : Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) Food resources : World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

e) Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources, Case studies.

f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification

- Role of individual in conservation of natural resources.
- Equitable use of resources for sustainable lifestyles. (10 hrs)

Unit 3: Ecosystems

- Concept of an ecosystem
- Structure and function of an ecosystem
- Producers, consumers and decomposers
- Energy flow in the ecosystem
- Ecological succession
- Food chains, food webs and ecological pyramids.
- Introduction, types, characteristic features, structure and function of the given ecosystem:-
  a. Forest ecosystem

(6 hrs)

ModuleII Unit 1: Biodiversity and its conservation

- Introduction
- Biogeograhical classification of India
- Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.
- India as a mega-diversity nation
- Hot-sports of biodiversity
- Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts
- Endangered and endemic species of India

(8 hrs)

Unit 2: Environmental Pollution

Definition

Causes, effects and control measures of: -

a. Air pollution
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

- Solid waste Management: Causes, effects and control measures of urban and industrial wastes.

- Role of an individual in prevention of pollution
- Pollution case studies
- Disaster management: floods, earthquake, cyclone and landslides.

(8 hrs)

Unit 3: Social Issues and the Environment

- Urban problems related to energy
- Water conservation, rain water harvesting, watershed management
- Resettlement and rehabilitation of people: its problems and concerns, Case studies
- Environmental ethics: Issues and possible solutions
- Climate change, global warming, acid rain, ozone layer depletion , nuclear accidents and holocaust, Case studies
- Consumerism and waste products
- Environment Protection Act
- Air (Prevention and Control of Pollution) Act
- Water (Prevention and control of Pollution) Act
- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation
- Public awareness (10 hrs)

Module – III Unit I: Economics and Environment

Environmental Economics – Definition – Scope – Meaning – importance – Environment-Economy interaction (linkages) – material balance model – ecosystem – structure and functions – relation between environment and development – Environment as a necessity and luxury-environmental issues and global concern-Stockholm Conference – Helsinki Convention – Montreal Protocol – Kyoto Protocol – Rio Summit – Paris Convention. Population growth and Environment – market failure – tragedy of commons-sustainable development-policy approach to sustainable development(An overview only). (16hrs)

Module IV Unit 1: Framework and Criteria for Environmental Analysis

Evaluation of environmental benefits – Contingent Valuation Method – Hedonic approach – travel cost method – preventive expenditure method - surrogate market approach – property value approach and wage differential approach - cost benefit analysis – UNIDO analysis –

Little- Mirrlees approach - Environmental Impact Analysis. Pollution control – socially optimum level of pollution – environmental policies and legislations in India. (18hrs)

Module – V Unit 1- Human Rights– An Introduction to Human Rights, Meaning, concept and development, Three Generations of Human Rights (Civil and Political Rights; Economic, Social and Cultural Rights).

Unit-2 Human Rights and United Nations – contributions, main human rights related organs - UNESCO,UNICEF, WHO, ILO, Declarations for women and children, Universal Declaration of Human Rights.

Human Rights in India – Fundamental rights and Indian Constitution, Rights for children and women, Scheduled Castes, Scheduled Tribes, Other Backward Castes and Minorities

Unit-3 Human Rights and environmental rights - Right to Clean Environment and Public Safety: Issues of Industrial Pollution, Prevention, Rehabilitation and Safety Aspect of New Technologies such as Chemical and Nuclear Technologies, Issues of Waste Disposal, Protection of Environment

Conservation of natural resources and human rights: Reports, Case studies and policy formulation. Conservation issues of western ghats- mention Gadgil committee repoirt, Kasthurirengan report. Over exploitation of ground water resources, marine fisheries,sand miningetc. (12Hrs)

Reference

1. Agarwal,K.C 2001 Environmental Biology, Nidi Publ. Ltd, Bikaner.
2. Bharucha Erach, Text Book of Environmental Studies for undergraduate Courses. University Press, IInd Edition 2013 (TB)
3. Brunner.R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc.480p
4. Clark.R.S., Marine Pollution, Clanderson Press Oxford (TB)
5. Cunningham, W.P.Cooper, T.H.Gorhani, E & Hepworth, M.T.2001. Environmental Encyclopedia, Jaico Publ. House. Mumbai. 1196p
6. Dc A.K.Enviornmental Chemistry, Wiley Eastern Ltd.
7. Down to Earth, Centre for Science and Environment (R)
8. Gleick, 11.P.1993 Water in crisis, Pacific Institute for Studies in Dev. Environment & Security. Stockholm Environment Institute Oxford University Press 473p

9. Hawkins R.E, Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R)
10. Heywood, V.H & Watson, R.T. 1995. Global Biodiversity Assessment, Cambridge University Press 1140p
11. Jadhav.H & Bhosale.V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284p
12. Mekinney, M.L & Schock.R.M. 1996 Environmental Science Systems & Solutions. Web enhanced edition 639p
13. Mhaskar A.K., Matier Hazardous, Techno-Science Publications (TB)
14. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co. (TB)
15. Odum.E.P 1971. Fundamentals of Ecology. W.B. Saunders Co. USA 574p
16. Rao.M.N & Datta.A.K. 1987 Waste Water treatment Oxford & IBII Publication Co.Pvt.Ltd.345p
17. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut
18. Survey of the Environment, The Hindu (M)
19. Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science (TB) XI
20. Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Stadards, Vol I and II, Enviro Media (R)
21. u) Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (TB)
22. Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p
23. (M) Magazine (R) Reference (TB) Textbook

24 Rabindra N Bhattacharya. (2007). Environmental Economis an Indian Perspective. Oxford University Press.

25 Charls D. Kolstad.(2007). Environmental Economics. New Delhi:OUP.

26 Ramaprasad Senguptha. (2009). Ecology and Economics. New Delhi: OUP.

27 Janet Thomas.(2009). Environmental Economics. New Delhi: Cenage Learning.

28 S.P. Mirsa, S.N. Pandey (2008). Essential Environmental Studies. New Delhi: Ane Books.

29 Katar Singh and Shishodia. (2007) Environmental Economics- Theory and application. New Delhi: Sage publication.

30 Tom Tietenberg. (2004). Environmental and Natural Resource Economics. Pearson Education.

31 Karpagam . M. (2008). Environmental Economics. New Delhi: Sterling Publishers.

32 R.K. Lekhi et al. (2008). Developmental and Environmental Economics. Ludhiana: Kalyani publishers.

33 Ulaganathan Sankar. (2009) Environmental Economics. New Delhi: OUP.

34 N. Das Gupha (1997). Environmental Accounting. Wheeler and Co New Delhi.

35 Thomas and Callan (2007). Environmental Economics. Thomas South-Western.

36 Paul Ackin .(2000) Economic Growth and Environmental sustainability, Routledge, London.

37 Nick Hanley. (2009) Environmental Economics in Theory and Practice. Palgrave Macmillian, New York.

38 Fisher A.C. (1981). Resource and Environmental Economics. Cambridge University Press, Cambridge.

39 Baumol. (1988). Theory of Environmental Policy (second edition). Cambridge University Press, Cambridge

40 PrasannaChandra:Projects-Planning,Analysis,Financing,Implementation&Review.(5th edition)TataMcGraw Hill.

41 PR Trivedi.(2014)Environmental Impact Assessment.APH Publishing Corporation.

42 Erach Baraucha (2014) Test book of Environmental studies, Orient Black Swann.

Semester 5				
Core Course No	**Course Code**	**Course Title**	**No. of Cr**	**No. of Teaching Hours**
10	**EC5CRT10**	**Introductory Econometrics**	**4**	**90**

Module One:

Classical Liner Regression Model—Meaning and methodology—Modern interpretation of econometrics—Population regression function (PRF) —The concept of linearity in econometrics—stochasticre –interpretation and its significance — Sample regression function (SRF) (20hrs)

Module Two:

Estimation of PRF—The method of OLS—Advantages of OLS—Numerical Properties of OLS estimators— Statistical properties of OLS— Gauss - Markov Theorem and the assumptions of Classical Linear Regression Model (15hrs)

Module Three:

Evaluation of SRF—Goodness of the Fit—R Square—Reliability and Precision of OLS estimators—Standard Error of the OLS Estimator and the Estimate (15hrs)

Module Four:

Hypothesis testing and estimation—Hypothesis testing of OLS estimators—t test—Point and interval estimation (Basics)—Introduction to Multiple Regression (15hrs)

Module Five:

Relaxing the assumptions of Classical Linear Regression Model Hetroscedasticity—nature, estimation in its presence—detection and remedial measures— Autocorrelation—nature and estimation in its presence—detection and remedial measures—
Multicollinearity—nature, estimation in its presence—detection and remedial measures
(25hrs)

Readings:

1) Gujarati, Porter and Gunasekhar, Basic Econometrics, Fifth Edition
2) A Koutsoyiannis, Theory of Econometrics, Second Edition, Palgrave Macmillan
3) Chandan Mukherjee, Howard White and Marc Wytus, "Econometrics and Data Analysis for Developing Countries", Routledge
4) James H Stock and Mark W. Watson, Introduction to Econometrics, Pearson Education; 3rd edition
5) RamuRamanathan, Introductory Econometrics with Applications, S.Chand & Company Ltd; 5th Revised edition
6) Christopher Dougherty, Introduction to Econometrics. NewDelhi: Oxford University Press
7) Johnston .J. Econometric Methods. McGraw Hill.
8) Dominick Salvatore , Derrick Reagle, Schaum's Outline of Statistics and Econometrics, Second Edition, McGraw-Hill Education

Semester 6				
Core Course No	**Course Code**	**Course Title**	**No. of Cr**	**No. of Teaching Hours**
11	**EC6CRT11**	**Quantitative Methods**		**108**

(STATISTICS FOR ECONOMIC ANALYSIS)

Learning objectives:

Students of Economics need a variety of statistical skills to collect,analyse and interpret empirical data. This course intends to provide an introduction to statistical methods and tools that are essential for the study of economics at the undergraduate level.

Module I

Role of Statistics in Economics – Functions–limitations.Methods of primary data collection-census and sampling methods - Preparation of schedules and questionnaires, sample designs – random sampling and non-random sampling (SRS, systematic, stratified, cluster and multistage sampling).

Classification and Tabulation of Statistical data: Characteristics and types of classification-types of tables-difference between classification and tabulation. Presentation of data using charts and diagrams. (Histogram, Polygon, frequency curve, Bar chart, Pie diagram, Ogives)

(28hrs)

Module II

Central tendency: Various Measures - Properties, merits & demerits of Arithmetic mean, median, mode, geometric mean and harmonic mean – applications in economics.

Dispersion: Various Measures, absolute and relative measures – Range, quartile deviation, mean deviation, standard deviation – Lorenz curve and its economic applications. (25hrs)

Module III

Correlation and Regression Analysis: Correlation- significance and types– measurement: scatter diagram, Karl Pearson's correlation coefficient, (for ungrouped data only) and Rank correlation. Cause and effect relationships:

Regression- meaning and significance-regression equations/regression lines-the line of best fit – prediction based on regression equations. Relation between correlation and regression.

(25hrs)

Module IV

Index Numbers – Different types – Importance and limitations, Problems in construction – Weighted and Unweighted price index numbers – Different methods of constructing price indices– Simple aggregative, simple average of price relatives, Weighted aggregative: Laspeyre's, Paasche's, Fisher's and Marshall Edgeworth's indices, weighted average of price relatives methods. Cost of living index numbers: significance, uses and methods of construction – aggregate expenditure method and family budget methods-WPI. Tests of index numbers

Time series: meaning, definition, uses, components – additive and multiplicative models, measurement of trend- free hand method, semi average, moving average and least square methods. (30hrs)

Readings

1. Gupta S.P. *Statistical methods*. New Delhi: Sultan Chand & Sons.
2. Sharma J.K. *Business statistics*. Noida, India: Pearson Education.
3. Richard I Levin et.al. *Statistics for management*. India: Pearson Education.
4. Srivastava U.K et.al. *Quantitative techniques for managerial decisions*. New Delhi: New Age International Publishers.
5. Chiang A.C. (2005). *Fundamental methods of mathematical Economics*. McGraw Hill.
6. Allen R.G.D. *Mathematical analysis for economists*. Palgrave Mac Millan.
7. Monga G.S. *Mathematics and statistics for economists*. New Delhi: Vikas Publishing House.
8. Bradley Terasa. *Essential mathematics for economics and business*. New Delhi: Wiley India Edn.

Semester 6				
Core Course No	**Course Code**	**Course Title**	**No. of Cr**	**No. of Teaching Hours**
12	**EC6CRT12**	**International Economics**		**90**

Learning Objectives

This course provides the students a thorough understanding and deep knowledge about the basic principles that tend to govern the flow of trade in goods and services at the global level. The contents of the Paper, spread over various modules, lay stress both on theory and applied nature of the subject.

MODULE I- Introduction to International Economics and Trade Theories

Nature and scope of international economics-differences between internal and international trade -Inter industry trade and intra-industry trade -Terms of trade –types, and factors affecting terms of trade – community indifference curve - Classical theory -Theory of absolute cost advantage, Theory of Comparative cost advantage, reciprocal demand theorem - offer curves - Opportunity cost theorem, Heckscher - Ohlin theory, Leontief's paradox, Factor price equalization theorem, Gains from Trade, static and dynamic gain from trade-

(25 Hrs)

MODULE II- Balance of Payments

Meaning and structure of balance of payments – equilibrium and disequilibrium - measures to correct disequilibrium- monetary and non-monetary measures- Devaluation, depreciation and Balance of payments- Elasticity approach-Marshall- Learner condition – Jcurve effect

(20 Hrs)

MODULE III— Foreign Exchange Market

Functions of foreign exchange markets - Forex Market participants.-Demand and supply of foreign exchange, Determination of equilibrium exchange rates - Factors influencing exchange rates. Theories of exchange rate determination- The Mint Parity Theory, Purchasing Power Parity theory, balance of payment theory. – Fixed and floating exchange Rate, spot and forward rates, hedging, speculation, arbitrage, futures, options and currency swaps. Exchange rate system in India-managed floating – partial and full convertibility on current and capital accounts. (25 Hrs)

MODULE IV- International Monetary and Trade System

Commercial Policy – free trade and protection – tariffs and quotas and their effects – other non-tariff barriers –Economic Integration-meaning, forms and benefits, BRICS – Gold standard – The Bretton Woods System, International Monetary Fund - World Bank. GATT - Uruguay round, WTO. (20 Hrs)

Readings

1. Dominic Salvatore, (Recent Edition), International Economics: Trade and Finance, John Wiley and Sons, Limited.

2. Sodersten, Bo and Reed. G. (2005), International Economics, 3rd edition, Mc Millian Press Ltd.– International Economics.

3. Paul Krugman and Maurice obstfeld (Recent Edition), International Economics: Theory and Policy, Pearson Education, Delhi.

4. Dominic Salvatore, Schaum's Outlines, Theory and Problems of International Economics. Tata MacGraw Hill, Delhi.

5. Kindle Berger C.P International Trade, R.D Irwin, Homewood 6. K.C Rana and K.N Varma, Internal Economics, Visual Publishing

7. Frncis Chirunilam, International Economics, Mc Graw Hill, Education

8. Rajkumar, Internal Economics, Excel Books, NewDelhi

Semester 6				
Core Course No	**Course Code**	**Course Title**	**No. of Credit**	**No. of Teaching Hours**
13	**EC6CRT13**	**Money & Financial Markets**	**4**	**108**

Learning Objectives :

Financial Market provides the life blood to the real economy. Financial market institutions, regulators and instruments gives developmental and stabilizing services for the entire economy. Developments related to the working of the financial market are very essential to understand the way of economic functioning especially in the modern context. This Core Course tries to provide preliminary idea about the working of various financial market segments as well as the functioning of major regulators. Learners are advised to go through the basic concepts along with the course.

Module-1 Financial System

Structure of Indian Financial System–Banks and NBFIs –Insurance Companies, Pension funds, Mutual Funds, Asset ManagementCompanies. (13 Hrs)

Module 2-Money and Central Banking

Static and Dynamic Functions ofmoney, nearmoney, inside money and outside money – monetary aggregates –M1,M2,M3, M4-High powered money and money multiplier. RBI-functions- Instruments of Monetary policy –Repo and Reverse Repo –Base rate. (25 Hrs)

Module3-Banking

Commercial banking in India –Structure-Functions of commercial banks –conflict between profitability and liquidity, credit creation and credit multiplier – Non-PerformingAssets-Digital Payment System in India – RTGS,NEFT,Prepaid Payments instruments. (25 Hrs)

Module-4 Money market

Money Market-Functions-Structure of money market-Call Money Market-CBLO market,Collateral Loan Market-Acceptance Market-Bill or Discount Market- Features of Indian Money Market. (15 Hrs)

Module5 –Capital market

Capital Market –Functions –structure and functions of primary market and secondary market –Methods of Public issue-IPO, FPO- Book building –Major investment groups –Retail Investors-Domestic Institutional Investors and Foreign PortfolioInvestors-SEBI-Functions.

(30 Hrs)

Readings:

1. Frederik S Mishkin, The Economics of Money, Banking and Financial Markets, Eleventh Edition, Pearson Education.

2. L.M. Bhole, JitendraMahakud. Financial institutions and markets – Structure, growth and innovations. (Latest edition), Tata McGraw Hill Education Private Limited, New Delhi

3. MY Khan, Indian Financial System, MacGraw Hills Education Pvt. Limited India.

4. F. S. Mishkin and S. G. Eakins, Financial Markets and Institutions, Pearson Education, 6th edition, 2011.

5. Bharati V. Pathak, Indian Financial System, Fourth Edition, Pearson Education, New Delhi

6. N. Jadhav, Monetary Policy, Financial Stability and Central Banking in India, Macmillan, 2006.

Semester 6				
Core Course No	**Course Code**	**Course Title**	**No. of Credit**	**No. of Teaching Hours**
14	**EC6CRT14**	**Indian Economy**	**4**	**90**

Module I: Economic Development Strategy since Independence

Mixed Economic Framework - Key and Strategic Role of PSUs – Economic Crisis of 1990 – Macro Economic Reforms Implemented Since 1991-Structural Adjustment Programmes - Globalisation, Liberalisation and Privatisation –Performance of Indian Economy before and after Economic Reforms -External Sector Reforms since 1991 - Trade and Currency Reforms, - foreign capital - FDI, portfolio investments and MNCs (25hrs)

Module II- Demographic Features-

Population–size, structure (sex and age) – characteristics – population change – rural–urban migrations, occupational distribution, problems of over population, population dividend, population policy, Gender inequality, women empowerment. (15hrs)

Module III: Agriculture, Industry and Service Sector

Role of Agriculture in Indian Economy-Land Reforms-New Agricultural Strategy - Green Revolution — Need for Second Green Revolution - Agricultural Growth and Performance - New Agricultural Policy – Changes in Land use and Cropping Pattern-Agricultural Finance and Issues - Agriculture during Economic Reform Period - WTO and Indian Agriculture. Industrial growth during pre reform and post reform period-Industrial Policy Resolution of 1956 and 1991 - Role of Micro, Small and Medium Scale Industries (MSMEs) in Indian Economy Its problems and remedies- Role and Performance of Service sector in Indian Economy. (20 hrs)

Module IV: Economic Planning and Development Issues

Meaning and rationale of Planning-Basic Strategies, Objectives and Achievements of Planning in India-Strategies of 12th Plan, Inclusive Development-NITI Aayog - Trends in India's National Income – Magnitude of poverty and inequality in India - unemployment, black money and corruption – rising prices - energy crisis – Micro finance and its significance – importance of infrastructure in India's economic development. (15hrs)

Module V: Kerala Economy

Features, Kerala model of development - Structural change and economic growth in Kerala - Land reforms - current issues in agriculture – food crisis – changes in cropping pattern – agricultural indebtedness – unemployment - IT sector in Kerala - fiscal crisis in Kerala, Gulf migration, energy policy and energy crisis, decentralized planning in Kerala.

(15hrs)

Readings

1. Misra and Puri (recent edition), Indian Economy, Himalaya Publishing House, Mumabai.

2.Gaurav Datt & Ashwani Mahajan (recent Edition), Datt & Sundharam Indian Economy, S. Chand & Co., New Delhi

3. Meera Bai M. (ed) (2008), Kerala Economy, Serials Publication, New Delhi.

4. Prakash B A (2004) Kerala's Economic Development, Sage Publications, New Delhi

5. George K K (1993) Limits to Kerala Model of Developemnt, CDS, Trivandram

6. B A Prakash (2009), The Indian Economy since 1991: Economic reforms and performance , Pearson Education.

7. Sunil Mani et al. (ed) (2006), Kerala's Economy : Crouching Tiger, Sacred Cows, D C Books, Kottayam

8. State Planning Board, Economics Review , Government of Kerala, Thiruvananthapuram (latest issue)

9. Pulapre Balakrishnan (ed) (2011) Economic Reforms and Growth in India, Orient Black Swann.

10. Y V Reddy (2011) Global crisis, Recession and Uneven Recovery, Orient Black Swann.

Open Courses

Semester 5				
Open Course No	**Course Code**	**Course Title**	**No. of Credit**	**No. of Teaching Hours**
01	**EC5OPT01**	**Fundamentals of Economics**		**72**

Learning Objectives:

This course is designed to make the undergraduate students of other disciplines aware of the basic ideas and concepts in Economics.

Module 1: Basic Concepts

Economics – micro and macro – deduction and induction – basic economic problems- production possibility curve. Utility - total and marginal. Law of Demand – elasticity of demand - price elasticity - types. Law of supply. National income – meaning - components of national income (12 Hrs)

Module 2: Public Economics

State vs Market - public revenue - public expenditure – tax and non-tax revenue – direct and indirect taxes – goods and service tax in India - budget – types - fiscal deficit - revenue deficit - public debt – trade cycle and its phases - fiscal and monetary policies as tools for combating inflation and deflation. (16 Hrs)

Module 3: Financial System and International Trade

Negotiable and non-negotiable instruments – cheques – drafts - bills of exchange – promissory notes-letter of credit - certificate of deposits – commercial papers - banking and non-banking institutions - commercial banks — Core Banking, Internet Banking, Mobile Banking, ATM/Debit & Credit Cards,IFSC,NEFT,RTGS–NPA in Indian banking sector RBI – functions - money and capital market – major financial instruments – shares, debentures and bonds – Insurance: meaning, nature and types - stock exchange – BSE, NSE – stock market indices – SEBI - mutual funds. Terms of trade - balance of trade - balance of payments - foreign exchange - exchange rate – spot – forward – fixed – floating - IMF, World Bank – WTO. (24 Hrs)

Module 4: Indian Economic Development

An overview of Planning in India - Planning Commission –NITI Aayog- Finance Commission – Green revolution – changing pattern of India's industrialisation - Liberalization - Privatization - Globalization (LPG) – Major features of population in India and Kerala - Kerala model of development (20 Hrs)

Readings

1. R R Paul (2008), Monetary Economics, Kalyani Publishers, Lidhiyana

2. V K Bhalla (2008), Investment Management, S. Chand & Co., New Delhi.

4. Bo Sodersten & Reed Dominic, International Economics, palgrave mcmillan

5. Samuelson (2009), Economics, Tata McGraw Hill, New Delhi.

6. Gaurav Datt & Ashwani Mahajan, (recent edition) Datt & Sundharam Indian Economy, S. Chand & Co., New Delhi (recent edition)

7. Alwin Prakash, Kerala;'s Economic Development (2004),Sage Publications, New Delhi.

8. Meera Bai M (ed) (2008), Kerala Economy, Serials Publication, New Delhi.

Semester 5				
Open Course No	**Course Code**	**Course Title**	**No. of Credit**	**No. of Teaching Hours**
02	**EC5OPT02**	**Economics Of Population**		**72**

Module 1: Introduction to the study of Demography

Definition, scope and historical background of formal demography - Recent population trends - World - More Developed Regions - Less developed Regions and Least Developed Regions of the world - components of population growth - population composition- age composition in more developed and less developed regions of the world - population growth in India. Basic demographic methodology - rates in demography- birth (fertility) - mortality - marriage (Nuptiality) - infant mortality rate- computation of infant mortality rate -population projection- sources of population data - sources of demographic data in India. (20 hrs)

Module II : Theories of population

Thomas Robert Malthus - Micheal Thomas Sadler - an overview of sociological theories - optimum theory of population- demographic transition theory- demographic dividend - population and economic growth - economic characteristics of population- economically active population- work participation and unemployment - working population and work participation rate in India. (12hrs)

Module III Composition of Population

Pattern of sex and age structure in developed and developing countries- determinants of age and sex structure- demographic effects of age - sex- structural transition- ageing and younging of population- feminization. Determinants of population ageing - ageing index- median age - dependency ratio - potential support ratio and parental support ratio - Madrid plan - concepts of active ageing - healthy ageing - successful ageing and productive ageing- age structure transition and population ageing in India and Kerala. (20hrs)

Module IV Fertility - Mortality - Nuptiality

Trends and differentials in fertility transition in India and Kerala - causes of demographic changes in South India- trends and differentials in mortality in India and Kerala- Foetal and

infant mortality - life expectancy - still birth, abortion and prenatal mortality - laws relating to abortion in India- epidemiological transition- morbidity in Kerala. (12hrs)

Module V - Migration

Concepts - types - laws- Theories of migration - Todaro- Fei-Rani's models - cause and effect of migration (8hrs)

References

1. D.J.Bogue - Principles of Demography, Wiley 1971
2. Spiegelmon M- Introduction to Demography
3. H.S.Shryok - The Methods and Materials of Demography
4. A.A.Bhande - Principles of population studies, Himalaya and T. Kanitkar
5. Debraj Ray - Development Economics OXFORD, INDIA
6. RobVos, Jose Antonio Ocampo and Ana Luiza Cortez - Ageing Development, Orient and Black swan
7. John C Cladwe P.H.Reddy - Causes of Demography change - Pat Cald Well Experimental Research in SouthIndia, The University of Wisconsin press.
8. S. Iruday Rajan, US Misra & P.Sankara Sarma - India's Elderly -Burden or Challenge sage publications, New Delhi
9. S.Irudaya Rajan - Social Security for the elderly- experiments from South Asia, Routledge
10. Roland Pressat - Demographic analysis projections on Natality, Fertility and Replacement, Aldine Transaction- A division of Transaction Publishers.
11. D.Jayraj and S.Subramanian - Poverty inequality and population - OXFORD
12. P.K.Majumdar - India’s Demography: Changing Demographic Senario in India, Rawat publications

13. Giridhar Kumar, Sathyanarayana, James, Alam - Population Ageing in India, Cambridge

14. Asis Kumar Chattopadhyay Anuj Kumar Saha - Demography: Techniques and Analysis, Viva Books Private Limited.

15. Rajendra K Sharma - Demography and population problems Atlantic Publishers and Distribtors.

16. N.Jayapalan - Social Demography,Book Enclave publishers

17. D.Radhadevi - Economics of Ageing, Serials publicaiton

18. Kerala state planning Board - Growing old in Kerala

20. K.C Zachariah,S.Irudaya Rajan - Kerala's Demographic transition, Determinants and consequences, Sage publications

21. A.K.Shiva kumar Pradeep panda Rajani R.Ved - Hand Book of Population and Development

22. UN(2002) - Political Declaration and Madrid plan of Action on Ageing, Second world Assembly on Ageing.

23. U.N - World population prospects (for various years) world population Ageing 2013 wwww.un.org/ esa/population/publication.

24. US census bureau - An ageing world www.census .gov/prod.

25. Office of the Registrar General - Compendium of India's fertility- and Census Commission of India Mortality indicators.

Semester 5				
Open Course No	**Course Code**	**Course Title**	**No. of Credit**	**No. of Teaching Hours**
03	**EC5OPT03**	**Gender Economics**		**72**

Learning Objectives :

This course enables students to systematically perceive how the gender factor can Impact on economic and demographic development. It aims to make the student familiar with theoretical concepts in the area of Gender economics. It enables the students to conduct gender review of socio economic and demographic development programmes and strategies.

MODULE 1

The subject of Gender Economics-Interdisciplinary Approach in gender studies-HDI and incorporation of gender factor into HDI-Gender equality indices-GDI and GEM. Gender status in India and Kerala-Concept of Missing women (16 hrs)

MODULE 2 ECONOMIC GROWTH AND GENDER EQUALITY

Women's contribution to GDP-Feminization of poverty – Basic causes-Impact of gender equality on economic growth and socio economic development-Positive and negative impact of globalization on gender status-Occupational segregation-Gender discrimination in Education, Health, Employment, Political participation and decision making (20 hrs)

MODULE 3 DEMOGRAPHIC CHANGES AND GENDER STATUS

The gender factor in demographic development-Global demographic changes-Gender shift and demographic development-Impact on gender status-Gender differences in mortality-Concepts and factors-Biological factors. (16 hrs)

MODULE 4 GENDER POLICY

Objectives and methods of gender policy-Global and National gender policy-Gender inequality indicators- Indicators of gender differences in socio economic development-Main gender issues in socio economic development in developed and developing countries-International organizations and the role of gender studies and gender policy implementation-Gender Budgeting-Approaches and principles-Budgeting policies to reduce gender disparities. (20 hrs)

Readings

1. Gita Sen and Canen Crown; Gender and Class in Development Experience

2. Leela Gulati and Ramalingam; Kerala Women: A profile

3.Neera Desai and Maithreyi Krishnaraj; Health-A Gender Issue in India

4. Lourdes Beneria and Savithri Biswanath; Gender and Development: Theoretical, Empirical and Practical Approaches.

5. Lekha Chakraborthi; Invisibility of Women's Work in Budgeting.

6. National Institute of public Finance and policy (NIPFP); Gender Budgeting in India, www.nipfp.org.in.

7. UNDP - Human Development Reports

Choice Based Elective

Semester 6				
Choice Based Course	**Course**	**Course Title**	**No. of Credit**	**No. of Teaching Hours**
01	**EC6 CBT**	**Mathematics For Economic Ar**	**3**	**72**

Module I: Functions of one real variable

Types of functions- constant- polynomial- rational-exponential-logarithmic- Graphs and graphs of functions-Limit and continuity of functions-slope of curvilinear function. The Derivatives—rules of differentiation- higher –order derivatives- implicit differentiation-Economic applications. (25 Hours)

Module II: Calculus of multivariable functions

Functions of several variable- partial derivatives- rules of partial derivatives-second order partial derivatives. Optimization of multivariate functions- constrained optimization with Lagrange multiplier. Differentials-total and partial differentials-total derivatives-implicit and inverse function rules-Economic applications. (25 Hours)

Module III: Integral Calculus

The indefinite integral-integration-rule of integration- integration by substitution and by part. The definite integral- properties of definite integrals- area under a curve- area between curves- Economic application- consumer and producer surplus. (22 Hours)

Readings

1. Dowling,Edward T(2008): Introduction to Mathematical Economics,3rd Ed,Schaum'sOutline Series, McGraw Hill.(Chapters 3-6, 16-17)
2. Knut Sydsaeter, Peter Hammond and Arne Strom(2012): Essential Mathematics for Economic Analysis 4th Ed, Pearson India,.(Chapters-4-9)
3. MikWisneiwski(1998): Introductory Mathematical Methods in Economics, 2nd Ed McGraw- Hill,. (Chapters -7-10 and 13).
4. Michael Hoy,et.al(2009): Mathematics for Economics,2ndEd,PHI.(Chapters-Part IV-11-12 and Part V-16).
5. Geoff Renshaw(2009): Maths for economics, 2nd Ed,OUP.(Ch-6-9, 14-16 and 18).
6. K.Holden and A.W.Pearson(2010): Introductory Mathematics for Economics and Business,2nd Ed. Macmillan.(Ch-5-7).
7. Ian Jacques(2015): Mathematics for Economics and Business,5thEd,PH. (Ch-4-6).
8. Akihito Asano(2013): An Introduction to Mathematics for Economics, CUP, (Ch-4- 7)

9. Jean Soper(2016): Mathematics for Economics and Business: An Interactive Introduction,2nd,Blackwell.(Ch-5-10).
10. Mike Roser(2014): Basic Mathematics for Economists,2nd Ed,Routledge(Ch-8-11)
11. Caroline Dinwiddy(2002): Elementary Mathematics for Economists:2nd,OUP. (Ch-6- 9)
12. J.M Pearson(1989): Mathematics for Economists: A First Course: Longman.(Ch-5-7).
13. Carl P Simon and Lawrence Blue(2002): Mathematics for Economists,WW Norton.
14. ShapoorVali(2014): Principles of Mathematical Economics, Springer.(for economic applications)
15. Chiang A.C. and K. Wainwright(2013): Fundamental Methods of Mathematical Economics,4th Ed, ,Tata McGraw-Hill Education .
16. E. K. Ummer:Basic Mathematics for Economics,Business, and Finance,2014,Routledge.(Ch-3,4 and 8)

Semester 6				
Choice Based Course	**Course Code**	**Course Title**	**No. of Credit**	**No. of Teaching Hours**
02	**EC6CBT 02**	**Business Economics**	**3**	**72**

Learning Objectives

Business Economics discusses the application of economic theory and the tools of decision science to examine how an organisation can achieve its aims and objectives most efficiently. As an applied branch of economics, this course helps students understand how analytical tools of micro and macro economics are applied for solving many practical business problems.

Module I: Introduction to Business Economics

The scope and methods of Business Economics – role in managerial decision making – decision making – approaches to managerial decision making theory and firms – basic concepts in economics – scarcity – choice – resource allocation – fundamental concepts and principles : the incremental concept – the time perspective – the discounting principle – the opportunity cost concept – the equimarginal principle(concepts only). (12hrs)

Module II: Demand Analysis and Forecasting

Demand – types – determinants of demand – Law of demand – changes in demand – elasticity of demand – income – price – cross (with numerical illustration) – Demand determinants of non-durable consumer goods – durable consumer goods – capital goods – demand forecasting – types – methods of demand forecasting – forecasting demand for new products – criteria for a good forecasting method. (15hrs)

Module III: Production and Cost Analysis

Production function: Production function with empirical studies – Cobb Douglas production function – Cost concepts and classification – accounting cost and economic cost – actual cost and opportunity cost – explicit cost and implicit or imputed cost – out of pocket cost - book cost – direct and indirect cost – historical cost and replacement cost – short run and long run cost – total cost – average cost – marginal cost – cost estimation – accounting cost method – engineering cost method – objective of the firm: managerial theory of firm- by William J. Baumol. (15hrs)

Module IV: Pricing and Profits

Pricing methods – cost oriented pricing – competition oriented pricing – practical methods of pricing – peak-load pricing – pricing of a new product – multi product pricing – Dual pricing – administered pricing – transfer pricing – profit – profit theories – risk bearing theory – market imperfection theory – innovation theory – accounting and economic profit – profit planning – Break- even analysis (with numerical illustration). (15hrs)

Module V: Long Term Investment Decisions

Capital budgeting – meaning and need demand for capital – methods of investment criteria – payback period method – Average Rate of Return method – Discounted cash flow method – Net Present Value method – Profitability index – Internal Rate of Return method – (with numerical illustration) – cost of capital. (15hrs)

References

1. Dominick Salvatore. (2008) Managerial economics: Worldwide applications. New Delhi.
2. Nellis and Parker (2006). Principles of Business Economics. Pearson Education. New Delhi.
3. P.l. Mehta. Managerial Economics. Sultan Chand Publications.
4. H.L. Ahuja. Business Economics. S.Chand
5. S. Sankaran. (2002). Managerial Economics. Margham Publication
6. Mankar and Pillai. (2000). Business and managerial Economics. Himalaya.
7. Mote Paul and Gupta (2000) Managerial Economics. Tata Mc Graw Hill.
8. R.L. Varshney and K.L. Maheshwari. Managerial Economics. Sultan Chand.
9. Sampat Mukherjee. Business and Managerial Economics. New Central Book Agency (p) Ltd.
10. Francis Cherunilam. Business Economics

Semester 6				
Choice Base Course No	Course Code	Course Title	No. of C	No. of Teaching Hours
03	EC6CBT03	History of Economic Thought		72

Learning Objectives

The aim of the course is to portrait the routes through which the Science of Economics has evolved as well as its development through the ages primarily demonstrating how past mainstream thoughts has contributed to the scope and content of modern economics. It is also designed to discuss deviations from orthodoxy that have helped to shape contemporary economic thought.

Module 1: Introduction

History of Economic Thought –Reasons for studying Economic Thought- Approach to the History of Economic Thought: Relative and Absolute- Evolution of Methodological Thought- Logical Positivism- Falsification- From Falsificationism to Paradigms- From Research Programmes to Sociological and Rhetorical Approaches- Post Rhetorical Approach (Only an overview is Required) Economics as a System of Natural Harmony- Naturalism V/S Supernaturalism V/S Utopian Socialism(Overview only). (10 hrs)

Module 2. Ancient Economic Thought

Ancient Economic Thought: Hebrew Thought (Old Testament - Subsequent Collections of Laws- Greek Economic Thought(General view)-Roman Economic Thought. Precursors of Classical economic Thought: Mercantilism- Economic Ideas of Thomas Mun, Francoise Quesnay (Physiocracy) (Only an Overview is required) (10 hrs)

Module 3. Classical Economic Thought

Classical Economic Thought: Its Critics and Reformers- Economics of Adam Smith- The Definitional Basis of the Wealth of Nations- The Analysis of Value- Analysis of Income Distribution- Analysis of Capital Accumulation - Economics of Thomas Robert Malthus:- The law of Population- David Ricardo: Method, Policy and Scope- The Ricardian Reformulation of the Theory of Value, Jean- Baptiste Say- Says Law of Market- Says Identity- Dichotomization of the Pricing Process- Says Identity and Quantity Theory of Money- Says Equality- The Revisionism of John Stuart Mill- Reciprocal Demand- Laws of Production and Distribution- Jeremy Bentham and Utilitarianism- Critics and Reformers of

Classical School- Works of Sismondi- Friedrich List – An Over View of Utopian Socialist- Karl Marx and Economics of Das Capital. (20 hrs)

Module 4. The Marginal Revolution and the Neo-Classical School.

The Marginal Revolution: Herman Heinrich, William Stanley Jevons- Carl Menger- Leon Walras- Marshallian Economics- Paretian Welfare Economics- Marginal Productivity Theory- Product exhaustion theorem – Wicksteed- Wicksell, J.B Clarks Marginal Productivity Theory and the Theory of Capital- Economics of Arthur Cecil Pigou- Economics of Welfare- Unemployment - The Pigou Effect-Keynes and Keynes Economics-Overview of Monetarism- New Classical Economics- Supply side economics-New Keynesianism.(20 hrs)

Module 5. Indian Economic Thought

Economic Ideas Kautilya- Dadabhai Naoroji-Ghandhian Philosophy and Economic Ideas- DR. Gadgil, CN Vakil. P R Brahmananda - K N Raj- P C Mahalanobis- V K R V Rao- Amarthya Sen. (12 hrs)

References

1. Lewis H Haney :***History of Economic Thought***, Surjeeth Publications, New Delhi, 1979, 4th Edn.

2 . Harry Landreth and David C Colander: ***History of Economic Thought***, 4th Edn, Houghton Mifflin Company, Boston

3. Eric Roll: ***A History of Economic Thought***, Faber and Faber, London 2004

4. Robert Lekachmn: ***History of Economic Ideas***, The Universal Book Stall, New Delhi

5. Mark Blaug: ***Economic Theory in Retrospect***, 4th Edn, Cambridge University Press.

6. Lokanathan V: ***History of Economic Thought***, S Chand and Company, 1993

7.William J Barber: ***A History of Economic Thought,*** Penguin

8. Paul R R: ***History of Economic Thought,*** Kalyani Publications, Ludhiana,1993

9. Bhatia H L: ***History of Economic Thought***, Vikas Publishing House, Delhi

Complementary Course
Semester 1
Course1. MATHEMATICS FOR ECONOMIC ANALYIS-1

No. of Credits - 4
No. of Contact hours – 108
Learning Objectives
Students of economics should learn the basic mathematical tools for the better understanding of economic theories. Most of the economic theories are based on mathematics. So it is necessary to acquire knowledge in mathematical methods which help students to enhance knowledge in economics. This course is expected to provide an introduction to mathematical concepts to students of economics at UG level. The basic aim of the course is to develop students' skills in applying mathematical concepts in the depth study of economics.

MODULE I
Quantitative Methods
Matrix Algebra: Definition of matrix- types of matrices- operation on matrices- determinants- properties- crammer's rule- rank of matrix**-** Variables, constants, parameters, simple functional relationship and their graphs, solutions to simultaneous equations, quadratic equations. (30 Hrs)

MODULE II
Differential and Integral calculus
Rules of Differentiation, Higher order derivatives, Applications of derivatives in Economics- Maxima and minima of functions- Elementary ideas of integral calculus.(30 Hrs)

Module III Input- output analysis
Input-output analysis – static and dynamic model – technical viability–Hawkins-Simon's conditions - open and closed model- application and limitation of the model. (20 Hrs)

Module IV Linear Programming
LPP- Formulation of LPP - Solution of LPP: Graphical method, Simplex method – duality- application and limitation of linear programming. (28 Hrs)

Readings

1. Yamane, Taro (2004): "Mathematics for Economists: an elementary survey", Prentice Hall of India.
2. Chiang. A. C (1988): "Fundental Methods of Mathematical Economics",3ed. Mc Graw Hill.
3. Allen R.G.D (1956): "Mathematical Analysis for Economists" Macmillan.
4. Amithabh Kundu, P N Mathur, G S Bhalla and Chalapathi Rao (1976):"Input- Output Framework and Economic Analysis", Centre for the Study of Regional Development, Jawaharlal Nehru University, New Delhi.
5. Boumol. W.J (1987): "Economic Theory and Operations Analysis", 4 ed., Prentice Hall of India.
6. Loomba N.P (1979): " Linear Programming", Tata McGraw Hill Publishing Company

Complementary Course
Semester 2
COURSE 2: MATHEMATICS FOR ECONOMIC ANALYSIS-2

No. of Credits - 4

No. of Contact hours – 108

Learning Objectives

The aim of this course is to provide students with an introduction to economic theory through the use of elementary mathematics. This course covers essential topics in microeconomic theory. This course is expected to develop students' skill in applying mathematical tools in micro economic theory.

Module I Theory of Consumer Behaviour and Firms

The nature of utility function – indifference curve – maximisation of utility - Demand function – Demand curve - elasticity, types and measurements -Slutsky equation.

Production functions and product curves - isoquants - elasticity of substitution – Cobb-Douglas, CES production function- optimum combination of inputs-.Cost function - long run and short run (37hours)

Module II Market Structures

Demand and Supply functions under perfect competition - Goods market and Factor market

Equilibrium: Perfect competition, Monopoly, price discrimination, monopolistic competition. (37 hours)

Module III - Game Theory

Concept - Two-person zero sum game - Maximin and Minimax strategy - Saddle point-Mixed strategies- Prisoner's dilemma – Payoff matrix of a game-two-person-two-commodity-and zero –sum-game. (34 hours)

Readings

1. Allen, R.G.D (1974) Mathematical Analysis for Economics, McMillan Press, London. (reprint edition)
2. Chiang, A.C., Fundamental Methods of Mathematical Economics, McGraw Hill, New Delhi (recent edition).
3. Henderson, J. and R.E. Quandt (1980) Micro Economic Theory: A Mathematical Approach, McGraw Hill, New Delhi
4. Handy, S.T (1997) Operations Research: Prentice-Hall of Indian, New Delhi.
5. Jeffrey Baldani et al. (2009), An Introduction to Mathematical Economics, Cengage Learning, Delhi.
6. Boumol. W. J (1987): "Economic Theory and Operations Analysis", 4 ed., Prentice Hall of India.
7. Heathfield D.F and Wibe, Soren (1987): "An Introduction to Cost and Production functions"Macmillan.

COMPLEMENTARY COURSE (ECONOMICS)

For Other B A Programmes

Course 1 PRINCIPLES OF ECONOMICS

No of credits 4
No of contact hours 108

Learning objectives

To have a basic knowledge in basic micro economic theory

Module 1 **Nature and Scope of Economics.**

Definitions- wealth-welfare-scarcity and growth-methodology of economics-significance of economics-micro and macro economics- Positive and normative economics (12Hrs)

Module II Basic Economic problem – Choice and the allocation of resources.

The problem of scarcity and choice- allocation –growth and fuller utilization of resources – opportunity cost—production possibilities and technological choice. Basic features of capitalism ,socialism and mixed economy. (24Hrs)

Module III. Prices and markets

Market-types-Demand –demand curve- Law of demand- shift in demand -elasticity of demand- -degrees of elasticity of demand- measurement and practical uses of elasticity of demand.

Supply –law of supply – market equilibrium. (24Hrs)

Module IV- Consumer Behaviour.

Cardinal utility; law of diminishing marginal utility; derivation of the Marshallian demand curve Consumer's surplus- Marshallian measurement . (20 Hrs)

Module V Production and product pricing.

Production function- Short- Run and Long Run Law of variable proportions Returns to scale, Concepts of cost and Revenue, Market forms- perfect competition - salient features.monopoly- salient features- monopolistic competition salient features –oligopoly – salient features.(market forms –features only-No price and output determination in any of the market forms) (38 Hrs)

Readings

1. Samuelson P. A, Nordhaus (2009) *Economics*, Tata Mc Graw Hill
2. Mankiw , Gregory ,Principles of economics ,Cengage learning delhi
3. Case & Fair (2007) Principles of economics , Pearson Education , Delhi.

For Other B A Programmes Course II

Basic economic studies

No of credits 4
No of contact hours 108
Learning objectives :

The course intents to make UG students equipped with basic understanding in macro economics ,general issues in Indian economy and Kerala economy.

Module 1. National Income accounting.

Concept of Circular Flow, National income identities with government and international trade . concepts of National income Methods of National income accounting. –difficulties in estimating national income. (20 Hrs)

Module II.Public Economics.

State v/s market- sources of public revenue- GST-public expenditure –trends in India-budget- types –fiscal deficit-revenue deficit – public debt- fiscal policy –objectives, fiscal policy as tool for combating inflation and deflation (20 Hrs)

Module III Financial system.

Money — meaning, and functions- Meaning, Types, and Functions of commercial banks-Functions of a central bank – with reference to RBI.- Inflation and deflation— definition, types, causes and effects. Measures to control inflation- Monetary policy as a tool for combating inflation and deflation.. (20 Hrs)

Module IV Introduction to Indian economy.

Developed and less developed Economy: meaning and Concept. Characteristics of Indian Economy. Comparison of Indian Economy with Developed countries. a) Population b) per capita Income c) Human Development Index d) Agriculture e) Industry f) Service Sector.

Planning in india - five year plans- achievements and shortfalls Trends in National Income & Per Capita Income in india Since 1991. Place of Agriculture in the Indian Economy .Green Revolution: Achievements, & failures -Importance of Industrialization- Industrial policy since 1991. SEZ – Concept and features.New Economic Reforms – Concept i) Liberalization ii) Privatisation, iii) Globalization

NITI Ayog . Recent reforms in banking sector in India- Narasimham Committee I & II. Private Public participation in india. (28 Hrs)

Module V Basic Economic Issues of Kerala

Features of Kerala economy-structural changes- Kerala model of development- self reliance and self help groups (SHG'S) Impact of migration in Kerala economy (20 Hrs)

Readings

1 Samuelson P. A, Nordhaus (2009) *Economics*, Tata Mc Graw Hill.

2. Mankiw , Gregory ,Principles of economics ,Cengage learning delhi.

3. Uma Kapila *Indian economy since independence*. Accademic publication , New delhi

4. Meera Bai. M. (ed) (2008) Kerala Economy Serials Publication New delhi

5. Dre'ze Jean and Amarthya Sen(Ed) Indian developmt selected regional perspectives Oxford university press new delhi

6. Dutt and sundharam , Indian economy S chand and company New delhi.

B A ECONOMICS PROGRAMME
(VOCATIONAL)

Model - II

ECONOMICS, PRINCIPLES AND PRACTICES OF INSURANCE / FOREIGN TRADE AND COMPUTER APPLICATIONS VOCATIONAL - MODEL – II

Course Design

The course comprises of six semesters, each semester having a duration of 18 weeks. The breakup of courses, work load and the mode of evaluation are as follows.

Courses	Nos.	Hrs	Weightage of marks		Total Marks
			IA	EA	
1. Common Courses	6	54	20	80	100
2. Core Courses	13	11	20	80	100
3. Complementary Courses	4	36	20	80	100
4.Open Course	1	90	20	80	100
5. Vocational Courses	6	54	20	80	100
Total	30	27			

B.A. Economics Programme – Model - II
Common, Core, Vocational, Complementary & Choice-Based Elective Courses

Sem.	Common / Complementary / Vocational / Core Papers	Exam	No. of hrs/ week	No. of cred-its	Credits cumu-lated	Total hrs/ sem.	Uty. Exam dur-ation	Weightage of marks	
								IA	EA
S1	**Common Course 1** **1.** First Language					90	3 hrs	20	80
	Common Course 2 **2.** Second Language					90	3 hrs	20	80
	3.Core 1 Perspective and Methodology of Economics I					90	3 hrs	20	80
	4. Core 2 – Micro Economics-I					90	3 hrs	20	80
	5. Complementary 1 Introduction to Computers – Theory					54	3 hrs	20	80
	Introduction to Computers – Lab					36			
S2	**Common Course 3** **6.** First Language					90	3 hrs	20	80
	Common Course 4 **7.** Second Language					90	3 hrs	20	80
	8. Core 3: Micro Economics-II					90	3 hrs	20	80
	9. Core 4: Macro Economics I					90	3 hrs	20	80
	10.Complementary2 MS-Office Packages – Theory					54	3 hrs	20	80
	MS-Office Packages – Lab					36			
S3	**Common Course 5** **11.** First Language					90	3 hrs	20	80
	12. Core.5. Macro Economics-II					90	3 hrs	20	80
	13. Core 6: Economics of Development					90	3 hrs	20	80
	14. Compl. 3: Database concepts & MS-Access – Theory					54	3 hrs	20	80
	Database concepts & MS-Access – Lab					36			
	15. Vocational 1: International Trade: Theory and Practice / Insurance and Banking					90	3 hrs	20	80

S4	**16.Common Course6** –First Language				64	90	3 hrs	20	
	17. Core 7: Public Finance				68	90	3 hrs	20	
	18. Core 8.Quantitative TechniquesI				72	90	3 hrs	20	
	19. Compl. 4: Visual Programming techniques – Theory				75	54	3 hrs	20	
	Visual programming techniques – Lab				76	34			
	20. Vocational 2: International Business / Actuarial science and the Economics of Insurance				80	90	3 hrs	20	
S5	**21.OPEN COURSE** (Common to Model I & II)**				84	72	3 hrs	20	
	22. Core 9: Introductory Econometrics				88	90	3 hrs	20	
	23.Core 10: Environmental Economics				80	90	3 hrs	20	
	24. Vocational 3: International Banking /International Economics and Marine insurance				96	90	3 hrs	20	
	25. Vocational 4: Foreign Trade Financing Documentation and Procedures / General Insurance				100	90	3 hrs	20	
S6	**26. Core 11**: - Indian Economy				104	90	3 hrs	20	
	27. Choice Based Course-(Common to Model I and II) **				108	90	3 hrs	20	
	28. Core 12: Quantitative Economics II				112	90	3 hrs	20	
	29. Vocational 5: International Marketing / Life Insurance				116	90	3 hrs	20	
	30. Vocational 6: Shipping and Insurance Practices and Procedures / Fire Insurance				119	90	3 hrs	20	
	31. On the job Training/ Project field visit				120				

Core courses

13(including 1 elective)

Complementary courses 04

Open Course 01

Vocational 02

Open course and choice based course –common to both model I and II

Vocational Course – I

Banking, Financial Services And Insurance

No. Of Credits – 4

No. Of Contact Hours – 90

Learning Objectives

As there will be a growing demand for qualified manpower for the banking and insurance sector in the coming years on account of expansion of volume of business , banking and insurance industry will require professionally qualified manpower endowed with banking and insurance knowledge. The programme aims at training students to gain knowledge in the fields related to banking, insurance and other related financial services

Module I –History Of Banking In India.

- Banking Structure In India-Its Evolution-RBI-Latest Trends-Nationalized Banks commercial Banks: Meaning, Role And Functions , Banking Systems – Branch Banking Vs Unit Banking And Other Banking Systems- Virtual Banking, Internet Banking-Core Banking- - Retail Banking & Wholesale Banking- Deposit Banking Vs Commercial Banking- - Old & New Generation Private Banks, NABARD - Rural Banks, Co-Operative Banks-

(20hrs)

Module II –Financial Instruments And Stock Market Operations

Negotiable And Non-Negotiable Instruments – Cheques – Drafts - Bills Of Exchange – Promissory Notes-Letter Of Credit - Certificate Of Deposits – Commercial Papers - Banking And Non-Banking Institutions - Commercial Banks – Recent Trends In Indian Commercial Banking – (Core Banking, Internet Banking, Mobile Banking, ATM/Debit & Credit Cards) - RBI – Functions - Money And Capital Market – Major Financial Instruments – Shares, Debentures And Bonds – Stock Exchange – Stock Exchanges In India -BSE, NSE –

Stock Market Indices – SEBI - Mutual Funds- Exchange Traded Funds (Etf) - Credit Ratings - Credit Rating Institutions In India – CRISIL, ICRA AND CARE. (25hrs.)

Module III –Financial Inclusion And Financial Services

Financial Inclusion: Its History And Importance-Initiatives And Index Of Financial Inclusion-Committees On Financial Inclusion- Relevance For Rural Development And Semi-Rural Development-, Various Initiatives By Government And Non –Government agencies financial Inclusion Strategies-Progress Of Financial Inclusion-Financial Tripod -Other Financial Services: Investment Market - Debt And Equity Market- Primary And Secondary Market Risks -Non Bank Finance Companies . (25 Hrs.)

Module IV –Insurance Sector And Capital Market

Insurance In Economic Development- Insurance And Mobilization Of Savings-Insurance Institutions As Investment Institutions And Their Role In Capital Market-Contribution Of Insurance Sector In The Economic Development- Insurance As Social Welfare And Security Insurance As An Investment- Insurance And Taxation, Advantages And Disadvantages Of Insurance, Retirement Planning, Pension Plans - Insurance Regulation And Development Authority (IRDA)- Role And Functions Of Insurance Companies – Bancassurance-Assurbanking (20 Hrs.)

Readings

1..Chakrabarty K.C (2011), "Financial Inclusion And Banks: Issues And Perspectives", Rbi Bulletin, November, 2011.

2.Suraj B. Gupta (2012), Monetary Economics, Institutions Theory And Policy, S Chand And Company Limited, New Delhi

3.Sundaram, K.P.M., And Varshney, P.N., 'Banking Theory, Law And Practice', Sultan Chand And Sons, New Delhi-2.

4.Jyotsna Sethi And Nishwan Bhatia, Elements Of Banking And Insurance, Phi Learning Private Limited, New Delhi-1, 2008.

5.Rajmani Sangha,Financial Inclusion For Inclusive Growth, Concept Publishing Company,2013

6.L.M. Bhole (Recent Edition). Financial Institutions And Markets, Tata Mcgraw Hill, New Delhi

7.V.A. Avadhani, Investment And Securities Market In India, Himalaya Publishing House, Bombay (Recent Edition)

8. Zuvi Bodie, Robert C Merton Et Al. (2009), Financial Economics, Pearson Education (Ch.1 (1.1, 1.2), Ch.2 (2.1, 2.5, 2.7) Only.

9. M.Y. Khan (Recent Edition) Indian Financial System, Tata Mcgraw Hill, New Delhi.

Vocational Course – II

Actuarial Science and the Economics of Insurance

No. of Credits – 4

No. of contact hours – 90

Learning Objectives

This course attempts to give the meaning, history and importance of Actuarial Science and the economic overview of insurance to the students of Economics.

Module I –Foundation Of Actuarial Science

Meaning - scope – history and importance-- Probability- Mortality Table-factors influencing mortality assumptions for a new insurance product- Intuitive Thinking by consumers , Insurers and Regulators- Insurer behavior **-***safety first* model - guiding principles for making insurance-Assur banking –bancassurance (20 hrs)

Module II –Economic Overview of Insurance

Risk and Insurance – demand for insurance – elasticity of demand for insurance – price – income – cross elasticity. Supply of insurance – pricing of insurance – economic and social benefits of insurance – social cost of insurance – factors affecting insurance consumption. (20 hrs.)

Module III –Risk Management

Risk and uncertainty – loss, risk- hazard- peril-types of risk- need for security against economic difficulties - Risk management process – risk management and insurance,– risk management of life insurance companies – insurance company operations. Asymmetric Information and Insurance- Moral Hazard and Insurance, Insurance and Selection Problems, single Crossing Property; Imperfect information: pooling, contract, separate insurance-methods of handling risk (30 hrs.)

Module IV –Organisational Structure and Product Development

Types of organizational structure – departmentalization – marketing strategies for insurance products – developing a marketing mix for insurance companies – product development process of insurance companies. (20 hrs.)

Readings

1. K.C. Mishra and L.S. Kumar (2009), Elements of Acturial Science, National Insurance Academy | Cengage Learning, New Delhi.
2. K.C. Mishra and MangalaBakshi (2009), Insurance Business Environment and Insurance Company Operations, National Insurance Academy | Cengage Learning, New Delhi.
3. Rejda, Principles of Risk Management and Insurance, 9th Edition, Pearson Education.
4. M.N. Mishra | S.B Mishra (2008), Insurance, Principles and Practice, S. Chand and Company, New Delhi.
5. P.K. Gupta (2008), Fundamentals of Insurance, Himalaya Publishing House, Mumbai.
6. Periasami P. (2008), Principles and Practice of Insurance, Himalaya Publishing House, Mumbai.
7. Tripathy and Pal (2005), Insurance: Theory and Practice, Prentice -Hall of India
8. Patukale(2009), Insurance for Everyone, Macmillan India Ltd
9. Palande, Insurance in India, Sage Publications, Delhi
10. Bodla (2008), Insurance Management, Deep & Deep Publications, Delhi
11. Brian Hiller, Economics of Asymmetric Information
12. Hun Seog S. Economics of Risk and Insurance, Wiley-Blackwell
13. Harrington and G. Niehaus, Risk Management and Risk, Tata McGraw-Hill, second edition(2004)
14. Mikael Gidhagen Insurance marketing - services and relationships.
15. Behavioral Economics and Insurance: Principles and Solutions- Howard Kunreuther And Mark Pauly - Working paper2014

Vocational Course – III

International economics and Marine Insurance

No. of Credits – 4

No. of contact hours – 90

Learning Objectives

To familarise the students with the nature of marine insurance contracts, policy conditions, premium calculation, payment of claims and the progress of marine insurance business in India. To understand the basic concepts and theories of international trade and enable the students to have a basic understanding of the emerging trends ,issues and polices in the field of international Economic system

Module I – Marine Insurance Contract, policies and conditions

Basic Aspects- Historical Background, Meaning & Scope - Subject Matter of Marine Insurance – Principles of Marine Insurance- Marine Insurance business in India,— types of marine insurance contracts - Freight, cargo and vessel- Types of Marine Insurance Policies – Policy Conditions- Clauses in Marine Policies - Classes of policies – policy conditions - procedure for preparation and presentation of claim – payment of compensation. (20 hrs)

Module II – Marine Insurance Rating and Underwriting -Introduction – Sea routes – Inland/national waterways – rail/road transport multi-Modal transport- Important ports of India, Asia, Europe and other international ports -Incoterms – Domestic & International Trade. Marine Ins. Act, 1963 – Important provisions relating to underwriting cargo underwriting – Factors – Detailed analysis viz a viz modes of transport cargo rating factors hull underwriting – Different types of vessels – Ocean-going vessels – Sundry hulls - Classification of vessels – I.R.S. – Role hull rating factors – Initial rating and renewal rating deductible – Factors – Applicability - Cargo and hull reinsurance – Types – Methods – Applicability - Maritime fraud – Types - Prevention of maritime fraud. (25 hrs)

Module III- Theories Of Internationaltrade and BOP

International Economics - subject matter-basis of trade – Mercantilism and Physiocrats - Classical theory: Absolute and Comparative Advantage theories - Terms of trade- offer curve – community indifference curve – opportunity cost (concepts only). The Heckscher-Ohlin theory- Leontief Paradox – gains from trade – static and dynamic gains- trade as an engine of growth, foreign trade multiplier- Balance of Payments – Components- measures to correct disequilibrium – automatic and deliberate measures – Devaluation – Effects of devaluation -

Marshall –Lerner condition – J Curve effect – Absorption approach – FDI ,FII and MNC

(25 hrs)

Module III – Theory Of Commercial Policy And Exchange Rate Determination-

Commercial policy – free trade vs protection – tariff barriers - impact of tariff- optimum tariff- Non tariff barriers- Quantitative Restrictions. Economic Integrations – rationale and objectives – forms of integrations – Free Trade Area – Customs Union- Common Market – Economic Union – Economic Integration - EU – Regionalism Vs Multilateralism – WTO and its objective- mint parity theory – purchasing power parity theory – BOP theory- Exchange rate systems – fixed and flexible exchange rates (20 hrs.)-

Readings

1. K.C. Mishra | G.C. Thomas (2009), General Insurance : Principles and Practice, National Insurance Academy | Cengage Learning, New Delhi.
2. M.N. Mishra | S.B Mishra (2008), Insurance: Principles and Practice, S. Chand and Company, New Delhi.
3. P.K. Gupta (2008), Fundamentals of Insurance, Himalaya Publishing House, Mumbai.
4. Periasami P. (2008), Principles and Practice of Insurance, Himalaya Publishing House, Mumbai.
5. Rodder, Marine Insurance, Prentice Hall, New Jersey.
6. Patukale (2009), Insurance for Everyone, Macmillan India Ltd
7. Palande, Insurance in India, Sage Publications, Delhi
8. Bodla (2008), Insurance Management, Deep & Deep Publications, Delhi
9. Tripathy et al, (2009), General Insurance Business Operations and Decisions Making, National Insurance Academy | Cengage Learning, New Delhi.
10. Soderstein, B O and Geffry Reed (2006): International Economics, Palgrave Mc Milan
11. Apple yard, Dennis R (2014): International Economics, 5th ed, TMH,New Delhi
12. Salvatore, Dominic(2012): International Economics', John Wiley and Sons
13. Cherunilam, Francis (2012): International Economics, Tata McGraw Hill, New Delhi.,
14. K C and K N Verma (2014): International Economics, Vishal publishing, Economics,:

Vocational Course – IV

General Insurance – An Overview

No. of Credits – 4

No. of contact hours – 90

Learning Objectives

Insurance industry is an important constituent of financial services industry in India and is a major player in the capital market. The study of the subject 'General Insurance' gives the students a comprehensive view of the prominent segments of the insurance sector.

Module I –History of General Insurance

Introduction to insurance-meaning-types -General insurance: meaning-importance - Growth of Insurance industry after Independence – -insurance sector reforms-Malhotra Committee 1994-structure of general insurance market in India- General Insurance Corporation and other of insurance institutions - regulations issued by the IRDA-FDI in insurance sector. (15hrs)

Module II –Operation of the Insurance Business.

Insurance Contract Fundamentals – Insurance marketing - insurance loss payment – underwriting – rating – reinsurance and other functions

(15hrs.)

Module III –Health and Motor Insurance

Health insurance – meaning - principles– growth of health insurance in India- Regulatory and Legal Aspects of Health Insurance;– Health insurance products in India: Insurance Act, 1938; IRDA Act 1999; File and Use procedure of IRDA; Other IRDA directions and guidelines on Health Insurance.

Motor Insurance – basic principles – types of motor vehicles – types of policies – private car policy – commercial vehicles and other policies – underwriting aspects on damage claims – Documents- Proposal form - Certificate of insurance and cover note- Policy forms – Endorsements and renewal notice- Underwriting and rating – No claim discount- - Claim (own damage) Documents and procedures- Types of losses – Claims (third party liability) – Legal and procedural aspects – motor vehicles act. (30 hrs.)

Module IV –Rural Insurance & Property & Liability Insurance

Rural and Crop Insurance – Farmers package – Plantation Insurance – artisans — Live stock insurance: Cattle, Sheep, Goat, Poultry, Duck, Sericulture, Honey, Dog, Camel, Elephant, etc. – Hut Insurance. IRDA Regulations on rural insurances, Reinsurance. Property insurance-meaning-types- Liability insurance-scope-features-types-Employers liability-public liability- rating -reinsurance -legal aspect of liability insurance. (30 hrs.)

Readings

1. K.C. Mishra | G.C. Thomas, General Insurance: Principles and Practice, NationalInsuranceAcademy | Cengage Learning, New Delhi.
2. M.N. Mishra | S.B Mishra (2008), Insurance: Principles and Practice, S. Chand and Company, New Delhi.
3. Kenneth Black (2000), Life and Health Insurance, 13th Edition, Pearson Education.
4. Periasami P. (2008), Principles and Practice of Insurance, Himalaya Publishing House, Mumbai.
5. Tripathy et al. (2009), General Insurance Business Operations and Decisions Making, NationalInsuranceAcademy | Cengage Learning, New Delhi.
6. P.K. Gupta (2008), Fundamentals of Insurance, Himalaya Publishing House, Mumbai.
7. Tripathy and Pal (2005), Insurance: Theory and Practice, Prentice-Hall of India.
8. Bodla, (2008), Insurance Management, Deep & Deep Publications, Delhi.

Vocational Course – V

Life Insurance

No. of Credits – 4

No. of contact hours – 90

Learning Objectives

This course imparts general awareness on Life Insurance and helps to understand the essentials of life insurance contract.

Module I –Introduction to Life Insurance

Life insurance-meaning-importance-difference between life and non life insurance-Evolution of life insurance - ancient India - modern form of life insurance - regulation of life insurance business in India - Individual life insurance-insurance sector reforms-IRDA-Structure and function-Life Insurance Corporation . (15 hrs.)

Module II –Life Insurance Contract

Insurance as a contract, distinguishing characteristics, insurable interest, utmost good faith, principle of indemnity- doctrine of subrogation - warranties, medical examination, policy construction and delivery, nomination and assignment, lapse revival, surrender value, paid up policies, maturity, loan to policy holders, Methods of calculating economic risks in life insurance proposal –factors effecting risk- underwriting process - distribution of surplus – premium - basic elements in computation of life insurance premium- important documents in life insurance contract. (30 hrs.)

Module III –Life Insurance Policies and its applications

Important life insurance policies issued by the Life Insurance Corporation of India – Life Insurance activities – Group insurance - general structure of a policy document. **-** Concept of Risk Management – Pension and Annuities individual pension scheme principles and types. -Reinsurance,- types of Different methods - Life Insurance –Taxation Aspects – Different types of insurance policies-individual life Insurance Plans – Retirement benefits that are to be by the employer to employees – Equity Linked Insurance Plans. Survival, Maturity and Death claims, Proposal), Missing persons, Presumption of Death. (30 hrs.)

Module IV –Life Insurance Salesmanship and Benefit Payment

Benefit payment guidelines - classification of benefit payment –insurance agent- essential qualities of an ideal insurance agent, rules of agency, insurance marketing- – after sale service to policy holders. (15 hrs.)

Readings

1. K.C. Mishra | C.S. Kumar, Life Insurance: Principles and Practice, NationalInsuranceAcademy | Cengage Learning, New Delhi.
2. M.N. Mishra | S.B Mishra (2008), Insurance: Principles and Practice, S. Chand and Company, New Delhi.
3. Kenneth Black (2000), Life and Health Insurance, 13th Edition, Pearson Education.
4. Patukale (2009), Insurance for Everyone, Macmillan India Ltd.
5. Life Insurance Corporation of India, Try with Trust: The LIC Story
7. Tripathy and Pal (2005), Insurance: Theory and Practice, Prentice -Hall of India
8. Palande, Insurance in India, Sage Publications, Delhi
9. K.C. Mishra and R. Venugopal(2009), Life Insurance Underwriting, National Insurance Academy | Cengage Learning, New Delhi.

Vocational Course – VI

Fire Insurance

No. of Credits – 4

No. of contact hours – 90

Learning Objectives

This course highlights the origin and nature of fire insurance and its policy conditions.

Module I – Introduction

History and origin of fire insurance – definition – causes of fire – prevention of loss – fire insurance contracts.Kinds of Fire Insurance Policies -Policy conditions – implied and express conditions – reinsurance – definition – advantages and methods. (25 hrs)

Module II – Fire Insurance Claims

Principles Of Fire Insurance-Standard Fire Policy-Add On Covers-Various Fire Warranties-Ex-Gratia Settlement-Procedures Related To Claim Settlement-Role Of Surveyors—Process Of Survey And Loss Assessment-Waiver And Estoppel-. (20 hrs.)

Module III – Rate Fixation in Fire Insurance

Processes – Principles Of Rate Fixation – Basis Of Tariff Rates — Salvage Corps – Average Clause – Pro-Rata Condition Of Average.-Structure Of All India Tariff-Rules And Regulations- types of Industrial hazards (25 Hrs)

Module IV. –Fire Insurance Underwriting

Progress Of Fire Insurance - Fire Insurance Underwriting.-Fire Insurance Practice In India- Industrial Risk Policy-Petro Chemical Risk- Underwriting Experience Of Fire Insurance Portfolios – During Tariff Regime As Well As During Tariff-Free Regime-Underwriting Traditional Approach – New Dimensions As Per IRDA Regulators (20 hrs.)

Readings

1. K.C. Mishra | G.C. Thomas, General Insurance : Principles and Practice, National Insurance Academy | Cengage Learning, New Delhi.
2. M.N. Mishra | S.B Mishra (2008), Insurance: Principles and Practice, S. Chand and Company, New Delhi.
3. Godwen, Fire Insurance
4. P.K. Gupta (2008), Fundamentals of Insurance, Himalaya Publishing House, Mumbai.
5. Periasami P. (2008), Principles and Practice of Insurance, Himalaya Publishing House, Mumbai.
6. Tripathy and Pal (2005), Insurance: Theory and Practice, Prentice -Hall of India
7. Palande, Insurance in India, Sage Publications, Delhi
8. Bodla,(2008), Insurance Management, Deep & Deep Publications, Delhi
9. Tripathy et al. (2009), General Insurance Business Operations and Decisions Making, National Insurance Academy | Cengage Learning, New Delhi.
10. K.C. Mishra (2009), Practical Approach to General Insurance Underwriting, National Insurance Academy | Cengage Learning, New Delhi.

Vocational Course – I

International Trade Theory and Practice

No. of Credits – 4

No. of contact hours – 90

Learning objectives:

To familiarize the students with the basic principles of foreign trade and the environment in which foreign trade takes place. To enable the students to understand the position of India's foreign trade, import and export policies and various export promotion measures adopted by the Government.

Module I - Introduction to the Theory of International Trade

International Economics – Meaning and Significance – Pure theory of international trade – Basic concepts – opportunity cost – Absolute advantage – Comparative advantage – Heckscher – Ohlin theory – Leontief Paradox. (25 hrs.)

Module II – Trade barriers and terms of trade

Free Trade v/s Protection – instruments of protection – Tariff and quotas – Types of tariff– partial equilibrium effect of tariff – concept of optimum tariff. Terms of trade – meaning and types - offer curve – community indifference curve. Gains from trade – static and dynamic gains concept of terms of trade – secular deterioration of terms of trade. (25 hrs.)

Module III - Balance of Payments

Meaning and structure of balance of payments – equilibrium and disequilibrium in the balance of payments – measures to correct disequilibrium – monetary and non-monetary measures – Devaluation and Balance of Payments - Marshall-Lerner condition. (20 hrs.)

Module IV: India's Foreign Trade

India's foreign trade policy – import substitution and export promotion – import liberalization – recent trade policy. Foreign investment – classification – FDI- FII– Regulations – FERA – FEMA- current and capital account convertibility. (20 hrs.)

Readings

1. Sodersten, Bo. and Geoffry Reed, International Economics, palgrave macmillan
2. Dominic Salvatore, (recent edition) International Economics. John Wiley and Sons, Delhi.
3. Francis Cherunilam (2008), International Economics, Tata McGraw Hill, Delhi.
4. Paul Krugman and Maurice Obstfeld (recent edition), International Economics: Theory and Policy, Pearson Education, Delhi.
5. Subba Rao (2013), International Business, Himalaya Publishing House
6. Sumati Varma (2012), International Business, Pearson
7. Dutt and Sundharam: Indian Economy, S. Chand and Co., New Delhi. (Recent edition)

Semester IV

Vocational Course – III

International Business

No. of Credits – 4

No. of contact hours – 90

Learning Objectives

This course has become relatively more relevant from the policy point of view under the present waves of globalization and liberalization both in the North and in the South.

Module I – Nature and scope of International Business

Definition and meaning of international business – advantages of international business – motive for internationalization-stages and theories of internationalization. Selection of export market and export products – Meaning of trade block-types & levels of trade blocks-major trade block – ASEAN, SAARC ,SAPTA, BRICS. WTO agreements and India's trade prospects (25 hrs)

Module II-Globalization and international business

Global business environment-PESTEL- meaning of Globalization -elements of globalization - international orientations/international business approach – essential conditions for globalization-arguments for and against globalization (25 hrs.)

Module III – Modes of Entry in International Business

Modes of entry – exporting, licensing – franchising – contract manufacturing – management contracts- sub-contracting, wholly owned subsidiaries and counter trade - turnkey projects – FDI – Mergers and acquisition – joint ventures – comparison of different modes of entry – functional alliance – break up of alliances. (20 hrs.)

Module IV – Institutional Framework for Export Promotion in India

A brief overview of different institutions for export promotion – Export incentive schemes - Duty exemption scheme –Duty remission schemes -Export Promotion Capital Goods Scheme (EPCG) – Export Processing Zones EPZs – SEZs - EOUs – Flow of credit to Export sector in India - Corporate social responsibility. (20 hrs.)

Readings

1. Francis Cherunilam (2007), International Business Environment, Himalaya Publishing House, Bombay.
2. P. Subba Rao (2013), International Business, Himalaya Publishing House
3. Sumati Varma (2012), International Business, Pearson
4. K.C. Kapoor, Export Management, Vilas Publishing House.
5. P. Arunachalam (ed.) (2009), Social, Political, Economic and Environmental Concerns of SEZ in India, Serials Publication, New Delhi.
6. O.S. Srivastava (2008), International Business, Kalyani Publishers, Ludhiana.
7. Aswathappa, International Business, Tata McGraw Hill

Semester V

Vocational Course – II

International Banking

No. of Credits – 4

Contact Hours – 90

Learning objective:

To enable students to get familiarized with the various aspects of International banking and its effect on economies and companies. To make students understand the movement of Foreign Exchange rates and the how Exchange rates are determined and calculation of Real and Effective Exchange rates.

Module I: An Overview of Banking

Evolution of Banking In India, Nationalization, Liberalization, Banking structure in India- Nationalized Banks, commercial banks- meaning and structure - Old & New Generation Private Banks, NABARD - Rural banks, Co-operative banks- Types of customers-Types of Accounts-Deposits – NPAs – Virtual banking, Merchant banking, NRI Banking , Loans and Advances - Retail Banking & Wholesale Banking- Payment and remittance systems in Banks- Financial Inclusion (25 Hrs)

Module II: International Banking

Introduction- Evolution of International Monetary System- international monetary institutions – IBRD, IMF, ADB - Foreign Exchange Markets – Federal Reserve of US, European Central Bank, Bank for International Settlements (BIS) - Major Currencies (20Hrs)

Module III: International banking Operations

Basic concepts in International Banking -NRIs/OCBs/ International Banking Transactions-International Remittances-Concepts and Techniques- SWIFT, Correspondent Banking/Nostro and Vostro Accounts-Mirror Accounts-Accounting for Foreign Exchange transactions.

(20Hrs)

Module IV: Foreign exchange Rate

Equilibrium Rate of Exchange – theories of exchange rate determination – mint parity theory – purchasing power parity theory – BOP theory – Fixed and flexible exchange rate - forward rate – spot rate – nominal, real, and effective rate of exchange – foreign exchange risks – hedging and speculation –currency derivatives –future options – currency swaps – LIBOR (concepts only) (25Hrs)

Readings

1. IIBF (2011), International Banking, Indian institute of Banking and Finance
2. Rupnarayan Bose (2015), Fundamentals of International Banking, McMillan India
3. Suraj B. Gupta (2012), Monetary Economics, Institutions Theory and Policy, S Chand and Company Limited, New Delhi
4. B. Srinivasan (2005), Foreign Exchange Simplified, Tata McGraw Hill
5. Maurice D. Levi (2009), International Finance, Routledge
6. Vyuptakesh Sharan (2012), International Financial Management, Prentice Hall India
7. P.G.Apte (2012), International Finance, Tata McGraw Hill

Semester V

Vocational Course – IV

Foreign Trade Documentation Financing and Procedures

No. of Credits – 4

No. of contact hours – 90

Learning Objectives

To impart the students the various methods and procedures of foreign trade financing, foreign exchange rates, costing and pricing of exports and the various institutions involved in export financing.

Module I –Export Business: steps and documents

Export Procedure: Starting an export firm – Steps - Registration procedures– IEC - RCMC-BIN - Selection of an export product -Market and Buyer. Licensing procedures- obtaining export – import license - types of import licenses-advance - special interest license. Export Incentive schemes- Export import documentation - need and rationale (25Hrs)

Module II –Methods of payment and financing export and import

Export payment terms – advance payment – bill of exchange - open account- consignment payment. Letter of credit- types – benefits- procedures. Pre-shipment and post-shipment finance. Export Factoring & Forfaiting - Import finance - buyer's credit-supplier's credit - line of credit. (20 Hrs)

Module III – Export finance- Role of financial institutions

Sources of Finance - Role of commercial bank, EXIM Bank, ECGC and others. Obtaining an ECGC policy and filing claims. (20 Hrs)

Module IV – Execution of export order - procedures

Pre-shipment stage- pre-shipment quality inspection and quality control- Excise clearance of export cargo. Customs clearance of export cargo - import cargo – manual - EDI procedure. Customs valuation- harmonized system - Shipment of goods - port procedure. Post shipment formalities – foreign exchange and GR formalities - Claiming duty drawbacks and other benefits. (25 Hrs)

Readings

1. Acharya Jain (2007), Export Marketing, Himalaya Publishing House.
2. Justin Paul and Rajiv Aserkar (2008), Export Import Management, Oxford University Press
3. Francis Cherunilam (2015), International Trade and Export Management, Himalaya Publishing House.
4. Usha Kiran Rai (2012) Export Import and Logistic Management, PHI India
5. Ministry of Commerce, Handbook of Import and Export Procedures, Government of India.

Semester VI

Vocational Course – V
International Marketing

No. of Credits – 4

No. of contact hours – 90

Learning Objectives

To familiarise the students with the nature and scope of international marketing strategies and policies.

Module I – Major Activities in International Marketing

Domestic Vs. International Marketing - Nature and scope of international marketing - functions of international Marketing —International market assessment – Developing international Marketing strategies - international product strategies – Standardization Vs Adaptation - Product life cycle - Market segmentation – international marketing management - Understanding international Consumers – Cultural Dynamics in assessing Global markets – new trends in international marketing (30 hrs)

Module II – International Marketing Channels

Channel selection –indirect exporting – marketing middleman - levels of marketing channels – types of foreign intermediaries - appointment of agents – agency agreement and payment of agency commission- direct export- factors influencing channel selection - global marketing of services. (20 hrs.)

Module III – Advertisement and Promotion in International Market

Business environment and promotion strategies –factors affecting international marketing communication - communication mix- advertisement- sales promotion- personal selling- public relations - Developing International advertising strategy – trade fair and exhibition – Role of EPC in international marketing- problems in international marketing communication. (20 hrs.)

Module IV – International Pricing

Determinants of selling prices – pricing strategies –price discrimination – Dumping – forms of Dumping -strategic pricing- skimming and penetration pricing - predatory pricing – multipoint pricing –bundling price - experience curve pricing- Transfer pricing — INCOTERMS (20 hrs.)

Readings

1. Francis Cherunilam (2009), International Marketing, Himalaya Publishing House.
2. Francis Cherunilam (2007), International Business, Himalaya Publishing House.
3. P. Subba Rao (2013), International Business, Himalaya Publishing House
4. Sumati Varma (2012), International Business, Pearson
5. Acharya Jain (2007), Export Marketing, Himalaya Publishing House.
1. U.C. Mathur (2008), International Marketing Management, Sage Publications, Delhi.
2. Varshney and Bhattacharya (2005), International Marketing Management : Text and Cases, Sultan Chand and Co., Delhi.
3. Justin Paul and Rajiv Aserkar (2008), Export Import Management, Oxford University Press, Delhi.

Semester VI

Vocational Course – VI

Shipping and Insurance Practices and Procedures

No. of Credits – 4

No. of contact hours – 90

Learning Objectives

To make the students aware of the shipping and insurance practices and procedures which constitute the essential service for the operation of foreign trade.

Module I – International Logistics and Distribution

Planning physical distribution – Logistics- concept- benefit of efficient logistic system- critical elements of logistic system – International Transport systems – sea, air, and road - choice of modes of transport–performance, characteristics and selection –various modes of transportation (multimodal) –merits of each all modes of transportation. Liners and Tramps operation – Charter Party - types of ships in international trade. (25Hrs)

Module II – Characteristics of shipping industry

History – characteristics, role of intermediaries in shipping – clearing and forwarding (c & f) agents – freight forwarders – Third party Logistic operators – latest trend in logistics operation- ocean freight structure. INCOTERMS -Shipping conference and freighting methods -The liner tariff- pallet rules - General Rate increase, Loyalty. Containerization and Development – history – types – benefits. World container trade -Container leasing practices – Inland Container Depots (ICD)- Container Corporation of India (20 Hrs)

Module III – Export Packaging and Labeling

Importance of packaging – Packing- Packaging -labeling– marking - Factors influencing packaging decisions- Evaluation of bulk packages –Functional Requirements – Transport Packaging – Consumer Packaging – shipping Hazards –Packing Notes and Packing Lists – Packing nets – Packing List – Marking Shipping Marks – Leading Marks – Subsidiary Marks –factors influencing packaging - Indian Institute of Packaging – Labeling. (20 Hrs)

Module IV – Meaning and need of Marine Insurance

Principle of insurance -Meaning & Scope of Marine Insurance - Cargo Insurance – Hull insurance - Important Institutions - Marine Insurance business in India, Institute Cargo Clauses- Non-Institute Clauses, - types of covers - Marine Insurance Policy – Contents of

Policy –Voyage and Time Policies – Valued and unvalued policies – Specific and Open Policies. Types of Marine Losses – Basic risks - Total Losses – Filling a claim – Document required to proceed Cargo Claim, Time limit for filling claims. (25 Hrs)

Readings

1. Justin Paul and Rajiv Aserkar (2008), Export Import Management, Oxford University Press
2. Acharya Jain (2007), Export Marketing, Himalaya Publishing House.
3. Usha Kiran Rai (2012) Export Import and Logistic Management, PHI India
4. Francis Cherunilam (2009), International Trade and Export Management, Himalaya Publishing House.
5. Ministry of Commerce, Handbook of Import and Export Procedures, Government of India.
6. Bennet (1999), International Business, Pearson E

B A ECONOMICS PROGRAMME

Model - III

B.A CORPORATE ECONOMICS

Major highlights of the course:

1. Forecasting, information provision, policy analysis and consulting.
2. Monitoring current economic trends.
3. Developing unique insights on how external events affect the domestic economy.
4. Monitors and disseminates key indicators such as inflation, employment, interest rates and exchange rates.
5. Catering to the requirements of the corporate world and this would offer immense career opportunities in corporate firms, banking, finance and insurance sectors as market analysts, finance analysts , economists etc.
6. Preparing of forecasts of variables influencing the operations of corporate firms at various levels, for both planning and budgeting.
7. The monitoring of the economy and other factors on a continuous basis.
8. Responding to the current problems facing corporate or parts thereof which involve problem- definition, detailed analysis, generating alternative solutions.

Papers included in the course

Semester I

1.Language- English - I

2.Micro- Economics- I

3.Elementary Statistics for Economists- I

4.Mathematics for Economics- I

5.Financial Accounting- I

6.Financial Administration- I

Semester II

1.Language- English - II-Critical Thinking

2.Micro- Economics- II

3.Elementary Statistics for Economists- II

4.Mathematics for Economics- II

5.Financial Accounting- II

6.Financial Administration- II

Semester III

1.Indian Economy and Reforms

2.Monetary Economics- I

3.Managerial Economics- I

4.Cost Accounting

5.Marketing Management

6. International Economics- I

Semester IV

1.Development Issues of the Indian Economy

2.Monetary Economics- II

3.Managerial Economics- II

4.Economics of Financial Markets

5.Computer Applications in Corporate Environment-I

6. International Economics- II

Semester V

1.Macro- Economics- I

2.Fiscal Economics- I

3.Principles and Practice of Management

4.Environmental Economics (Applicable to Model I)

5.Computer Applications in Corporate Environment-Theory and Practical- II

6.Open course

Semester VI

1.Macro- Economics- II

2.Fiscal Economics- II

3.Entrepreneurship Development and Strategic Management

4.Business Communication

5.Economics of Human Resources Management

6.Project and Viva-voce examination

OPEN COURSES

Open Course 1 – Fundamentals of Economics

Open Course-II- Demography

Open Course III – Gender Economics

PROJECT

All students must do a project. It can be done individually or as a group. However, the viva voce examination on this project will be conducted individually. The projects are to be identified during the V semester of the programme with the help of the supervising teacher. The report of the project is to be submitted to the department for valuation by the examiners appointed by the University.

A project is a scientific and systematic study of real issue or a problem intended to resolve the issue with application of concepts, principles, theories and processes. It should entail scientific collection, analysis and interpretation of data to valid conclusions.

7. PROGRAMME STRUCTURE

There shall be a maximum of three credits for the open course and remaining one credit should be shifted to choice based course or any other core course.

	Programme Duration	6 Semesters
	Total Credits required for successful completion of the programme	120
	Minimum credits required from common cour	38
	Minimum credits required from Core + complementary + vocational* courses includi Project	79
	Minimum credits required from Open course	3
	Minimum attendance required	75%

*The credit distribution for vocational courses is to be decided separately.

SCHEME AND SYLLABUS OF B.A CORPORATE ECONOMICS (C.B.C.S.S)

MODEL – III

SEMESTER –I

Sl.No.	Paper	Title of the paper	Instructional hours	Credits
1.	Common - I	Language – English- I	5	4
2.	Core-1	Micro- Economics- I	4	4
3.	Core-2	Elementary Statistics for Economists-I	4	3
4.	Core-3	Mathematics for Economics- I	4	3
5.	Core -4	Financial Accounting- I	4	3
6.	Core-5	Perspectives and Methodology of Economics	4	4
			25	21

SEMESTER –II

Sl.No.	Paper	Title of the paper	Instructional hours	Credits
1.	Common - I	Language – English- II- Critical Thinking	5	4
2.	Core-1	Micro- Economics- II	4	4
3.	Core-2	Elementary Statistics for Economists-II	4	3
4.	Core-3	Mathematics for Economics- II	4	3
5.	Core -4	Financial Accounting- II	4	3
6.	Core-5	Financial Administration	4	4
			25	21

SEMESTER –III

Sl.No.	Paper	Title of the paper	Instructional hours	Credits
1.	Core-1	Indian Economy and Reform	5	4
2.	Core-2	Monetary Economics- I	4	3
3.	Core-3	Managerial Economics- I	4	3
4.	Core-4	Cost- Accounting	4	3
5.	Core -5	Marketing Management	4	3
6.	Core-6	International Economics-I	4	4
			25	20

SEMESTER –IV

Sl.No.	Paper	Title of the paper	Instructional hours	Credits
1.	Core-1	Development Issues of the Indian Economy	4	4
2.	Core-2	Monetary Economics- II	4	3
3.	Core-3	Managerial Economics-II	4	3
4.	Core-4	Economics of financial markets	4	3
5.	Core -5	Computer Applications in Corporate Environment-I	5	4
6.	Core-6	International Economics -II	4	3
			25	20

SEMESTER –V

Sl.No.	Paper	Title of the paper	Instructional hours	Credits
1.	Core-1	Macro – Economics- I	4	3
2.	Core-2	Fiscal Economics – I	4	3
3.	Core-3	Principles and Practice of Management	4	3
4.	Core-4	Environmental Economics (Common to Model I)	4	3
5.	Core -5	Computer Applications in Corporate Environment-Theory and Practical-II	5 (3+2)	4 (2+2)
6.		Open course	4	3
			25	19

SEMESTER –VI

Sl.No.	Paper	Title of the paper	Instructional hours	Credits
1.	Core-1	Macro – Economics- II	5	4
2.	Core-2	Fiscal Economics – II	5	4
3.	Core-3	Entrepreneurship Development and Strategic Management	5	4
4.	Core-4	Business Communication	5	3
5.	Core -5	Economics of Human Resource Management	5	3
6.	Core-6	Project and Viva- voce examination		1
			25	19

Total Credits: 120

SEMESTER- I

CORE PAPER - 1
MICRO ECONOMICS - I

Learning Objectives

This course is designed to provide basic understanding of micro economic concepts, behavior of economic agents – consumer, producer, factor owner – price fluctuations in the market. The modules included in this course deal with the concepts of consumer behaviour, production, market, factor pricing and Welfare Economics.

UNIT - I

Definition and scope of Economics - Difference between Micro and Macro Economics - Inductive and Deductive Methods - Positive and Normative - Statics and Dynamics - Partial and General Equilibrium.

UNIT - II

Utility analysis-cardinal utility- consumer equilibrium-law of demand-determinants of demand-individual demand and market demand curves - Elasticity of Demand–different types of elasticity-measurement of elasticity-its significance -Consumer's Surplus.

UNIT - III

Ordinal utility-Indifference Curve Analysis-consumer equilibrium using ordinal utility - Giffen goods-weak ordering and strong ordering-Revealed Preference Theory.

UNIT - IV

Cost analysis- AC and MC curves-various concepts of short and long run cost curves and their significance-law of supply-determinants- Production Function - Law of Variable Proportions - Returns to scale.

UNIT - V

Revenue Analysis-various concepts- AR and MR curves - Theories of price determination in perfect competition and monopoly.

REFERENCES :

1. Ahuja H.L.: Advanced Economic Theory-S.Chand & Co.,
2. Ashimakopoulos.A. : An Introduction to Economic Theory: Micro Economics.
3. Bell & Todaro : Economic Theory - Oxford University Press.
4. Dewett.K.K. : Modern Economic Theory
5. Dwivedi : Micro Economics, Pearson Education.
6. Hutchinson : Economics - ACCA Series, London.
7. Joan Robinson & Eatwell : Introduction to Economic Theory
8. Koutsoyiannis, A : Modern Micro Economics – ELBS
9. Leftwich : Price System and Resource Alloction
10. Lipsey : An Intorduction to Positive Economics – ELBS
11. Lipsey & Steiner : Economics
12. Maddala :Micro Economics : Theory and Applications – Mc Graw Hill
13. Maurice Dobb :Theories of Value and Distribution since Adam Smith- Vikas Publishing House, New Delhi.
14. Pindyck & Rubinfeld : Micro Economics - Pearson Education.
15. Salvatore Diulio : Principles of Economics - Schaum Series
16. Salvatore, Dominick : Micro Economics - Schaum Series.
17. Samuelson, Paul : Economics - McGraw Hill, London.
18. Sankaran, S : Micro Economics - Margham Publication.
19. Stonier & Hague : Text Book of Economic Theory
20. Watson, D.S : Price Theory and its uses

CORE PAPER - 2

ELEMENTARY STATISTICS FOR ECONOMISTS- I

Learning Objectives:

This paper aims at providing the students an understanding about the significance of statistical analysis through graphical presentation and through measures of averages, dispersion, skewness and kurtosis.

UNIT - I

Nature - Significance and Limitations of Statistics - Collection, Classification and Tabulation of Data.

UNIT - II

Diagrammatic and Graphic representation - Bar Diagrams - Pie Diagrams - Histograms - Pictograms - Cartograms - Frequency Distribution - Frequency Graphs - Ogives - Lorenz curve.

UNIT - III

Measures of Central Tendency - Arithmetic Mean - Median - Mode.

UNIT - IV

Measures of Dispersion - Range - Quartile Deviation - Mean Deviation - Standard Deviation - Coefficient of variation - Percentiles and Deciles.

UNIT - V

Skewness and Kurtosis' - Pearsanain and Bowley measures of skewness - kurtosis.

REFERENCES :

1. Agrawal : Basic Statistics, New Age International
2. Gupta, S.P. : Statistical Methods
3. Hooda, R.P. : Statistics for Economics, Macmillan
4. Paden, D.W., & Lindquist,E.L : Statistics for Economics and Business
5. Pillai, R.S.N. & Bagavathi,V : Statistics
6 .Sweeney, Anderson Statistics for Economics and Business, Williams : Thomson Publication.
7. Schaum Series : Statistics

CORE PAPER 3
MATHEMATICS FOR ECONOMICS- I

Learning Objectives:

Economics has increasingly become the most scientific of all social sciences these days. An important reason for this is that most economic analysis and theorizing are easily amenable to mathematical tools and techniques. The student is exposed to economic concepts in mathematical format through simple illustration and prepares the ground for more scientific study.

UNIT - I

Vector and matrices - Addition and multiplication of Matrices - Linear independence and rank.

UNIT - II

Determinant of a Matrix - Solving a system of linear equations by Cramer's Rule and Matrix inversion.

UNIT - III

Input Output Analysis.

UNIT - IV

Linear programming -problems involving two choice variable - Graphical and algebraic solutions, relationship between primal and dual.

UNIT **- V**

Equation

Equations, identities, simplex, quadratic equation, solution by factorization, simultaneous equations.

Refererences :

1. Allen, R.G.D (1974) Mathematical Analysis for Economics, McMillan Press, London. (reprint edition)
2. Chiang, A.C., Fundamental Methods of Mathematical Economics, McGraw Hill, New Delhi (recent edition).
3. Henderson, J. and R.E. Quandt (1980) Micro Economic Theory: A Mathematical Approach, McGraw Hill, New Delhi
4. Handy, S.T (1997) Operations Research: Prentice-Hall of Indian, New Delhi.
5. Jeffrey Baldani et al. (2009), An Introduction to Mathematical Economics, Cengage Learning, Delhi.

CORE PAPER – 4
FINANCIAL ACCOUNTING- I

Learning objectives:

To provide wide options for Economics students to enter into the fields like M.A. (Eco.) M.B.E., C.A., I.C.W.A., M.Com., M.B.F., M.I.B., and M.B.A. successfully. As per the University norms students who have studied two Accounts Papers alone are eligible to get admission in M.Com., During the present regime of Globalization to succeed in the business, trade and in entrepreneurial activities knowledge in Accounts are very much essential. To create manpower to cater to the needs of the emerging corporate sector.

UNIT - I Introduction:

Basic Accounting Concepts and Conventions - Groups interested in accounting - Accounting Equation - Journal - Ledger - Subsidiary Books

Unit II-Trial balance

Errors - Types - Rectification of Errors - Bank Reconciliation Statement.

Unit III- Final accounts

Meaning - Preparation of Final Accounts - Trading Account - Profit and loss a/c Manufacturing a/c- Balance Sheet - Distinction between Trial Balance and Balance Sheet - Adjustment Entries.

UNIT - IV Single Entry System:

Definition - Salient features - Limitations - Differences between Single Entry System and Double Entry System - Methods.

UNIT – V- Depreciation Accounting:

Meaning of Depreciation - Methods of Providing Depreciation - Fixed Percentage on Original Cost - Fixed Percentage on Diminishing Balance (including change in the method of depreciation).

REFERENCES:

1. Grewal, T.S. : Principles of Accountancy, S.Chand & Co.,
2. Gupta R.L.& : Financial Accounting, Sultan Chand & Sons.Gupta, V.K.
3.Gupta, R.L.& : Advanced Accountancy, Sultan Chand & Sons
4. Jain & Naurang : Advanced Accounts, Kalyani Publishers.
5. Shukla & Grewal : Advanced Accounts Vol.I, S.Chand & Co.,

CORE PAPER – 5

Perspectives and Methodology of Economics

(As common to Model I)

SEMESTER-II

CORE PAPER- 1

MICRO ECONOMICS-II

Learning objectives:

This paper enables the students to study about pricing under various market situations and theories of distribution.

UNIT - I

Pricing under various markets-

Perfect Competition, Monopoly, and Discriminating Monopoly - Pricing policies of Public Sector Undertakings- break even analysis, price skimming and penetration pricing-full cost pricing.

UNIT - II

Imperfect Competition - Monopolistic Competition –wastes of monopolistic competition- Oligopoly – kinked demand curve and price rigidity under oligopoly.

UNIT - III

Distinction between Personal and Functional distribution - Theories of Distribution - Distribution shares - Marginal Productivity Theory - Wage Theories - Real and Money wages - Trade Union and Wages.

UNIT - IV

Rent - Ricardian Theory - Scarcity and differential rent - Modern theory of rent - Quasi and transfer earnings - Profits-Distinction between gross and net profits - Theories of Profits- innovation theory, risk and uncertainty bearing.

UNIT - V

Interest - Classical theories of interest - Keynesian Criticism - Liquidity Preference theory - Loanable funds theory.

References:

1. A. Koutsoyiannis (1978), Modern Micro Economics, Palgrave Macmillan
2. Dominick Salvatore, Micro Economics – Theory and Application 4th ed., Oxford University Press, New Delhi.
3. Robert S. Pindyck, et al., (recent edition) Micro Economics – Pearson Education.
4. G.S. Maddala and Ellen Miller (2004), Micro Economic Theory and Applications, Tata McGraw Hill.

CORE PAPER-2
ELEMENTARY STATISTICS FOR ECONOMISTS- II

Learning objectives:

This paper familiarizes students with various sampling techniques, correlation, regression and time- series analysis.

UNIT - I

Sampling – population, sample. Types of sampling - Simple - Random and stratified Random sampling- Design of questionnaire - Sampling Errors - Sampling Design.

UNIT - II

Correlation - Limits of Co-efficient of correlation - calculation of co-efficient of correlation - Rank correlation - co-efficient.

UNIT - III

Regression - Two valuable linear regression - Meaning - Regression lines and regression co-efficient.

UNIT - IV

Index Number - Methods - Unweighted indices and Weighted indices - Value Index Numbers.

UNIT - V

Analysis of Time Series - Four Components - Measurement of Secular Trend - Moving Average Methods and Methods of Least squares - Uses of Time series Analysis.

REFERENCES :

1. Agrawal : Basic Statistics, New Age International
2. Gupta, S.P. : Statistical Methods
3. Hooda, R.P. : Statistics for Economics, Macmillan
4. Paden, D.W., & Lindquist,E.L : Statistics for Economics and Business
5. Pillai, R.S.N. & Bagavathi,V : Statistics
6.Sweeney, Anderson and Statistics for Economics and Business, Williams : Thomson Publication.
7. Schaum Series : Statistics

CORE PAPER- 3
MATHEMATICS FOR ECONOMICS - II

Learning Objectives:

This course is designed to equip the students to understand the economic concepts and theories which use mathematical tools and techniques to refine the verbal logic.

UNIT - I

Derivatives-logarithmic differentiation, higher order derivatives.

UNIT - II

Assignment Problems- solving methods for assignment problems-maximization in assignment problems-unbalanced assignment problems

UNIT - III

Transportation problems-Transportation model-solution by simplex method-north west corner, lowest cost entry, Vogel's and MODI method

UNIT -IV

Matrices- rank of a matrix, non singular and singular matrices, elementary transformations, inverse of a non singular matrix, canonical form.

UNIT - V

Set theory, meaning, union, intersection, subset, universe, Venn diagram

Readings

1. Allen, R.G.D (1974) Mathematical Analysis for Economics, McMillan Press, London. (reprint edition)
2. Chiang, A.C., Fundamental Methods of Mathematical Economics, McGraw Hill, New Delhi (recent edition).
3. Kanthi Swaroop: Operations Research
4. Handy, S.T (1997) Operations Research: Prentice-Hall of Indian, New Delhi.
5. Premkumar Gupta and D S Hira: Operations Research
5. Shanti Narayan, Matrices, S. Chand & Company

CORE PAPER 4

FINANCIAL ACCOUNTING- II

Learning objectives:

To give an understanding about branch accounts, departmental accounts, hire purchase arrangement, partnership accounts and modern systems of accounting

UNIT - I

Branch Accounts: Objectives, features and types-dependent branches-debtor system, stock and debtor system, independent branch-incorporation of branch trial balance-adjustments for goods in transit, cash in transit (excluding foreign branches)

Dependent Branches

UNIT – II

Departmental Accounts:

Basis for allocation of expenses - Inter Departmental Transfer at cost or selling price - Treatment of expenses which cannot be allocated.

UNIT –III

Introduction of a partnership firm

Meaning and definition, partnership deed, partner's capital account-fixed and fluctuating capital, methods, goodwill-valuation of goodwill

UNIT – IV

Reconstitution of a Partnership firm

Meaning, change in profit sharing ratio, sacrificing ratio, gaining ratio, admission of a partner, retirement of a partner, death of partner-revaluation account.

UNIT - V

Dissolution of a partnership firm

Meaning and definition, modes of dissolution, realization account.

REFERENCES :

1. Grewal, T.S. : Principles of Accountancy, S.Chand & Co.,

2. Gupta R.L.& : Financial Accounting, Cultan Chand & Sons.Gupta, V.K.

3.Gupta, R.L.& : Advance Accountancy, Sultan Chand & Sons. Radhaswamy

4. Jain & Naurang : Advance Accounts, kalyani Publishers.

5. Shukla & Grewal : Advance Accounts Vol.I, S.Chand & Co.,

CORE PAPER -5
FINANCIAL ADMINISTRATION

Learning objectives:

To give an understanding about budgetary control , making of budget, government accounting and public debt management

UNIT - I

Budget and budgetary control - Meaning and objectives - Fiscal federalism in India - Budget and plan coordination.

UNIT - II

Budget making - Its process - Pre budget exercise - Execution of Budget.

UNIT - III

Legislative approval of the budget - Estimates committee - Public Accounts committee - Controller and Auditor General of India - Appointment - Powers.

UNIT - IV

System of Government accounting - Standardized system of budget classification - Fiscal machinery in developing Countries.

UNIT - V

Public debt management - Debt of Union Government and State Government - Public debt and budget financing.

References :

1. Van Horne James, Financial Management Policy, Prentice Hall India
2. I M Panday, Financial Management, Vikas Publications, New Delhi.
3. Prasanna Chandra, Financial Management, Tata Mc Graw Hill, New Delhi.
4. Khan M Y& Jain P K, Financial Management, Tata Mc Graw Hill, New Delhi.
5. Lawerence J Gitman, Principles of Managerial Finance, Pearson Education limited. New Delhi.
6. James C Vanhorne, John M Wachowicz Jr, Fundamentals of Financial Management, Pearson Education Limited, New Delhi.

SEMESTER-III

CORE – PAPER -1

INDIAN ECONOMY AND REFORMS- I

Learning Objectives:

The objective of the course is to equip the students with the theoretical, empirical and policy issues relating to the society, polity and economy of India. The course, in particular, has been prepared in the background of the globalization process and its diverse ramifications on the knowledge economy.

UNIT - I

Features of less developed and developing Economics - Economic and non - Economic factors impeding economic development - Concept of growth and development - Indicators - Factors in economic development - Role of NGO's in Economic development.

UNIT - II

Capital formation - Human and Physical, Savings and investment Pattern during the Plans - National Income - Methods, trends, limitation - Distribution - Recent trends in National Income.

UNIT - III

Human resources - Population growth as a retarding factor - Population Policy.

UNIT - IV

Agriculture - Its Contribution to Economic development - Food problems - Methods of solving - Measures to increase agricultural Productivity - Land reforms - Green revolution - Agricultural Inputs and Agricultural Credit - Evaluation of Agricultural Policy during the plan period - Reforms in Agricultural sector.

UNIT - V

Role of industries in Economic development - Cottage, small scale and large scale (cotton, Iron and steel, Jute, Sugar and Tea) - Assessment of industrial Policy during the plan period - Public Sector - Privatization - Industrial Reforms.

References :

1. Gaurav Datt & Ashwani Mahajan (recent edition) 2.Uma Kapila (recent edition), Indian Economy since Independence, Academic Foundation, New Delhi.
3. Misra and Puri (recent edition), Indian Economy- Himalaya Publishing House, Mumbai
4. Dhingra I.C (recent edition), Indian Economy, Sultan Chand & Co., New Delhi.
5. A.N Agrawal (recent edition), Indian Economy, New Age International, New Delhi.

6. Datt & Sundharam Indian Economy, S. Chand & Co., New Delhi

CORE PAPER-2
MONETARY ECONOMICS –I

Learning objectives:

This paper intends to make the students aware about the role of money , monetary standards and factors affecting value of money and inflation.

UNIT - I

Money - Functions and Classification- Gresham's Law - Role of Money in Capitalist Socialist - and Mixed Economies

UNIT - II

Monetary Standards - Paper currency -Systems of note issue - Indian Currency System- Decimalization of Indian currency in 1957-Development and Problems.

UNIT - III

Value of Money- Quantity of Money - Fisher's Equation - Cambridge Equations – Keynesian Liquidity Preference theory

UNIT - IV

Factors influencing money supply - money supply and price level –Mechanistic and behavioural models of money supply determination

UNIT - V

Inflation - Cost push and demand pull- Causes and Remedies - Effects of Inflation on Different sections of the Economy – Deflation-Stagflation and its effects on developing countries.

References:

1. Gurley John and Shaw Edmund, Money in a Theory of Finance, Brooking Institutions
2. Seth ML, Monetary Economics
3. Gupta, S.B. (1994), *Monetary Economics*, S. Chand and Co., Delhi.
4. Don Patinkin, Money, Interest and Prices
4. Levacic Rosalind and Rebbman Alexander : Macro Economics: An Introduction to Keynesian-Neoclassical Controversies

CORE PAPER- 3

MANAGERIAL ECONOMICS- I

Learning Objectives:

To acquaint the students with the basic micro and macroeconomic concepts relevant for business decisions.

UNIT - I

Definition, Meaning, Nature and Scope of Managerial Economics - Economics & Managerial Economics - Role and Responsibilities of Managerial Economics.

UNIT - II

Demand Analysis Meaning, Demand Determinants, Law of Demand - Individual Demand & Market Demand, Demand Distinctions- Elasticity of Demand: Types and Importance of Elasticity of Demand - Advertising Elasticity of Demand.

UNIT - III

Demand Forecasting- Meaning - Purpose of Demand Forecasting - Methods of Demand Forecasting - Demand Forecasting Methods for new products - Criteria for good forecasting method.

UNIT - IV

Production Analysis - Production Functions - Law of variable proportions - Cobb - Douglas - Producers equilibrium - economics of scale - Cost concepts - Cost & Output relationship - Cost Control & Cost Reduction.

UNIT - V

Break - Even Analysis - Meaning, determination of Break - Even Point - Usefulness & limitations of Break - Even Analysis - Linear Programming - Graphical methods.

References :

1. Dominick Salvatore (2008), *Managerial Economics*: Worldwide Application, Oxford University Press, New Delhi.
2. Nellis and Parker (2006), *Principles of Business Economics,* Pearson Education, New Delhi.
3. H.L. Ahuja (2008), *Business Economics*, S. Chand & Co., New Delhi.
4 P.L. Mehta (2008), *Managerial Economics*, Sultan Chand & Sons, New Delhi.
5 Varshney and Maheswari (2007) *Managerial Economics*, Sultan Chand & Sons, New Delhi

CORE – PAPER – 4
COST ACCOUNTING

Learning objectives:

To familiarize students with the difference between cost accounting and financial accounting, material and labour cost , overheads and the different methods of costing.

UNIT - I

Cost Accounting: Introduction - Objectives - Elements of cost accounting - Classification of Cost - Distinction between Cost Accounting and Financial Accounting

UNIT - II

Material Cost: - Meaning of Material - Methods of Pricing issue of materials-Methods - FlFO - LIFO - Simple average Methods and Weighted average Methods.

UNIT - III

Labour Cost : Meaning of labour- Casual workers and out workers - Methods of wage payment - Labour Turnover - Calculation of normal time and overtime wages - Time rate system - piece rate system - Deferential piece rate system - Taylor system and Merrick's multiple piece rate system - Halsey plan-Rowan plan.

UNIT - IV

Overhead: Classification of overheads - primary Distribution Overhead - secondary Distribution overhead - Direct distribution and continued distribution methods.

UNIT - V

Methods of Costing: Preparation of Cost sheet and profit- Job costing - Contract Costing - Batch costing - Process costing-Techniques of costing Theory 25% problem 75%

References:

1. Cost accounting – Reddy and Hariprasad Reddy- Margham publication.
2. Cost and Management Accounting – S.N. Maheswari - Sulthan Chand
3. Cost and Management Accounting - Reddy and Hariprasad Reddy- Margham publication.

CORE- PAPER- 5
MARKETING MANAGEMENT

Learning Objectives

To impart knowledge in various aspects of marketing and acquaint the students with the applied problems of marketing with special reference to India.To familiarize the students the different channels of distribution and the promotion mix.

UNIT - I

Nature, scope and significance of marketing - Evolution of marketing - Basic concepts of marketing Different types of market - Modern marketing - Marketing environment.

UNIT - II

Functions of marketing - Function of exchange - Functions of physical distribution - Storage and warehousing - Transportation - Facilitating function - Grading and standardization

UNIT - III

Branding packaging and labelling - Marketing information system - Marketing research - Marketing risk

UNIT - IV

Marketing Mix-Product - New product - Product planning and development - Product life cycle – Marketing segmentation-Marketing of manufactured goods - Manufactured consumer goods - Manufactured industrial goods - Their classification.

UNIT - V

Marketing of agricultural products – structure and organization of agricultural marketing – types-problems- regulated and organized market - Co-operative marketing bodies.

References :

1. Kotler, Kevin, Jha & Koshi (2009), *Marketing Management*, Pearson Education, Delhi
2. William J Stanton et al (2007), *Marketing*, McGraw Hill Publishing Company Pvt. Ltd, Delhi
3. Pillai RSN and Bagavati (2005), S Chand & co. Ltd, New Delhi.
4. Ramaswamy & Namakumari (2009), *Marketing Management*, Macmillan India Ltd, Delhi
5. Hajela TN(2000), Co-operation: Principles, Problems and Practice, Konark Pub.(p) Ltd. Delhi

CORE- PAPER -6

INTERNATIONAL ECONOMICS- I

Learning Objectives

The objective of this course is to arrive at an understanding of theories of international trade and to examine the impact of the trade policies on the world economy.

UNIT - I

I. Definition and scope of International Economics

International Economics- Meaning and significance- basic tools of IT- Production Possibility Curves- Community Indifference Curves- Price Ratio Curves- Offer curves- Isoquants

UNIT - II

The Classical Theory of International Trade-Mercantilism- Flaws of mercantilism- Absolute cost theory- comparative cost theory- Elaborations and the refinements of the classical theory

UNIT - III

Modern theory of International trade-Opportunity cost theory- H.O theory- Leontieff paradox- Stopler Samuelson theorem- Metzler paradox- Intra-Industry trade- Economies of scale- Technological gaps and product cycles

UNIT - IV

Gains from International trade-Gains from trade- static and dynamic- Distribution of gains- Special gains to small countries- Disadvantages/Problems of trade

UNIT - V

Terms of trade-Terms of trade- types of terms of trade- Factors influencing terms of trade- Mill's doctrine.

References :

1. Sodersten, Bo. and Geoffry Reed, International Economics, Palgrave Macmillan
2. Dominic Salvatore, (recent edition) International Economics. John Wiley and Sons, Delhi.
3. Francis Cherunilam (2008), International Economics, Tata McGraw Hill, Delhi.
4. Paul Krugman and Maurice Obstfeld (recent edition), International Economics: Theory and Policy, Pearson Education, Delhi.
5. Dominic Salvatore, Schaum's Outlines, Theory and Problems of International Economics. Tata McGraw Hill, Delhi.

SEMESTER-IV

CORE PAPER -1

DEVELOPMENT ISSUES OF THE INDIAN ECONOMY

Learning Objective:

The objective of the course is to equip the students with the theoretical, empirical and policy issues relating to the economic underdevelopment and economic development of the world economy in general and economy of India in particular.

UNIT 1-

Approaches to Economic Development Distinction between economic growth and economic development-characteristics of underdevelopment- stages of economic growth- The Vicious circle of poverty- Low level equilibrium trap- Critical Minimum Effort thesis- Big Push theory- Technological and financial dualism- Balanced versus Unbalanced growth strategy- Cost benefit analysis

UNIT –II **Environment and Economic Development**

Environment as a public good and as a luxury- Tragedy of commons- Market failure for environmental goods- Property rights approach to environmental damages- Valuation of environmental damages- Pollution- Control of pollution policy instruments and legislations- environmental accounting

UNIT - III

Transport - Importance of transport (Road, Railways, Shipping and Civil Aviation) to Economic growth - Evaluation of Government Policy - Transport Co-ordination - Reforms of the Infrastructure sector.

UNIT - IV

Planning in India - Strategy of Indian Planning - Resources for Financing Plan - Agriculture and Industrial Development - Planning Techniques - Investment Priorities - Fiscal Reforms, Monetary Reforms.

UNIT - V

Poverty in India - Poverty Eradication Programmes - Role of Micro Credit - Regional Development disparities - Economic Development and Social changes - India's Foreign Trade and Balance of Payments.

References:

1.Higgins, Benjamin, Economic Development: Principles, Problems and Policies

2.Meir Gerald M. & Baldwin Richard E, Economic Development, International Edition.

3. Zuvekas Clarence (1979), Economic Development: An Introduction, Macmillan

4. Misra and Puri (2014), Indian Economy, Himalaya Publishing House, Mumbai.

5. Gaurav Datt & Ashwani Mahajan (2014), Indian Economy

6. Datt & Sundharam Indian Economy, S. Chand & Co., New Delhi

7. B.A Prakash (2009), The Indian Economy since 1991: Economic Reforms and Performance, Pearson Education.

CORE PAPER -2
MONETARY ECONOMICS -II

Learning objectives:

This paper aims to familiarize the monetary system, various theories of demand for money, factors affecting liquidity etc.

UNIT - I

Theories of demand for money:

Classical theory of demand for money- Irving Fisher -Cambridge versions-- Keynesian version of liquidity preference- Friedman's restatement of the quantity theory-Post-Keynesian theories-James Tobin and William J.Baumol.

UNIT-2

The Income theory of money

Income in relation to value of money- Saving investment approach- Inequality between saving and investment-commodity theory of money-rational expectations

UNIT - III

Classical dichotomy-Real – balance effect-The Pigou effect- Patinkin's integration of monetary theory and value theory- Keynesian effect and wealth effect

UNIT - IV

Liquidity theory of money

Radcliff committee-Radcliffe – Sayer's version of the liquidity theory-Gurley and Shaw version of the liquidity theory

UNIT - V

Monetary policy:

Objectives- instruments – quantitative and qualitative- repo and reverse repo operations-effectiveness of monetary measures- its effectiveness to fight out inflation- Gurley and Shaw view on non- banking financial intermediaries.

.

References:

1.Money in a theory of Finance: Gurley and Shaw

2.Monetary Economics: M.L Seth

3.Money, Interest and Prices: Don Patinkin

4.Modern Banking: R.S Sayers

5.Central Banking: De Cock

CORE PAPER -3

MANAGERIAL ECONOMICS-II

Learning objectives:

To give an understanding about pricing policies, profit management, capital budgeting, decision making and game theory strategies

UNIT - I

Pricing Methods - Full cost pricing, target Pricing, Going rate pricing - Customary pricing, differential pricing - specific pricing methods - pricing a new product - pricing over the life cycle of a product - product line pricing - mark up & mark down pricing by retailers - resale price maintenance - dual pricing.

UNIT - II

Profit & Profit Management - Accounting profit and economic profit - Theories of Profit.

UNIT - III

Capital Budgeting- Need for capital budgeting - forms and process of capital budgeting - Nature of capital budgeting problem - project profitability: Methods of Appraising Project Profitability.-pay back method, Accounting Rate of Return, Internal Rate of Return and Net Present Value Index.

UNIT - IV

Managerial Decision Making: Risk & Uncertainty - Elements of Decision Theory - Classification of Managerial Problems - Decision taking under certainty & uncertainty.

UNIT - V

Game Theory- Definition - Zero Sum two persons game - Maximini & Minimax Strategies - Equilibrium (Saddle Point), Prisoner's dilemma.

Readings

1. Dominick Salvatore (2008), *Managerial Economics*: Worldwide Application, Oxford University Press, New Delhi.
2. Nellis and Parker (2006), *Principles of Business Economics,* Pearson Education, New Delhi.
3. H.L. Ahuja (2008), *Business Economics*, S. Chand & Co., New Delhi.

4 P.L. Mehta (2008), *Managerial Economics*, Sultan Chand & Sons, New Delhi.

5 Varshney, (recent edition) *Managerial Economics*, Sultan Chand & Sons, New Delhi

3. S. Sankaran, Managerial Economics (2011), Margham Publications, Chennai.

CORE PAPER-4
ECONOMICS OF FINANCIAL MARKETS

Learning objectives:

Financial institutions and markets play a significant role in all the modern economies of the world. The study of this area is significant especially after the financial sector reforms in most of the countries. The present course is designed to acquaint the students with the changing role of the financial sector of the economy. The stake holders are to familiarize with the basic concepts, the financial institutions and markets.

Module I – Financial Institutions and Securities

Financial Institutions - Monetary and Non-monetary (banking and non-banking) financial intermediaries - insurance companies (life and general insurance), pension funds and provident funds, mutual funds, investment banks, venture capital funds - primary security and secondary security - gilt-edged securities-treasury bill and bonds.

Module II – Money Market

Financial markets-money and capital markets; Money market-meaning and structure-developed and underdeveloped money markets- advantages of developed money market - London and New York money markets - major financial instruments in the money markets - Money market in India.

Module III – Capital Market

Capital market-meaning and composition-primary and secondary markets-major financial instruments-equity shares and preference shares, debentures and bonds - G.D.Rs and A.D.Rs-IDRs -DFIs and FIIs-QIBs - Primary market-institutions in the primary market-underwriters, merchant bankers and managers to issue-public issue

Module-IV-Transactions relating to public issues-

Methods of public issue, IPO and FPO-book building-private placement, ESOP, blue chip shares, rights shares and bonus shares-listing of securities - physical shares and demat shares, depository participants-NSDL and CSDL-SEBI and capital market in India (only an overview).

Module V – Stock Exchanges and Trading (Overview only)

Stock exchanges - stock exchanges in India - BSE and NSE -auction trading and screen based trading system - BOLT-Stock indices in India and abroad - BSE Sensitive index and Nifty indices; Dow Jones, NASDAQ, FTSE, Nikkei-kerb trading – stock split-

derivatives-option trading-stock futures - exchange traded funds (ETF) - Credit ratings - credit rating institutions in India – CRISIL, ICRA and CARE.

References :

1. S.B. Gupta (2001). Monetary Economics: Institutions, Theory and Policy, S. Chand & Co, New Delhi, Part I
2. L.M. Bhole (recent edition). Financial Institutions and Markets, Tata McGraw Hill, New Delhi
3. V.A. Avadhani, Investment and Securities Market in India, Himalaya Publishing House, Bombay (recent edition)
4. Shashi K. Gupta et al(2011), Economics of Financial Markets, Kalyani Publishers, Ludhiana
5. Zuvi Bodie, Robert C Merton et al. (2009), Financial Economics, Pearson Education (Ch.1 (1.1, 1.2), Ch.2 (2.1, 2.5, 2.7) only.
6.. M.Y. Khan (recent edition) Indian Financial System, Tata McGraw Hill, New Delhi.

CORE PAPER-5

COMPUTER APPLICATIONS IN CORPORATE ENVIRONMENT (THEORY AND PRACTICAL)-I

Learning Objectives:

To make the students aware about computers, their accessories, micro computers, and software packages such as MS Word,MS Excel etc.

UNIT - I

Introduction to Computers - History of Computers - Characteristics of Computer - Applications- Classification of Computers - Basic anatomy of the Computer - Arithmetic and Logic unit - Memory unit - Control Unit.

UNIT - II

Computer Accessories : Hardware - Software - System Software , Application Software - Storage Device - Input Device - Output Device, Data Representation : Number System - Computer Languages : Low / Machine level language - Assembly Language - High Level language

UNIT - III

Microcomputer - Basic Structure - Microprocessor Unit - Memory - RAM - ROM - PROM - EPROM - Human / Computer interface, Data Communication - Computer Networks - Types of Networks : Local Area Networks, Metropolitan Area Networks, Wide Area Networks

UNIT - IV

MS - Word : Introduction to MS - Word - Features - Components of MS - Word - Word Basics : Creating, Opening, Saving and Closing document - Formatting tool Bar - Font, Bullets and Numbering - Border Shading - Text Manipulation - Text Formatting - Creating Table - Table Manipulation - Mail Merge Concepts

UNIT - V

MS - Excel : Introduction to MS - Excel - Features - Components of MS - Excel - Excel Basics :Working with worksheet - inserting and deleting of cells, rows and columns - switching between worksheet - moving, copying, inserting and deleting worksheets - charts - Types of charts - Functions in excel : Sum - Average - Abs - Sqrt - Count - Max - Min - Round - Now - Upper - Lower.

PRACTICAL - I

MS – WORD

1. Text Manipulation
2. Usage of Numbering, Bullets, Headers and Footers
3. Usage of Spell Check and Find and Replace
4. Text Formatting
5. Picture Insertion
6. Mail Merge Concept
7. Creation of Table and Formatting tables.

MS – EXCEL

1. Creation of worksheet and Entering Information
2. Aligning , Editing data in Cell
3. Excel Functions
4. Changing column width and row height
5. Moving, Copying, Inserting and Deleting Rows and Columns
6. Drawing borders around cells
7. Creation of Charts

Reference

1. Roger Hunt, John Shelley : Computers and Commonsense, Fourth Edition – Prentice Hall of India. (Unit – I & II)

2. Sanjay Saxena, MS – Office 2000 for every one, Vikhas Publishing Hosue Pvt Ltd, New Delhi. (Unit – IV & V)

3. R.Kalakota and A.B Whinston, Readings in Electronic Commerce, Addision Wesley,1997 (Unit – III)

CORE PAPER-6
INTERNATIONAL ECONOMICS-II

Learning Objectives

The objective of this course is to arrive at an understanding of theories of international trade and to examine the impact of the trade policies on the world economy.

UNIT - I

The Rate of Exchange- Equilibrium rate of Exchange- theories of Exchange rate determination- BOP theory- PPP theory-Mint parity theory- fixed and flexible exchange rate- forward rate- spot rate- nominal-real and effective rate of exchange- foreign exchange risks- hedging and speculation- currency derivatives- future options- currency swaps

UNIT - II

The Balance of Payments – distinction between balance of trade and balance of payments- Meaning and structure of BOP- Equilibrium and disequilibrium of BOP- measures to correct disequilibrium- monetary and non monetary measures- devaluation and BOP- Marshall-Lerner condition

UNIT - III

International Capital Movements-hot money, portfolio investment, direct foreign investment- international capital movements though Mauritius.

UNIT - IV

Tariffs, Import Quotas, Exchange control –

Tariffs, Import Quotas, Exchange Control

Commercial policy- free trade- protection and protectionism- Tariff- Effects of Tariff- Quota- Effects of Quota

UNIT - V

Bretton Woods Agreement of 1944 – IBRD and International Monetary Fund-GATT and WTO.

References :

1. Sodersten, Bo. and Geoffry Reed, International Economics, Palgrave Macmillan
2. Dominic Salvatore, (recent edition) International Economics. John Wiley and Sons, Delhi.
3. Francis Cherunilam (2008), International Economics, Tata McGraw Hill, Delhi.
4. Paul Krugman and Maurice Obstfeld (recent edition), International Economics: Theory and Policy, Pearson Education, Delhi.
5. Dominic Salvatore, Schaum's Outlines, Theory and Problems of International Economics. Tata McGraw Hill, Delhi.

SEMESTER- V

CORE- PAPER-1

MACRO-ECONOMICS- I

Learning Objectives:

This course is designed to make the students aware of the theoretical aspects of Macro Economics**.**

UNIT - I

Nature of Macro Economics - Circular flow model- basic, two sector, three sector and four sector models.

UNIT - II

National Income –various concepts of national income-Measurement and uses of National Income analysis-difficulties in the measurement in the developing countries.

UNIT - III

Macro Economic Techniques and Instruments- fiscal policy, monetary policy-Philips curve-short run and long run-contributions of Phelps and Friedman.

UNIT - IV

Classical Theory of Output and Employment - Say's Law- Keynesian criticism-

UNIT - V

Keynesian Macro Analysis - Consumption function and its attributes - Investment function and M.E.C. - Simple Keynesian model of income and employment determination-concepts of aggregate demand, aggregate supply and effective demand-unemployment, under employment and full employment-deflationary gap and inflationary gap.

References:

1. Ahuja, H.L., : Macro Economics, Theory and Policy, S.Chand & Co.,
2. Amit Bhaduri : Macro Economics, Macmillan Co,
3. Barro, Robert .J. : Macro Economics, John Wilely and Sons, New York
4. Brooman : Macro Economics
5. Crouch : Macro Economics
6. Dernberg & McDougal : Macro Economics
7. Dillard, D : Economics of J.M.Keynes
8. Duesen berry, James.S : Business Cycles and Economic Growth, McGraw Hill
9. Eugene A Diulio : Macro Economic Theory - Schaum Series, McGrow Hill Book Company
10. George Leland Bach : Macro Economics: Analysis, Decision Making and Policy, Prentice Hall
11. John Evans & Pritchard : Macro economics, Macmillan
12. Lindaver : Macro Economics
13. Michl : Macro economics Theory, Prentice Hall
14. Raghbendra JHa : Contemporary Macro Economic Theory & Policy Wiley Eastern Ltd.,
15. Sankaran, S : Macro Economics, Margham Publications.
16. Shapiro, E : Macro Economic Analysis
17. Turnovsky : Methods of Macro Economic Dynamics, Prentice Hall
18. Levacic Rosalind and Rebbman Alexander : Macro Economics: An Introduction to Keynesian-Neoclassical Controversies

CORE- PAPER-2
FISCAL ECONOMICS- I

Learning Objectives:

The purpose of this course is to give an understanding of the role of state in fostering the economic activities via budget and fiscal policies. This course enables the students to understand the various issues between Central and State Governments

UNIT - I

Meaning and scope of Public Finance - Distinction between Private and Public Finance - Public goods, Private Goods - Principle of Maximum Social Advantage - Modern theory of public Finance.

UNIT - II

Public Expenditure - Classification - Wagner's Law - Causes and Effects of Public Expenditure with reference to India.

UNIT - III

Public Revenue - Sources - Distinction between Tax Revenue and Non-Tax Revenue - Taxation - Classification - Canons - Theories of Taxation - Impact and incidence of Taxation - Effects of Taxation.

UNIT - IV

Individual Taxes - (with reference to India) Income Tax - Expenditure Tax - Wealth Tax - Property Tax Customs duty - Excise Duty - Sales Tax - Value added Tax- Service tax-GST and GST Council.

UNIT - V

Characteristics of a good tax system - Taxable Capacity - Factors determining taxable capacity - Limits - Measurement of Taxable capacity.

References :

1. Harvey Rosen, (2008) Public Finance, McGraw Hill, New York.
2. Bernard P. Harbar, Modern Public Finance (Richard Irvin Inc)
3. H.L. Bhatia., Public Finance, Vikas Publishing House Pvt Ltd., New Delhi (recent edition)
4. B.P. Tyagi., Public Finance, Jai Prakash Nath & Co., Meerut (recent edition)
5. Musgrave and Musgrave (1984), Public Finance in Theory and Practice, McGraw Hill, New Delhi (reprint edition)
6. Joseph Stiglitz, Economics of Public sector, Norton, New York (recent edition)

CORE- PAPER-3

PRINCIPLES AND PRACTICE OF MANAGEMENT

Learning objectives:

This paper deals with various business concepts, management, its principles, business organization etc.

UNIT - I

Business concepts and Different Forms of Business organization - The Society - Economics of Business - Business and Management - Role of Business and its concern of Society.

UNIT - II

Management- Meaning - Nature and Scope of Management Process - Management Art or Science - Management and Administration Development of Scientific Management - Schools of Thought - Taylor, Payroll, Drucker and others- Principles of Management

UNIT - III

Planning -The meaning and purpose of planning - Steps in Planning - Goal Setting - Types of Plan- Concept of MBO - Policies - Procedures and Methods - Evaluating of Success of plans.

UNIT - IV

Organization- Fundamentals of organization - Types of Organization structure - Line. Functional, Line as staff - committee organization- span of control - Authority and responsibility - Delegation of Authority – Departmentation- Decentralization - Formal and Informal.

UNIT - V

Staffing and controlling. Nature and Importance –Recruitment-meaning – sources and procedure. Training –steps in training- Formal and Informal leaders - Leadership styles - Controlling Process - Effect of control on employee behavior

Reference

1. Bhusan Y.K – Business Origanization

2.Prakash Jagadeesh – Business Organization management

3.Reddy P.N & Gulshan – Principles of Business Organization and Management

4.Shukla M. C – Business Organization and Management.

5.J.Jayashankar – Principles of Management – Margham Publication

6.Prasad L.M - Principles and Practice of Management

7.Tripahty .P.C – Principles of Management – TMH

CORE PAPER 4

ENVIRONMENTAL ECONOMICS (COMMON TO MODEL I)

CORE PAPER- 5

COMPUTER APPLICATIONS IN CORPORATE ENVIRONMENT-II

Learning objectives:

To give an understanding to students about computer applications in business, medicine, use of modems, applications of MS Power Point, MS Access etc.

UNIT - I

Computer Application in Business - payroll and personnel records - Office automation - word processing - Desktop publishing - Electronic Office - Stock control and sales - Banking - Insurance and stock broking

UNIT - II

- Medicine - Law and order - Libraries and museums - Education - Application in different fields : Electricity - Steel - Printing and paper Engineering design - Local Authorities - Central Government - Public Utilities-Telephones Information System

UNIT - III

Modem - (EDI) - Electronic Payment System - Cyber Crime - Cyber Internet - Advantages - Web Browsers - Search Engine - URL - Web pages- Web site - World Wide Web(WWW) - E - mail - Functions E - Commerce - Introduction - Definition - Classification of E-Commerce - Electronic Data Interchange Resource

UNIT - IV

MS - Power Point : Introduction to Power Point - Features - Basic Power point - Creating new presentation - Inserting, Copying and Deleting a Slide - Inserting pictures -Organization Charts - Usage of design template - Using headers and footers - Inserting sound from file - Inserting movies from file

UNIT - V

MS - Access - Introduction To Access - Features - Parts of an Access window : Starting Microsoft Access - Creating Tables - Creating Queries - Creating Forms - Creating Reports - Exporting data into excel.

Reference

1.Roger Hunt, John Shelley : Computers and Commonsense, Fourth Edition – Prentice Hall of India. (Unit – I & II)

2. Sanjay Saxena, MS – Office 2000 for every one, Vikas Publishing Hosue Pvt Ltd, New Delhi. (Unit – IV & V)

3. R.Kalakota and A.B Whinston, Readings in Electronic Commerce, Addision Wesley,1997 (Unit – III)

PAPER VI-OPEN COURSE

SEMESTER – VI

CORE PAPER- 1

MACRO ECONOMICS - II

Learning Objectives:

This course equips the students to understand systemic facts and the latest theoretical developments in Macro Economics.

Module - I

Theory underlying the multiplier - Induced investment and Accelerator - The interaction Principle and modern approaches to business cycle theory.

Module - II

Money in the Keynesian model - Demand for money in the Keynesian Theory-Theories of inflation-cot push demand pull-stagflation-impact of stagflation on developing countries.

Module - III

Monetary Theory in Relation to under employment and full employment –Great depression of 1930's and Great Recession of 2007-9

Module - IV

Post Keynesian Macro Analysis - General Equilibrium of Monetary and real sector - Contribution of Hicks-Hansen, ISLM - Diagram.

Module - V

Theories of International Trade-foreign trade multiplier- foreign trade as an engine of growth-spread effect and backwash effect (Gunnar Myrdal), Secular deterioration in the terms of trade (Singer-Prebisch)-Indian and International trade

References :

1. N. Gregory Mankiw (recent edition), Macro Economics, Worth Publications, New York.
2. Richard T. Froyen (recent edition), Macro Economics, Pearson Education, Delhi.
3. Macro Economics – Schaum's Outlines, Tata McGraw Hill, Delhi.
4. Shapiro, Edward (1982), Macro Economic Analysis, Galgotia Publications, New Delhi (reprint edition).
5. Sampat Mukerjee (2008), Analytical Macro Economics: From Keynes to Mankiw, New Central Book Depot, Calcutta.
6. Andrew B. Abel (2011), Macro Economics, Pearson, Delhi.
7. I C Dingara (2014), The Indian Economy: Environment and Policy, Sultan Chand & Sons, New Delhi.
8. Dominick Salvatore(2014): International Economics,11th edition, Wiley.

CORE PAPER - 2
FISCAL ECONOMICS II

Learning Objectives :

The purpose of this course is to give an understanding of the role of state in fostering the economic activities via budget and fiscal policies. This course enables the students to understand the various issues between Central and State Governments

Module - I

Public Debt - Sources - Effects of Public debt - Public Debt in India. Redemption and Management of Public Debt.

Module- II

Deficit financing - Meaning – objectives- Role of deficit Financing in India - Its effects.

Module - III

Federal Finance - Principles - Center and state Financial Relationship - Finance Commissions - Analysis of latest Finance - Commission - Recommendations.

Module- IV

Local Finance - Sources of finance - Financial Administration of Local bodies.

Module - V

Fiscal Policy - objectives and instruments of fiscal policy in a developing economy with reference to India- Budgeting in India.

References :

1. Harvey Rosen, (2008) Public Finance, McGraw Hill, New York.
2. Bernard P. Harbar, Modern Public Finance (Richard Irvin Inc)
3. H.L. Bhatia., Public Finance, Vikas Publishing House Pvt Ltd., New Delhi (recent edition)
4. B.P. Tyagi., Public Finance, Jai Prakash Nath & Co., Meerut (recent edition)
5. Musgrave and Musgrave (1984), Public Finance in Theory and Practice, McGraw Hill, New Delhi (reprint edition)
6. Joseph Stiglitz, Economics of Public sector, Norton, New York (recent edition)

CORE PAPER- 3
ENTREPRENEURIAL DEVELOPMENT AND STRATEGIC MANAGEMENT

Learning objectives:

To enable the students to create a ground where the students view entrepreneurship as a desirable and feasible career option.

UNIT - I

Introduction Meaning - Types of entrepreneurs - characteristics and qualities of an Entrepreneur - Functions of Entrepreneurs - View: Peter Drucker - Schumpeter - Walker - Factors influencing Entrepreneurship.

UNIT - II

Women Entrepreneurs - Concepts - Problems - Prospects and Empowerment - Functions - Role - Characteristics of Rural Entrepreneurs - Development of Women Entrepreneurs- Types of Business/Industries and Women Entrepreneurs.

UNIT - III

Entrepreneurial Growth - Role Played by Government and Non-Government agencies - EDP's - TIIC - SIDBI, PIPDIC - IDBI - IFCI etc.

UNIT - IV

How to enter into Market? Business Idea Generation Techniques - Marketing Feasibility - Financial Feasibility - Technical Legal - Managerial and Location Feasibility.

UNIT - V

Meaning of Strategy - Corporate Strategy - Missions - Goals – Factors, Objectives and Goals - strategic Management process - Corporate planning - Competitive analysis - Competitive advantages - Internal Corporate Analysis.

References :

1. Kasmi – Business Policy and Strategic Management – TMH

2. AzharKasmi – Business Policy

3. Batachariya S T – Strategic Management and Cases – S.Chand

4. Dr. Sankaran – Strategic Management – Margham Publication

5. Jayashree Suresh - Entrepreneural Development – Margham Pub.

6.Gupta C. B – Entrepreneural Development

CORE PAPER- 4

BUSINESS COMMUNICATION

Learning objectives:

To enable the students to know about the principles, objectives and importance of Communication in Commerce and Trade.

UNIT - I

Features of Business Communication - Importance of effective communication in Business - Classification of communication - Characteristics (7cs) and Guidelines of effective Business Communication.

UNIT - II

Analysis of Business Letters - Basic Principles in drafting - Appearance, Structure and Layout - Letter Styles.

UNIT - III

Various types of Business Letters - Letters of Enquiry - Offers, Quotations, Orders, Complaints and Settlement, Circular Letters, Status enquiry, Collection Letters, Application for jobs, CV, Resumes, Reference Letters.

UNIT - IV

Company correspondence - Correspondence with share Holders, Debenture & fixed Deposit Holders.

UNIT - V

Bank and Insurance Correspondence - Import & Export correspondence - Correspondence with Govt. Departments. Report Writing Format and Style. [Problems: 80%, Theory: 20%]

References:

1. Communication for Business – Shirley Taylor. Pearson Publication, New Delhi.

2. Business Communication Today – Bovee, Thill, Schatzman 7th Edition Pearson Publication, New Delhi.

3. Essentials of Business Communication – Rajendra Pal, J.S.Korlahalli**.**

CORE PAPER- 5

ECONOMICS OF HUMAN RESOURCES MANAGEMENT

Learning objectives:

To give an understanding about scope of human resource management

Module - I

Introduction to HRM-personnel management - objectives-scope & importance-Process of Human Resource of Management-Emerging trends in HRM – Manpower planning.

Module- II

Performance Appraisal: Meaning - Need - Importance - Objectives - Problems - Factors Influencing Performance Appraisal. Techniques of Performance Appraisal - Traditional Techniques - Modern Techniques of Performance Appraisal.

Module- III

Transfer: Objective - Policy - Types. Promotion: Purpose - Promotion Policy - demotion. Discipline: Meaning - Positive And Negative Aspects Of Discipline - Causes Of Indiscipline - Disciplinary Procedure - Maintaining Discipline.

Module – IV

Compensation: Objective - Principles - Factors - Influencing Wage And Salary - Executive Compensation Plans - Benefits And Employee Services - Fringe Benefits.

Module- V

Motivation: Meaning - Features - Techniques - Importance - Theories of Motivation.

References:

I. Dessler, *Human Resource Management*, 11th edition, Pearson Education, Delhi

2. Biswanath Ghosh, *Human Resource Development and Management*, Vikas Pubblishing House, Delhi

3. Anuradha Sharma & Aradhana Khandekar (2006), *Strategic Human Resource Management*, Response Books, New Delhi

4. Bohlander and Shell (2007), *Human Resource Management,* Cengage Learning, Delhi.

5. Aswathappa, *Human Resource and Personnel Management*, 3rd edition, Tata McGraw Hill, Delhi

CORE PAPER-6

PROJECT AND VIVA -VOCE EXAMINATION

(GROUP WISE PROJECT- THE NUMBER OF STUDENTS IN THE GROUP SHOULD NOT EXCEED FOUR).

MAHATMA GANDHI UNIVERSITY

SYLLUBUS FOR ENGLISH LANGUAGE AND LITERATURE (MODEL 1)

2017 ADMISSIONS ONWARDS

SCHEME

Semester	Title	Course Category/Code	Hours Per Week	Credits	Internal Assessment	External Exam
1	Fine-tune Your English	Common Course-1 EN1CC01	5	4	20	80
1	Pearls from the Deep	Common Course -2 EN1CC02	4	3	20	80
1	Second Language	Common Course	4	4	20	80
1	Methodology of Literary Studies	Core Course-1 EN1CR01	6	4	20	80
1	History/Political Science/ Sociology/ Psychology	Complementary Course	6	4	20	80
2	Issues that Matter	Common Course -3 EN2CC03	5	4	20	80
2	Savouring the Classics	Common Course -4 EN2CC04	4	3	20	80
2	Introducing Language and Literature	Core Course -2 EN2CR02	6	4	20	80
2	Second Language	Common Course	4	4	20	80
2	History /Political Science / Sociology/ Psychology	Complementary Course	6	4	20	80
3	Literature and/as Identity	Common Course -5 EN3CC05	5	4	20	80
3	Second Language	Common Course	5	4	20	80
3	Harmony of Prose	Core Course -3 EN3CR03	4	4	20	80
3	Symphony of Verse	Core Course -4 EN3CR04	5	4	20	80
3	Evolution of Literary Movements: the Shapers of Destiny	Complementary Course 3 - EN3CM03	6	4	20	80
4	Illuminations	Common Course -6 EN4CC06	5	4	20	80
4	Second Language	Common Course	5	4	20	80
4	Modes of Fiction	Core Course -5 EN4CR05	4	4	20	80
4	Language and Linguistics	Core Course -6 EN4CR06	5	4	20	80
4	Evolution of Literary	Complementary Course 4	6	4	20	80

	Movements: the Cross Currents of Change	- EN4CM04				
5	Open Course	EN5CROP01 Appreciating Films EN5CROP02 Theatre Studies EN5CROP03 English for Careers	4	3	20	80
5	Acts on the Stage	Core Course -7 EN5CR07	6	5	20	80
5	Literary Criticism and Theory	Core Course -8 EN5CR08	5	4	20	80
5	Indian Writing in English	Core Course -9 EN5CR09	5	4	20	80
5	Environmental Science and Human Rights	Core Course EN5CREN01	5	4	20	80
6	Choice Based Course	EN6CB01 Comparative Literature EN6CB02 Modern Malayalam Literature in Translation EN6CB03 Regional Literatures in Translation EN6CB04 Voices from the Margins	4	4	20	80
6	Postcolonial Literatures	Core Course -10 EN6CR10	5	4	20	80
6	Women Writing	Core Course -11 EN6CR11	5	4	20	80
6	American Literature	Core Course -12 EN6CR12	5	4	20	80
6	Modern World Literature	Core Course -13 EN6CR13	5	4	20	80
6	Project	EN6PR01	1	2	20	80

Common Courses

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR COMMON COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 1- Fine-tune Your English

Course Code	**EN1CC01**
Title of the course	**Fine-tune Your English**
Semester in which the course is to be taught	**1**
No. of credits	**4**
No. of contact hours	**90**

AIM OF THE COURSE

The course is intended to introduce the students to the basics of grammar, usage and effective communication.

OBJECTIVES OF THE COURSE

On completion of the course, the student should be able to:
1. confidently use English in both written and spoken forms.
2. Use English for formal communication effectively.

COURSE OUTLINE

Module 1 **(18 Hours)**

The Sentence and Its Structure - How to Write Effective Sentences – Phrases -What Are They? - The Noun Clauses - The Adverb Clause - "If All the Trees Were Bread and Cheese" - The Relative Clause - How the Clauses Are Conjoined -

Word-Classes and Related Topics - Understanding the Verb - Understanding the Auxiliary Verb - Understanding the Adverbs - Understanding the Pronoun - The Reflexive Pronoun - The Articles I - The Articles II - The Adjective - Phrasal Verbs - Mind Your Prepositions

Module 2 **(18 Hours)**

To Err Is Human - Concord - A Political Crisis - Errors, Common and Uncommon - False Witnesses - The Anatomy of Mistakes- A Fault-finder Speaks - A Lecture on AIDS - A Test for You, Reader - Ungrammatical Gossip - Round Circles and Equal Halves: A Look at Tautology - Comparisons are Odious - In Defence Of A Friend - An Invitation

Spelling and Pronunciation - Pronunciation: Some Tips - More Tips on Pronunciation – Spelling - An Awesome Mess? - Spelling Part II

Module 3 **(18 Hours)**

Singleness of Meaning - Shades of Meaning - Confusing Pairs - What Is the Difference? - Mismatching Mars the Meaning

The Tense and Related Topics - 'Presentness' and Present Tenses- The 'Presentness' of a Past Action - Futurity in English - Passivization

Idiomatic Language- 'Animal' Expressions - Idiomatic Phrases - 'Heady' Expressions - Body Language

Module 4 **(18 Hours)**

Interrogatives and Negatives - Negatives- How to Frame Questions -What's What? The Question Tag

Conversational English - Polite Expressions - Some Time Expressions - In Conversation - Is John There Please?

Miscellaneous and General Topics - On Geese and Mongooses - Pluralisation - On Gender and Sexisms

Reading – Kinds of Reading – Recreational Reading – Study-type Reading Survey Reading – The Process of Reading – Readability – The Importance of Reading – Previewing - Skimming

Module 5 **(18 Hours)**

The world of words- have a hearty meal- word formation-Use the specific word- word games-the irreplaceable word- Let's play games- body vocabulary

Very Good but Totally Incompetent - Long Live the Comma - The Possessive Case- Letter Writing- Academic Assignments

Get your doubts cleared

Core Text: ***Fine-tune Your English*** **by Dr Mathew Joseph.** Orient Blackswan and Mahatma Gandhi University

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR COMMON COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 2 - Pearls from the Deep

Course Code	**EN1CC02**
Title of the Course	**Pearls from the Deep**
Semester in which the Course is to be taught	**1**
No. of Credits	**3**
No. of Contact Hours	**72**

AIM OF THE COURSE

To introduce students to the different genres of literature and to the niceties of literary expression.

OBJECTIVES OF THE COURSE

On completion of the course, the student should be able to:
1. appreciate and enjoy works of literature.
2. appreciate the aesthetic and structural elements of literature.

COURSE OUTLINE

Module 1 [Fiction] **(18 hours)**

Ernest Hemingway: *The Old Man and the Sea*

Module 2 [One Act Plays] **(18 hours)**

Susan Glaspell: Trifles
Asif Currimbhoy: The Refugee
A. A. Milne: The Boy Comes Home

Module 3 [Short Stories] **(18 hours)**

Guy De Maupassant: Two Friends
O. Henry: The Gift of the Magi

K. A. Abbas: Sparrows
Flora Annie Steel: Valiant Vicky, the Brave Weaver

Module 4 [Poems] **(18 hours)**

Rumi: The Chance of Humming
Walter Scott: Lochinvar
John Keats: La Belle Dame sans Mercy
Robert Frost: After Apple Picking
Chinua Achebe: Refugee Mother and Child
Kamala Das: My Grandmother's House
Ted Hughes: Jaguar
Pablo Neruda: Tonight I can Write the Saddest Lines
P. P. Ramachandran: How Simple!

Core Text: *Pearls from the Deep.* Cambridge University Press and Mahatma Gandhi University

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SYLLABI FOR COMMON COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 3 - Issues that Matter

Course Code	**EN2CC03**
Title of the course	**Issues that Matter**
Semester in which the course is to be taught	**2**
No. of credits	**4**
No. of contact hours	**90**

AIM OF THE COURSE

To sensitize the learners to contemporary issues of concern.

OBJECTIVES

By the end of the course, the learner should be able to:

1. Identify the major issues of contemporary significance
2. Respond rationally and positively to the issues raised
3. Internalise the values imparted through the selections.

COURSE OUTLINE

Module 1 **(18 hours)**

Luigi Pirandello: War

Judith Wright: The Old Prison

Arundhati Roy: Public Power in the Age of Empire

Module 2 **(18 hours)**

Bertolt Brecht: The Burning of the Books

W. H. Auden: Refugee Blues

Romila Thapar: What Secularism is and Where it Needs to be Headed

Module 3 **(18 hours)**

Zitkala- Sa: A Westward Trip

Bandhumadhav: The Poisoned Bread

Temsula Ao: The Pot Maker

Module 4 **(18 hours)**

Khushwant Singh: A Hosanna to the Monsoons

Ayyappa Paniker: Where are the woods, children?

Sarah Joseph: *Gift in Green* [chapter 2] - Hagar: A Story of a Woman and Water

Module 5 **(18 hours)**

Ghassan Kanafani: Six Eagles and a Child

Sanchari Pal: The Inspiring Story of How Sikkim Became India's Cleanest State

Indrajit Singh Rathore: Hermaphrodite

Core Text: *Issues that Matter*

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR COMMON COURSES – UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 4 - Savouring the Classics

Course Code	**EN2CC04**
Title of the Course	**Savouring the Classics**
Semester in which the course is to be taught	**2**
No. of credits	**3**
No. of contact hours	**72**

AIM OF COURSE

To introduce the students to the taste of time tested world classics.

OBJECTIVES OF THE COURSE

On completion of the course, the student should:
1. become familiar with the classics from various lands.
2. understand the features that go into the making of a classic.

OUTLINE OF THE COURSE

Module 1 [Poems] **(18 hours)**

Homer: Odysseus tells Eurycleaia to conceal his identity (*Odyssey* - Book 19: 476 - 507)
Sappho: Jealousy
Kalidasa: Look to This Day
Omar Khayyam: Rubaiyat (last four quatrains: 72-75)
Dante - Dante meets Virgil (*Inferno* - Canto 1: 61-99)
Matsuo Basho: Haikus
Alexander Pushkin: The Song of the Kazak

Module 2 [Shakespeare Excerpts] **(18 hours)**

Romeo and Juliet: ACT II, Scene ii
The Merchant of Venice: ACT IV, Scene i

Module 3 [Novel Excerpts] **(18 hours)**

Victor Hugo: *Les Miserables* (Part 1- Fantine Book II)
Mark Twain: *The Adventures of Huckleberry Fin* (Raft Passage)

Module 4 [Short Fiction] **(18 hours)**

Dostoyevsky: A Christmas Tree and a Wedding
Arthur Conan Doyle: The Adventure of the Dancing Men

Core Text: *Savouring the Classics*

Recommended Reading

Italo Calvino: *Why Read the Classics?*

A. C. Bradley: *Shakespearean Tragedy*

Katherine Armstrong: *Studying Shakespeare: A Practical Introduction*

Gemma McKenzie: *Foundations of European Drama*

Harold Bloom: The Western *Canon*

Jeremy Hawthorn: *Studying the Novel*

C. Marydas: *Shakespearean Aesthetics for University Wits*

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SYLLABI FOR COMMON COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 5 - Literature and/as Identity

Course Code Title of the course	**EN3CC05** **Literature and/as Identity**
Semester in which the course is to be taught	**3**
No. of credits	**4**
No. of contact hours	**90**

AIM OF THE COURSE

The course is intended to sensitivise students to the various ways in which literature serves as a platform for forming, consolidating, critiquing and re-working the issue of 'identity' at various levels.

OBJECTIVES OF THE COURSE

On completion of the course, the student should be aware of the following:

1. The subtle negotiations of Indigenous and Diasporic identities with-in Literature.
2. The fissures, the tensions and the interstices present in South Asian regional identities.
3. The emergence of Life Writing and alternate/alternative/marginal identities.

COURSE OUTLINE

Module 1 (Diasporic Identities) **(18 hours)**

Agha Shahid Ali: I See Kashmir from New Delhi at Midnight
M.G. Vassanji: Leaving
Imtiaz Dharker: At the Lahore Karhai
Chitra Banerjee Divakaruni: Indian Movie, New Jersey

Module 2 (South Asian Identities) **(18 hours)**

C. V. Velupillai: No State, No Dog
Sadaat Hasan Manto: The Dog of Tetwal
Intizar Hussain: A Chronicle of the Peacocks
Selina Hossain: Double War

Module 3 (Life Writings) **(18 hours)**

Malcolm X: "Nightmare", excerpt from *The Autobiography of Malcolm X*.
Sashi Deshpande: Learning to be a Mother in *Janani – Mothers, Daughters, Motherhood*, (ed.) Rinki Bhattacharya.

Module 4 (Indigenous Identities) **(18 hours)**

Excerpts from *Binti*, the Santhal creation song of cosmology, the *Bhilli Mahabharat* and *Garhwali Songs* in *Painted Words - An Anthology of Tribal Literature* - Edited by G. N. Devy.
Amos Tutuola: *The Palm-Wine Drinkard*. [Excerpt]

Module 5 (Alter Identities) **(18 hours)**

Nathaniel Hawthorne: The Birth Mark
John Henrik Clarke: The Boy Who Painted Christ Black
Ruskin Bond: The Girl on the Train

Core Text: *Literature and/as Identity*

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SYLLABI FOR COMMON COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 6 – Illuminations

Course Code	**EN4CC06**
Title of the course	**Illuminations**
Semester in which the course is to be taught	**4**
No. of credits	**4**
No. of contact hours	**90**

AIM OF THE COURSE

To acquaint the learners with different forms of inspiring and motivating literature.

OUTLINE OF THE COURSE

At the end of the course, the student shall be able to:
1. maintain a positive attitude to life.
2. evaluate and overcome setbacks based on the insights that these texts provide.

COURSE OUTLINE

Module 1 [Life Sketches] **(18 hours)**

Helen Keller: Three Days to See
Jesse Owens: My Greatest Olympic Prize
Dominic Lapierre: Mother Teresa

Module 2 [Essays] **(18 hours)**

Lafcadio Hearn: On Reading
Stephen Leacock: Are the Rich Happy?
A.G. Gardiner: On Courage

Module 3 [Speeches] **(18 hours)**

J. K. Rowling: The fringe benefits of failure and the importance of imagination
Malala Yousafzai: Nobel Lecture

Module 4 [Short Stories] **(18 hours)**

Oscar Wilde: The Nightingale and the Rose
George Orwell: The Miser

John Galsworthy: Quality
Paolo Coelho: The Beggar and the Baker

Module 5 [Poems] **(18 hours)**

William Ernest Henley: Invictus
Robert Frost: The Road Not Taken
Kahlil Gibran: Of Good and Evil
Joyce Kilmer: Trees

Core Text: *Illuminations*

Core Courses

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR CORE COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 1 - Methodology of Literary Studies

Course Code Title of the course Semester in which the course is to be taught	**EN1CR01** **Methodology of Literary Studies** **1**
No. of credits No. of contact hours	**4** **108**

AIM OF THE COURSE

The course seeks to introduce the student to the major signposts in the historical evolution of literary studies from its inception to the current postcolonial realm.

OBJECTIVES OF THE COURSE

On completion of the course, the student should be able to discern the following:
1. The emergence of literature as a specific discipline within the humanities.
2. The tenets of what is now known as 'traditional' approaches and also that of 'formalism.'
3. The shift towards contextual-political critiques of literary studies.
4. The questions raised by Cultural Studies and Feminism(s)
5. The issues of sublaternity and regionality in the literary domain.

COURSE OUTLINE

Module 1 **(18 hours)**

Part A: W. H. Hudson: "Some Ways of Studying Literature" from *An Introduction to the Study of Literature.*
Part B: William Shakespeare: Sonnet 116 – "Let Me Not to the Marriage of True Minds"

Module 2 **(18 hours)**

Part A: Cleanth Brookes: "The Formalist Critics" from the *My Credo* series: *The Kenyon Review*
Part B: Emily Dickinson: "Because I could not stop for Death" (poem 479)

Module 3 **(18 hours)**

Part A: Terry Eagleton: "What is Literature?" from *Literary Theory: An Introduction*.
Part B: Mahasweta Devi: "Kunti and the Nishadin"

Module 4 **(18 hours)**

Part A: Lois Tyson: "Feminist Criticism"
Part B: Sara Joseph: "Inside Every Woman Writer"

Module 5 **(18 hours)**

Part A: Peter Barry: Postcolonial Criticism

Part B: 2 Poems in tandem: Mahmoud Darwish: "Identity Card" and S. Joseph: "Identity Card"

Module 6 **(18 hours)**

Part A: Pradeepan Pampirikunnu: "What did Literary Histories Say to You?"
Part B: Poikayil Appachan: "No Alphabet in Sight"

Approaching the Course:
Ideally this paper should have a consistent linearity from Module 1 to 6; such a step-by-step progression will help trace the following trajectory effectively: **Traditional** to **Formalist** to **Political-Contextual** to **Feminist** to **Postcolonial** to **Regional-Subaltern** methodologies.

Core Text: ***Nuances: Methodology of Literary Studies.*** Macmillan and Mahatma Gandhi University

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SYLLABI FOR CORE COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 2 – Introducing Language and Literature

Course Code Title of the course	**EN2CR02** **Introducing Language and Literature**
Semester in which the course is to be taught	**2**
No. of credits	**4**
No. of contact hours	**108**

AIM OF THE COURSE

The course seeks to introduce the student to the basics of English language and literature.

OBJECTIVES OF THE COURSE

On completion of the course, the student should be able to discern the following:
1. The evolution and the differential traits of the English language till the present time.
2. The evolution of literature from antiquity to postmodern times.
3. The diversity of genres and techniques of representation and narration
4. The links between literature and film as narrative expressions.
5. The emergence of British and American Literature through diverse periods

COURSE OUTLINE

Module 1 **(18 hours)**

Language families - Indo European family of languages: Branches of Indo European - Home of the Indo Europeans - Main characteristics of Indo European languages

Germanic family of Languages: Characteristics - Grimm's Law - Verner's Law. - The position of English in Indo European family

Periods in the history of English language:
Old English period - Old English Dialects - Old English vocabulary
Middle English period - Norman Conquest - Middle English Vocabulary - Middle English dialects - French influence

Modern English period: Early modern English - The Great Vowel Shift - Renaissance and Reformation - The invention of printing - Authors and Books: The Bible - Shakespeare - Milton - Dictionaries - Loan words: Celtic, Scandinavian, Latin, French

Module 2 **(18 hours)**

Language Varieties

Dialect - Sociolect - Idiolect - Register - Pidgin - Creole -

English Today: Evolution of Standard English - Standard British English - Received Pronunciation - English as Global language - American English - Australian English - General Indian English - African English - Caribbean English - Second language acquisition

Word Formation: Compounding - Derivation - Abbreviation - Onomatopoeic words - Clipping - Acronyms - Portmanteau words

Historical Semantics - Semantic change: Generalisation - Specialisation - Association of Ideas - Euphemism - Popular misunderstanding

Module 3 **(36 hours)**

Classical Genres: Epic - Drama - Poetry

Modern Genres: Novel - Short Story - Novella

Genre Types:

Poetry - Narrative poetry and lyrical poetry - Elegy - Ode - Sonnet - Ballad - Dramatic Monologue

Drama - Tragedy - Comedy - Closet Drama – Epic Theatre - Theatre of the Absurd

Ambience:

Plot - Character - Point of View - Setting

Module 4 **(18 hours)**

Film and Literature - Dimensions of Film: Visual, Auditory and Spatial - Film Language: Montage and Mise-en-scene - Cut and the Shot - Styles of acting – Auteur theory - Adaptation

Module 5 **(18 hours)**

Periods of Literature: British and American

Old English - Middle English - Renaissance - Restoration - Neo-classical - Romantic - Victorian - Modern - Postmodern - American Crossover - American Transcendentalism

Core text for Modules 1 and 2:

V. Shyamala: *A Short History of English Language*.

Core Texts for Modules 3, 4 and 5:

Mario Klarer: *An Introduction to Literary Studies* [excluding the 4th chapter on 'Theoretical approaches to literature.']

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SYLLABI FOR CORE COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 3 – Harmony of Prose

Course Code	**EN3CR03**
Title of the course	**Harmony of Prose**
Semester in which the course is to be taught	**3**
No. of credits	**4**
No. of contact hours	**90**

AIM OF THE COURSE

The student is given space to mature in the presence of glorious essays, both Western and Non-Western.

OBJECTIVES OF THE COURSE

On completion of the course, the student shall be:

1. familiar with varied prose styles of expression.
2. aware of eloquent expressions, brevity and aptness of voicing ideas in stylish language.

COURSE OUTLINE

Module 1 **(18 hours)**

Francis Bacon: Of Friendship

Jonathan Swift: The Spider and the Bee

Joseph Addison: Meditations in Westminster Abbey

Module 2 **(18 hours)**

Samuel Johnson: Death of Dryden

Charles Lamb: Dream Children; a reverie

William Hazlitt: The Fight

Module 3 **(18 hours)**

Robert Lynd: Forgetting

Virginia Woolf: A Room of One's Own (an extract)

Aldous Huxley: The Beauty Industry

Module 4 **(18 hours)**

Nirad C. Choudhari: Indian Crowds (extract from *The Autobiography of an Unknown Indian*)

Amartya Sen: Sharing the World

A. K. Ramanujan: A Flowery Tree: A Woman's Tale

Module 5 **(18 hours)**

Kamau Brathwaite: Nation Language

Pico Iyer: In Praise of the Humble Coma

William Dalrymple: The Dancer of Kannur (extract from *Nine Lives*)

Core Text: *Harmony of Prose*

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR CORE COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 4 – Symphony of Verse

Course Code	**EN3CR04**
Title of the course	**Symphony of Verse**
Semester in which the course is to be taught	**3**
No. of credits	**4**
No. of contact hours	**90**

AIM OF THE COURSE

To acquaint the student with the rich texture of poetry in English.

OBJECTIVES OF THE COURSE

On completion of the course the students shall have:
1. an understanding of the representation of poetry in various periods of the English tradition.
2. an awareness of the emerging cultural and aesthetic expressions that poetry makes possible.

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COURSE OUTLINE

Module 1 (Renaissance and Restoration) (18 hours)

Edmund Spenser: One Day I Wrote Her Name
William Shakespeare: Sonnet 130
John Donne: Canonization
John Milton: Lycidas
John Dryden: A Song for St. Cecilia's Day

Module 2 (Romantic Revival) (18 hours)

William Wordsworth: Lucy Gray
Samuel Taylor Coleridge: Christabel (Part I)
Percy Bysshe Shelley: Ode to the West Wind
John Keats: To Autumn

Module 3 (Victorian) **(18 hours)**

Alfred, Lord Tennyson: Ulysses
Robert Browning: Porphyria's Lover
Matthew Arnold: Dover Beach
Christina Rossetti: A Hope Carol

Module 4 (Twentieth Century) **(18 hours)**

W. B. Yeats: Easter 1916
T S Eliot: The Love Song of J Alfred Prufrock
Philip Larkin: The Whitsun Weddings
Sylvia Plath: Lady Lazarus

Module 5 (Contemporary) **(18 hours)**

A. D. Hope: Australia
Maya Angelou: Phenomenal Woman
Seamus Heaney: Digging
Carol Ann Duffy: Stealing

Core Text: ***Symphony of Verse***

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR CORE COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 5 – Modes of Fiction

Course Code	**EN4CR05**
Title of the course	**Modes of Fiction**
Semester in which the course is to be taught	**4**
No. of credits	**4**
No. of contact hours	**90**

AIM OF THE COURSE

To acquaint students with various modes of fiction.

OBJECTIVES OF THE COURSE

On completion of the course, the student will have comprehended the categories of British and non- British short fiction, and also the novel as a form of literary expression.

COURSE OUTLINE

Module 1 [Short Fiction: British] (36 hours)

Mary Shelley: The Mortal Immortal
Jerome K. Jerome: The Dancing Partner
H. G. Wells: The Stolen Body
Somerset Maugham: Rain
G. K. Chesterton: The Blue Cross
James Joyce: Araby
Muriel Spark: The Executor
A. S. Byatt: On the Day E. M. Forster Died

Module 2 [Short Fiction: Non British] (36 hours)

Henry Lawson: The Drover's Wife
Maxim Gorky: Mother of a Traitor
Stephen Crane: A Dark Brown Dog
Katherine Mansfield: A Cup of Tea
Pearl S Buck: Once upon a Christmas
Gabriel Garcia Marquez: A Very Old Man with Enormous Wings

Mary Lerner: Little Selves
Nadine Gordimer: Once Upon a Time

Module 3 [Fiction] **(18 hours)**

Charles Dickens: *Great Expectations*

Core Text for Modules 1 and 2: *Modes of Fiction*

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR CORE COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 6 – Language and Linguistics

Course Code	**EN4CR06**
Title of the course	**Language and Linguistics**
Semester in which the course is to be taught	**4**
No. of credits	**4**
No. of contact hours	**90**

AIM OF THE COURSE

This course is an introduction to the science of linguistics. It seeks to give an overview of the basic concepts of linguistics and linguistic analysis to the students.

OBJECTIVES OF THE COURSE

This course seeks to achieve the following:
1. To show the various organs and processes involved in the production of speech, the types and typology of speech sounds, segmental & suprasegmental features of the English language, and transcription using IPA.
2. To describe and explain morphological processes and phenomena.
3. To show the various processes involved in the generation of meaning.
4. To enhance students' awareness that natural language is structure dependent and generative and to develop their ability to observe, describe and explain grammatical processes and phenomena.

COURSE OUTLINE

Module 1 [Introduction to Language, Linguistics and Phonetics] (36 hours)

What is Language? - What is Linguistics? Arbitrariness - Duality -Displacement - Cultural transmission
Basic Notions - Phonetics and Phonology - Branches of Phonetics – Articulatory, Acoustic, Auditory
Organs of Speech - Air Stream Mechanism – Pulmonic, Glottal, Velaric
Respiratory System - Phonatory System –Voiced and Voiceless Sounds
Articulatory System - Oral, nasal & nasalised sounds

Classification of Speech Sounds: Consonants and Vowels -
Criteria for Classification of Consonants - The Consonants of English RP

Place of Articulation - Bilabial, Labio-Dental, Dental, Alveolar, Post-Alveolar, Palato-Alveolar, Palatal & Velar Sounds
Manner of Articulation – Plosives, Fricatives, Affricates, Nasals, Lateral, Frictionless Continuants, Semi-Vowels, Trills & Taps
Criteria for Classification of Vowels - The Vowels of English RP
Tongue height: Close Vowels, Open Vowels, Half-Close Vowels, Half-Open Vowels
Part of the Tongue Raised: Front Vowels, Back Vowels, and Central Vowels
Position of Lips: Rounded Vowels, Unrounded Vowels
Diphthongs: Monophthongs and Diphthongs, Falling and Rising Diphthongs, Centring and Closing Diphthongs, Fronting and Retracting Diphthongs
Cardinal Vowels
    Vowel Diagram – Diphthongs - Tense and lax Vowels
Phonemes and Allophones
    Phone, Phoneme, Minimal pairs - Allophone, Aspiration, Dark and Clear / l /
    Contrastive Distribution and Complementary Distribution
Syllable
    What is a syllable? - Syllabic Structure – Onset, Nucleus, Coda - Syllabic Consonants
    Consonant Clusters, Abutting Consonants
Suprasegmentals
    Segmentals and Suprasegmentals - Suprasegmental Phonemes
    Word Stress - Sentence Stress - Weak forms and Strong Forms
    Rhythm – Intonation - Tone, Tonic Syllable, Tonicity - Intonation patterns
    Intonation – Functions
Juncture
Liasion
Assimilation
Elision
Linking / r / and Intrusive / r /
Transcription
    The incongruity between spelling and pronunciation in English
IPA
Broad and narrow Transcription
Transcription Practice

Module 2 [Morphology] (36 hours)

Basic Notions
    What is morphology?
    Morph, Morpheme
Morpheme Types and Typology
    Free and bound morphemes
    Root, Base, Stem
    Different types of affixes: Prefix, Suffix, Infix
    Inflection
    Inflectional and derivational affixes
    Class-changing and class- maintaining affixes
Allomorphy
    Allomorph
    Zero Morph
    Conditioning of allomorphs: Phonological &Morphological

Word
- Why is a word a difficult concept to define in absolute terms?
- Lexeme
- Form class and Function Class words

Morphological Operations/Processes
- Affixation
- Reduplication
- Ablaut
- Suppletion

Structure of Words
- Simple Words
- Complex Words
- Compound Words

SEMANTICS

Basic Notions
- What is semantics?
- Lexical and grammatical meaning
- Sense, reference, referent

Sense Relations

Synonymy – Antonymy – Hyponymy – Homonymy – Homography – Polysemy – Metonymy – Ambiguity – Tautology - Collocation

Module 3 [Syntax & Branches of Linguistics] (18 hours)

Basic Notions
- What is syntax?
- Grammar
- Grammaticality and Acceptability
- Descriptive and Prescriptive Grammar
- Synchronic and Diachronic Grammar
- Syntagmatic and Paradigmatic Relationships
- Sign, Signified and Signifier
- Langue and Parole
- Competence and Performance

Introduction to theories on Grammar
- Traditional Grammar
- Problems with traditional Grammar
- Structural grammars
- Phrase Structure Grammars
- Transformational Generative Grammars
  - Kernel Sentences
  - Deep and Surface Structures

One question from the essay section will be compulsory and shall deal with transcribing a passage of five lines of conversation and a set of five words using IPA symbols.

READING LIST

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H. A. Gleason: *Linguistics and English Grammar*. New York: Holt, Rinehart &. Winston, Inc.,
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MAHATMA GANDHI UNIVERSITY

SYLLABI FOR CORE COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 7 – Acts on the Stage

Course Code	**EN5CR07**
Title of the course	**Acts on the Stage**
Semester in which the course is to be taught	**5**
No. of credits	**4**
No. of contact hours	**108**

AIM OF THE COURSE

The course seeks to introduce the student to select theatre texts that form the canon of English drama.

OBJECTIVES OF THE COURSE

On completion of the course, the student shall be:
1. familiar with the works of the playwrights included in the course.
2. informed about the broad genre-based nuances in the realm of drama.
3. able to appreciate and critique drama as an art form.

COURSE OUTLINE

Module 1 **(72 Hours)**

William Shakespeare: *King Lear*

Module 2 **(36 Hours)**

One Act Plays

George Bernard Shaw: The Dark Lady of the Sonnets
Anton Chekov: The Boor
Maurice Maeterlinck: The Intruder
John Galsworthy: Strife

Core Text: ***Acts on the Stage***

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR CORE COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 8 – Literary Criticism and Theory

Course Code	**EN5CR08**
Title of the course	**Literary Criticism and Theory**
Semester in which the course is to be taught	**5**
No. of credits	**4**
No. of contact hours	**90**

AIM OF THE COURSE

The course seeks to introduce students to the major signposts in Literary Criticism, Literary Theory and Indian Aesthetics.

OBJECTIVES OF THE COURSE

On completion of the course, the student:
1. will have awareness about the major developments in literary criticism from the ancient times to the twentieth century.
2. will be initiated to the realm of literary theory and major theoretical schools.
3. will have awareness about the chief strains of Indian literary criticism.
4. will be able to analyse short poetical pieces critically.

COURSE OUTLINE

Module 1 [Literary Criticism] **(36 hours)**

A. Classical Criticism
Plato - Aristotle
B. Neoclassical Criticism
Neoclassicism in England - Dryden, Pope, Aphra Behn, Samuel Johnson
C. Romantic criticism
German Idealism - British Romantic criticism: Wordsworth, Coleridge
D. Victorian Criticism
Matthew Arnold
E. From Liberal Humanism to Formalism
The poetics of Modernism: Yeats, Pound, Eliot
Formalism - Russian Formalism: Boris Eichenbaum, Mikhail Bakhtin, Roman Jakobson- New Criticism: John Crowe Ransom, Wimsatt and Beardsley

F. Early 20th Century Criticism

F. R. Leavis - Marxist and Left Wing critics - Early feminist critics: Virginia Woolf, Simone de Beauvoir

From M. A. R Habib: *Literary Criticism from Plato to the Present: An Introduction*. Oxford: Wiley Blackwell, 2011

Module 2 [Literary Theory] **(36 hours)**

A. Structuralism - Poststructuralism - Deconstruction - Psychoanalysis
B. Ideology and Discourse
C. Postmodernism

From Mary Klages: *Literary Theory: A Guide for the Perplexed*. London: Continuum, 2008.

Module 3 [Indian Aesthetics & Practical Criticism] **(18 hours)**

A. Indian Aesthetics

Rasa - Dhvani - Vakrokti

From G. Balamohan Thampi: *Essays on Eastern Aesthetics*

B. Practical Criticism

Critical analysis of poetry

Based on Neil McCaw: Close Reading (Chapter 3 of *How to Read Texts**:** A Student Guide to Critical Approaches and Skills*. London: Viva-Continuum, 2008.)

Note: A compulsory question on practical criticism to be included in Section B (5 Marks) of the Question Paper

Core Text: *Literary Criticism and Theory*

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR CORE COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 9 – Indian Writing in English

Course Code	**EN5CR09**
Title of the course	**Indian Writing in English**
Semester in which the course is to be taught	**5**
No. of credits	**4**
No. of contact hours	**90**

AIM OF THE COURSE

The course is intended to sensitivise students to the various ways in which literature written in English, in the Indian sub-continent serves as a platform for forming, consolidating, critiquing and re-working the issue of national 'identity' at various levels.

OBJECTIVES OF THE COURSE

On completion of the course, the student should be aware of the following:
1. The subtle flavours that distinguish the 'Indian' quotient in English writings from India.
2. The different concerns that Indian English writers share, cutting across sub-nationalities and regionalities.
3. The *locus standi* of diasporic 'Indian' writers.

COURSE OUTLINE

Module 1 (Poetry) **(18 Hours)**

Henry Derozio: The Harp of India
Nissim Ezekiel: The Patriot
Jayanta Mahapatra: Freedom
Kamala Das: Introduction
Dom Moraes: Absences

Module 2 (Fiction) **(18 Hours)**

Anita Nair: *Ladies Coupe*

Module 3 (Drama) **(18 Hours)**

Girish Karnad: *Tughlaq*

Module 4 (Short Fiction) **(18 Hours)**

R. K. Narayan: The Antidote
Salman Rushdie: The Free Radio
Jhumpa Lahiri: The Interpreter of Maladies
Chitra Banerjee Divakaruni: Mrs Dutta Writes a Letter

Module 5 (Prose) **(18 Hours)**

Rabindranath Tagore: Nationalism in India
B. R. Ambedkar: Back from the West and Unable to Find Lodging in Baroda
Satyajit Ray: Odds Against Us
Amitav Ghosh: The Imam and the Indian

Core Text: *Indian Writing in English*

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR CORE COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE – Environmental Science and Human Rights

Course Code	**EN5CREN01**
Title of the course	**Environmental Science and Human Rights**
Semester in which the course is to be taught	**5**
No. of credits	**4**
No. of contact hours	**90**

Core module syllabus for Environmental Studies & Human Rights for under-graduate courses of all branches of higher education

VISION

The importance of environmental science and environmental studies cannot be disputed. The need for sustainable development is a key to the future of mankind. Continuing problems of pollution, solid waste disposal, degradation of environment, issues like economic productivity and national security, Global warming, the depletion of ozone layer and loss of biodiversity have made everyone aware of environmental issues. The United Nations Conference on Environment and Development held in Rio de Janerio in 1992 and World Summit on Sustainable Development at Johannesburg in 2002 have drawn the attention of people around the globe to the deteriorating condition of our environment. It is clear that no citizen of the earth can afford to be ignorant of environment issues.

India is rich in biodiversity which provides various resources for people. Only about 1.7 million living organisms have been described and named globally. Still many more remain to be identified and described. Attempts are made to conserve them in ex-situ and in-situ situations. Intellectual property rights (IPRs) have become important in a biodiversity-rich country like India to protect microbes, plants and animals that have useful genetic properties. Destruction of habitats, over-use of energy resource and environmental pollution has been found to be responsible for the loss of a large number of life-forms. It is feared that a large proportion of life on earth may get wiped out in the near future.

In spite of the deteriorating status of the environment, study of environment has so far not received adequate attention in our academic programme. Recognizing this, the Hon'ble Supreme Court directed the UGC to introduce a basic course on environment at every level in college education. Accordingly, the matter was considered by UGC and it was decided that a

six months compulsory core module course in environmental studies may be prepared and compulsorily implemented in all the University/Colleges of India.

The syllabus of environmental studies includes five modules including human rights. The first two modules are purely environmental studies according to the UGC directions. The second two modules are strictly related with the core subject and fifth module is for human rights.

OBJECTIVES

Environmental Education encourages students to research, investigate how and why things happen, and make their own decisions about complex environmental issues by developing and enhancing critical and creative thinking skills. It helps to foster a new generation of informed consumers, workers, as well as policy or decision makers.

Environmental Education helps students to understand how their decisions and actions affect the environment, builds knowledge and skills necessary to address complex environmental issues, as well as ways we can take action to keep our environment healthy and sustainable for the future. It encourages character building, and develops positive attitudes and values.

To develop the sense of awareness among the students about the environment and its various problems and to help the students in realizing the inter-relationship between man and environment and helps to protect the nature and natural resources.

To help the students in acquiring the basic knowledge about environment and the social norms that provides unity with environmental characteristics and create positive attitude about the environment.

Module I **(18 hours)**

Unit 1: Multidisciplinary nature of environmental studies - Definition, scope and importance Need for public awareness.

Unit 2: Natural Resources: Renewable and non-renewable resources: Natural resources and associated problems.
a) Forest resources: Use and over-exploitation, deforestation: case studies - Timber extraction, mining, dams and their effects on forest and tribal people.
b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources: case studies.
d) Food resources: World food problems - changes caused by agriculture and overgrazing - effects of modern agriculture – fertilizer & pesticide problems – water logging – salinity: case studies.
e) Energy resources: Growing energy needs - renewable and non renewable energy sources - use of alternate energy sources: case studies.
f) Land resources: Land as a resource - land degradation - man induced landslides – soil

erosion and desertification.
Role of individual in conservation of natural resources - Equitable use of resources for sustainable life styles.

Unit 3: Ecosystems
Concept of an ecosystem - Structure and function of an ecosystem - Producers, consumers and decomposers - Energy flow in the ecosystem.
Ecological succession - Food chains, food webs and ecological pyramids.
Introduction, types, characteristic features, structure and function of the given ecosystem - Forest ecosystem

Module II **(26 hours)**

Unit 1: Biodiversity and its conservation
Introduction - Bio-geographical classification of India
Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.
India as a mega-diversity nation.
Hot-sports of biodiversity
Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts - Endangered and endemic species of India

Unit 2: Environmental Pollution
Definition - Causes, effects and control measures of: Air pollution - Water pollution - Soil pollution - Marine pollution - Noise pollution - Thermal pollution - Nuclear hazards
Solid Waste Management: Causes, effects and control measures of urban and industrial wastes
Role of an individual in prevention of pollution - Pollution case studies
Disaster management: floods, earthquake, cyclone and landslides

Unit 3: Social Issues and the Environment
Urban problems related to energy - Water conservation, rain water harvesting, watershed management
Resettlement and rehabilitation of people: its problems and concerns: case studies
Environmental ethics: Issues and possible solutions
Climate change, global warming, acid rain, ozone layer depletion , nuclear accidents and holocaust: case studies - Consumerism and waste products

Environment Protection Act - Air (Prevention and Control of Pollution) Act – Water (Prevention and control of Pollution) Act - Wildlife Protection Act - Forest Conservation Act
Issues involved in enforcement of environmental legislation - Public awareness

Module III **(10 hours)**

Jean Giono: *The Man Who Planted Trees*

K. Satchitanandan: Hiroshima Remembered

Module IV **(10 hours)**

Bessie Head: Heaven is not Closed

Safdar Hashmi: Machine

Module V **(26 hours)**

Unit 1: Human Rights
An Introduction to Human Rights: Meaning, concept and development - Three Generations of Human Rights (Civil and Political Rights, Economic, Social and Cultural Rights).

Unit 2: Human Rights and United Nations
Contributions, main human rights related organs - UNESCO, UNICEF, WHO, ILO, Declarations for women and children, Universal Declaration of Human Rights.

Human Rights in India – Fundamental rights and Indian Constitution, Rights for children and women, Scheduled Castes, Scheduled Tribes, Other Backward Castes and Minorities

Unit 3: Environment and Human Rights
Right to Clean Environment and Public Safety
Issues of Industrial Pollution - Prevention, Rehabilitation and Safety Aspect of New Technologies such as Chemical and Nuclear Technologies - Issues of Waste Disposal - Protection of Environment

Conservation of natural resources and human rights: Reports, Case studies and policy formulation.
Conservation issues of Western Ghats: Mention Gadgil committee report, Kasthuri Rangan report.
Over-exploitation of ground water resources, marine fisheries, sand mining, etc.

Internal: Field study

Visit to a local area to document environmental grassland/ hill /mountain
Visit a local polluted site: Urban/Rural/Industrial/Agricultural Study of common plants, insects, birds, etc
Study of simple ecosystem: pond, river, hill slopes, etc
(Field work Equal to 5 lecture hours)

REFERENCES

Bharucha, Erach. *Text Book of Environmental Studies for Undergraduate Courses*. University Press, 2nd Edition 2013 (TB)

Clark, R. S. *Marine Pollution*, Oxford: Clarendon (Ref)

Cunningham, W. P., Cooper, T. H., Gorhani, E & Hepworth, M. T. 2001 *Environmental Encyclopaedia*, Mumbai: Jaico. (Ref)

Dc A. K. *Environmental Chemistry*, Wiley Eastern. (Ref)

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Heywood, V. H & Watson, R. T. 1995. *Global Biodiversity Assessment*, Cambridge UP (Ref)

Jadhav, H & Bhosale,V. M. 1995. *Environmental Protection and Laws*. Delhi: Himalaya (Ref)

McKinney, M. L & Schock, R. M. 1996. *Environmental Science Systems & Solutions*. Web enhanced edition (Ref)

Miller T.G. Jr., *Environmental Science*, Wadsworth (TB)

Odum, E. P 1971. *Fundamentals of Ecology*. W. B. Saunders (Ref)

Rao, M. N. & Datta, A. K. 1987. *Waste Water Treatment* Oxford & IBII (Ref)

Rajagopalan, R. *Environmental Studies from Crisis and Cure*, Oxford UP, 2016 (TB)

Sharma B.K., 2001. *Environmental Chemistry*. Meerut: Geol. (Ref)

Townsend C. Harper J, and Michael Begon, *Essentials of Ecology*, Blackwell Science (Ref)

Trivedi R. K. *Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards*, Vol I and II, Enviro Media (Ref)

Trivedi, R. K. and P. K. Goel. *Introduction to Air Pollution*. Techno-Science (Ref)

Wanger, K. D. 1998. *Environmental Management*. Philadelphia: W.B. Saunders (Ref)

(M) Magazine (R) Reference (TB) Textbook

Human Rights

Amartya Sen. *The Idea Justice*. New Delhi: Penguin, 2009.

Chatrath, K. J. S. Ed. *Education for Human Rights and Democracy*. Shimla: Indian Institute of Advanced Studies, 1998.

Law Relating to Human Rights. Asia Law House, 2001.

Shireesh Pal Singh, *Human Rights Education in 21st Century*. New Delhi: Discovery

S. K. Khanna. *Children and the Human Rights*. Common Wealth, 2011.

Sudhir Kapoor. *Human Rights in 21st Century*. Jaipur: Mangal Deep, 2001.

United Nations Development Programme. *Human Development Report 2004: Cultural Liberty in Today's Diverse World*. New Delhi: Oxford UP, 2004.

Six months compulsory core module course in Environmental Studies & Human Rights for undergraduates

Teaching Methodologies

The core Module Syllabus for Environmental Studies includes class room teaching and Field Work. The syllabus is divided into five modules covering 72 lectures. The first two modules will cover 44 lectures which are class room based to enhance knowledge skills and attitude to environment. The third and forth is based on subject related environmental studies which will be covered in 20 lecture hours and would provide student a multidisciplinary knowledge on environmental issues in relation with the core subject. Human rights is also included in the fifth module and 8 lectures are set apart for that. Field study is one of the most effective learning tools for environmental concerns and is purely for internal evaluation. This moves out of the scope of the text book mode of teaching into the realm of real learning in the field, where the teacher merely acts as a catalyst to interpret what the student observes or discovers in his/her own environment. Field studies are as essential as class work and form an irreplaceable synergistic tool in the entire learning process.

Course material provided by UGC for class room teaching and field activities be utilized.

The universities/colleges can also draw upon expertise of outside resource persons for teaching purpose.

Environmental Core Module shall be integrated into the teaching programmes of all undergraduate courses.

Core Text for Module 3 & 4: *Greening Knowledge*

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR CORE COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 10 – Postcolonial Literatures

Course Code	**EN6CR10**
Title of the course	**Postcolonial Literatures**
Semester in which the course is to be taught	**6**
No. of credits	**4**
No. of contact hours	**90**

AIM OF THE COURSE

To familiarize the students the varied dimension s of postcolonial subjectivity through theory and literature.

OBJECTIVES OF THE COURSE

On completion of the course, the student will:
1. be aware of the social, political, cultural aspects of postcolonial societies.
2. realise the impact of colonialism and imperialism on native cultural identities.
3. get an insight into the links between language, history and culture.

COURSE OUTLINE

Module 1 [The Domain] **(36 hours)**

Bill Ashcroft, Gareth Griffiths and Helen Tiffin: Introduction of *The Empire Writes Back*
Edward Said: Orientalism [an excerpt]
Frantz Fanon: The Fact of Blackness

Module 2 [Poetry] **(18 hours)**

Faiz Ahmed Faiz: A Prison Evening
A. K. Ramanujan: Small Scale Reflections on a Great House
David Malouf: Revolving Days
Wole Soyinka: Civilian and Soldier
Margaret Atwood: Journey to the Interior

Module 3 [Fiction] **(18 hours)**

Peter Carey: *Jack Maggs*

Module 4 [Drama] **(18 hours)**

Ngugi wa Thiong'o: *The Trial of Dedan Kimathi*

Core Text: *Postcolonial Literatures*

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR CORE COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 11 – Women Writing

Course Code	**EN6CR11**
Title of the course	**Women Writing**
Semester in which the course is to be taught	**6**
No. of credits	**4**
No. of contact hours	**90**

AIM OF THE COURSE

To introduce the theoretical and literary responses by women and the concerns that govern feminist literature.

OBJECTIVES OF THE COURSE

On completion of the course, the students will be able to:
1. critically respond to literature from a feminist perspective.
2. realize how the patriarchal notions pervade in the social and cultural scenario and how feminism exposes these notions.
3. identify how stereotypical representations of women were constructed and how these are subverted by feminist writing

COURSE OUTLINE

Module 1 [Essays] **(36 hours)**

Betty Friedan: The Problem that has No Name (Chapter 1 of *The Feminine Mystique*)
Elaine Showalter: Towards a Feminist Poetics
Patricia Hill Collins: Mammies, Matriarchs and Other Controlling Images (Chapter 4 of *Black Feminist Thought* pp. 79-84

Module 2 [Poetry] **(18 hours)**

Anna Akhmatova: Lot's Wife

Mamta Kalia: After Eight Years of Marriage
Julia Alvarez: Women's Work
Meena Alexander: House of a Thousand Doors
Sutapa Bhattacharya: Draupadi
Kristine Batey: Lot's Wife
Vijayalakshmi: Bhagavatha

Module 3 [Short Fiction] **(18 hours)**

Charlotte Perkins Gilman: The Yellow Wallpaper
Willa Cather: A Wagner Matinee
Isabel Allende: And of the Clay We Created
Sara Joseph: The Passion of Mary

Module 4 [Fiction] **(18 hours)**

Alice Walker: *The Color Purple*

Core Text: *Women Writing*

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR CORE COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 12 – American Literature

Course Code	**EN6CR12**
Title of the course	**American Literature**
Semester in which the course is to be taught	**6**
No. of credits	**4**
No. of contact hours	**90**

AIM OF THE COURSE

To enable the students to have a holistic understanding of the heterogeneity of American culture and to study works of prose, poetry, drama, and fiction in relation to their historical and cultural contexts.

OBJECTIVES OF THE COURSE

At the end of the course, the student shall be:
1. familiar with the evolution of various literary movements in American literature.
2. acquainted with the major authors in American Literary History.

COURSE OUTLINE

Module 1 [Prose] **(18 hours)**

M. H Abrams: Periods of American Literature in *A Glossary of Literary Terms*
Robert E. Spiller: The Last Frontier in *The Cycle of American Literature*
Ralph Waldo Emerson: Gifts
James Baldwin: If Black English isn't Language, then Tell me, What is?

Module 2 [Poetry] **(18 hours)**

Walt Whitman: I Hear America Singing
Emily Dickinson: I dwell in Possibility
Robert Frost: Love and a Question
e. e. cummings: Let's Live Suddenly without Thinking
Langston Hughes: Let America be America Again
Allen Ginsberg: A Supermarket in California
Adrienne Rich: In a Classroom

Marianne Moore: Poetry

Module 3 [Short Story] **(18 hours)**

Nathaniel Hawthorne: My Kinsman, Major Molineux
Edgar Allan Poe: The Purloined Letter
Mark Twain: How I Edited an Agricultural Paper
Leslie Marmon Silko: Lullaby
Kate Chopin: A Respectable Woman

Module 4 [Drama] **(18 hours)**

Arthur Miller: *The Crucible*

Module 5 [Novel] **(18 hours)**

Harper Lee: *To Kill a Mocking Bird*

Core Text: *American Literature*

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR CORE COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 13 – Modern World Literature

Course Code	**EN6CR13**
Title of the course	**Modern World Literature**
Semester in which the course is to be taught	**6**
No. of credits	**4**
No. of contact hours	**90**

AIM OF THE COURSE

To make the students aware of the stupendous variety that resides in Literatures the world over.

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OBJECTIVES OF THE COURSE

On completion of the course, the students should be able to discern the following:
1. That literatures the world over engage in very deep ways with the vicissitudes of life.
2. World literatures often defy genres/regionalities and canonical assumptions to emerge as a platform where poetics and politics fuse.
3. The notion of Major and Minor, Central and Peripheral literatures is a myth.

COURSE OUTLINE

Module 1 [Poetry] **(18 hours)**

Marina Tsvetaeva: Meeting
Federico Garcia Lorca: New Heart
Pablo Neruda: Ars Poetica
Leopold Sedar Senghor: Black Woman
Wizlawa Szymborska: The Terrorist, He's Watching
Adonis: Nothing but madness remains
Bei Dao: The Answer
Ko Un: A Poet's Heart

Module 2 [Short Stories: European] **(18 hours)**

Leo Tolstoy: God Sees the Truth, but Waits
Bjornstjerne Bjornson: The Father
Franz Kafka: Before the Law

Bertolt Brecht: The Monster
Albert Camus: The Guest
Javier Marias: The Life and Death of Marcelino Iturriaga

Module 3 [Short Stories: Non-European] **(18 hours)**

Ryunosuke Akutagawa: In a Grove
Jorge Luis Borges: The Garden of Forking Paths
Naguib Mahfouz: Half of a Day
Julio Cortazar: Continuity of Parks
Danilo Kis: The Encyclopaedia of the Dead
Juan Gabriel Vasquez: The Dogs of War

Module 4 [Novel] **(18 hours)**

Italo Calvino: *The Cloven Viscount*

Module 5 [Drama] **(18 hours)**

Eugene Ionesco: *Chairs*

Core Text: *Modern World Literature*

Complementary Courses

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR COMPLEMENTARY COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS
SEMESTER 3 (BA English Model 1 & Model 2)

COURSE 3: The Evolution of Literary Movements: The Shapers of Destiny

Course Code	**EN3CM03**
Title of the course	**The Evolution of Literary Movements: The Shapers of Destiny**
Semester in which the course is to be taught	**3**
No. of credits	**4**
No. of contact hours	**108**

1. AIM OF THE COURSE

To make the learner aware of the way in which history shapes the life and literature of a people

2. OBJECTIVES OF THE COURSE

- To give the learner a comprehensive overview of the history of Britain and its impact upon the rest of the world
- To enable him to understand English literature in the light of historical events
- To analyse the manner in which a person is moulded by the historical events of his personal and communal life

3. COURSE OUTLINE

Module 1: Moulding and Being Moulded **18 hours**

Early settlers and invaders- the Iberians, the Celts and Romans, the Angles, Saxons, Jutes. The Anglo Saxon heptarchy- The coming of Christianity- Theodore of Tarsus and the organization of the church- Alfred the Great – St. Dunstan and Edgar – Canute the Danish king- Edward the Confessor, Harold Godwin- Society and literature of the time-the

Witangemot -the Anglo Saxon Chronicle, Beowulf, Caedmon, Cynewulf, Venerable Bede and others-

Module 2: The True Briton 36 hours

Normans: the last invaders –William the Conqueror –the reforms of Henry I- Feudalism- the Angevin kings - the struggle between the church and the state, St. Thomas Becket – the universities of Oxford and Cambridge–the Guilds - Richard the Lionheart and the Crusades- the Magna Carta- Henry III – Simon de Montfort, and the Parliament- Edward I, annexation of Wales, Scotland and Ireland – Edward II and Edward III – The Black Death, The Hundred Years War, The Peasants Revolt – the effects of these on society and literature- The Wars of the Roses – Chaucer and the growth of the East Midland dialect into standard English – Growth of drama and stage performances- Chaucer's contemporaries- John Wycliffe and the Lollards..

Module Three : Brittannia Rules the Waves 36 hours

The Tudor Dynasty- benevolent despots – Renaissance – maritime discoveries – the scientific temper and scientific inventions- flamboyant Henry VIII, Reformation- religious persecution- Thomas More, Erasmus, Thomas Cromwell-The Book of Common Prayer- Elizabeth I- Shakespeare – nest of singing birds- Francis Drake- peace and prosperity- The Stuarts and the Divine Right Theory- The Authorised Version- The Civil War- Oliver Cromwell and the Protectorate – John Milton- the Jacobean playwrights – Restoration- Caroline writers- The Whigs and Tories- Queen Anne and the expansion of colonialism – The Glorious Revolution

Module Four : A Precious Stone Set in the Silver Sea 18 hours

The United Kingdom today- Physical features of the British Isles, geography, demography – Customs and practices – myths and legends –the growth and development of the English language –the position held by the UK in today's world

Reading List

1. Trevelyan, G. M. Illustrated English Social History (Vol 1-6). England: Penguin, 1968.
2. Churchill, Winston. A History of the English Speaking Peoples (Vol 1-12). London: Cassel and Co., 1966.
3. Nehru, Jawaharlal. Glimpses of World History. New Delhi: Penguin, 2004.
4. Alexander, Michael (ed.) A History of English Literature. New York: Palgrave-Macmillan, 2007.
5. Sampson, George (ed.) A History of English Literature. Delhi: Foundation, 2004.
6. Thorndike, Lynn. Encyclopedia of World Civilization (Vol 2). Delhi: Shubi Publications, 1990.
7. Yeats, W. B. Writings on Irish Folklore Legend and Myth. London: Penguin, 1999.
8. Warner, Marina. From the Beast to the Blond. London: Vintage, 1995.

4. Core Text: Susan Varghese. *Evolution of Literary Movements: The Shapers of Destiny*. Current Books.

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR COMPLEMENTARY COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS
SEMESTER 4 (BA English Model 1 & Model 2)

COURSE 4: The Evolution of Literary Movements: The Cross Currents of Change

Course Code	**EN4CM04**
Title of the course	**The Evolution of Literary Movements: The Cross Currents of Change**
Semester in which the course is to be taught	**4**
No. of credits	**4**
No. of contact hours	**108**

AIM OF THE COURSE

To enable students to have a notion of the evolution of literature and to help them perceive the interplay of social processes and literature

OBJECTIVES OF THE COURSE

By the end of the course it is hoped that:
1. students will be competent to understand literature against the backdrop of history.
2. students will be inspired to contribute dynamically to historical and literary processes.

COURSE OUTLINE

Module 1 [Literature and Revolution] (36 hours)

a. The interaction between the French Revolution and the literature of the age
b. Literature in the context of the Russian Revolution

Module 2 [Literature and Renaissance] (18 hours)

a. The social context of the burgeoning of literature in Latin America
b. Kerala at the dawn of awakening

Module 3 [Literature and Liberation] (36 hours)

a. Literature and feminism
b. Dalit writing

Module 4 [Literature and the Third World] **(18 hours)**

a. Articulating the Postcolonial Experience
b. An overview of New Literatures

Core Text: Dr B Keralavarma. *Evolution of Literary Movements: The Cross-currents of Change*.

Open Courses

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR OPEN COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 1 – Appreciating Films

Course Code	**EN5CROP01**
Title of the course	**Appreciating Films**
Semester in which the course is to be taught	**5**
No. of credits	**4**
No. of contact hours	**72**

AIM OF THE COURSE

The course seeks to introduce the student to the major elements that constitute cinema. Also the attempt will be to equip the student to academically discuss cinema in terms of critiques and close analyses.

OBJECTIVES OF THE COURSE

On completion of the course, the student should be able to discern the following:
1. The broad contours of the history and aesthetics of films.
2. The overarching film genres and the basic terminology of film studies.
3. The distinction between mere appreciation of films and sustained ideological film analysis.
4. The questions raised by Cultural Studies and Feminism(s) in their encounter with films.
5. The issues raised by cinematic adaptations of literature.

.

COURSE OUTLINE

Module 1 (Broad Film Genres) (18 hours)

Lumiere vs. Melies [*Arrival of a Train* vs. *An Impossible Voyage*]
Narrative Cinema vs. Documentary Cinema
Hollywood Style as Norm - Roland Emmerich's *Independence Day* (1996)
German Expressionism - F.W. Murnau's *Nosferatu* (1922)
Neo-realism - Vittorio De Sica's *Bicycle Thieves* (1948)

Module 2 (Film Languages) (18 hours)

Montage Theory: [Clippings from Eisenstein's *Battleship Potemkin* and Chaplin's *Modern*

Times]
Mise-en-scene: [The opening sequence from Werner Herzog's *Aguirre, Wrath of God* **(**1972) and the infamous 'horse head' scene from Francis Ford Coppola's *The Godfather* (1972)]
Deep Focus, the Long Take and psychological representation: [Select scenes from Orson Welles' *The Magnificent Ambersons* (1942)]
Jump Cut (anti-seamless-dissolve) [Examples from Godard's *Breathless* (1960)]

Module 3 (Reading Films) (18 hours)

Cinema and Ideology/Identity Politics
[Kamal Haasan's *Hey Ram* (2000) and Shaji Kailas's] *Aaraam Thampuran* (1997)]

Cinema and Feminism
[Rajkumar Hirani's *PK* (2014) and K. G. George's *Aadaminte Variyellu* (1983))

Module 4 (Film Adaptations) (18 hours)

Shakespeare/Hamlet: Vishal Bhardwaj's *Haider* (2014)
Basheer/Mathilukal: Adoor Gopalakrishnan's *Mathilukal* (1990)

Films Recommended for Background Viewing

George Melies: *An Impossible Voyage*
Lumiere brothers: *Arrival of a Train*
Sergei Eisenstein: *Battleship Potemkin*
Charlie Chaplin: *Modern Times*
Werner Herzog: *Aguirre, Wrath of God*
Francis Ford Coppola: *The Godfather*
Orson Welles: *The Magnificent Ambersons*
Jean Luc-Godard: *Breathless*
V. K. Prakash: *Karmayogi* [Malayalam]

Core Text: *Appreciating Films*

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR OPEN COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 2 – Theatre Studies

Course Code	**EN5CROP02**
Title of the course	**Theatre Studies**
Semester in which the course is to be taught	**5**
No. of credits	**4**
No. of contact hours	**72**

AIM OF THE COURSE

The students will be introduced to a selection of plays from the West and the East, ranging from the tragic and the comic, the folk and the street, so as to generate interest in theatre and make them aware of the new trends in modern theatre.

OBJECTIVES OF THE COURSE

On completion of the course, the student should be able to imbibe the following:

1. An understanding of a selection of well-discussed plays across the world.
2. The classical and modern theatre in the West and the East.
3. The form and content of various kinds of theatre.
4. Colonial and subversive postcolonial aspects in Indian theatre.
5. Issues of gender, identity, caste, tradition, morality, etc dealt with by modern theatre.

.

COURSE OUTLINE

Module 1 (Classics) **(18 hours)**

Kalidasa: *Abhijnanasakunthalam* – Act I

William Shakespeare: *Othello* – Act I, Scene III, 1-295

Module 2 (Tragic Vision) **(18 hours)**

Eugene O'Neil: Before Breakfast

Langston Hughes: Soul Gone Home

Module 3 (Comic Vision) **(18 hours)**

Bernard Shaw: How He Lied to Her Husband

Anton Chekov: The Proposal

Module 4 (Folk/Street) **(18 hours)**

Kavalam Narayana Panicker: Maraattom

Malini Bhattacharya: Giving Away the Girl

Core Text: *Theatre Studies*

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR OPEN COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 3 – English for Careers

Course Code	**EN5CROP03**
Title of the course	**English for Careers**
Semester in which the course is to be taught	**5**
No. of credits	**4**
No. of contact hours	**72**

AIM OF THE COURSE

To make the students competent in their job-seeking, job-getting, and job-holding needs. The course shall cater to equipping the students in Comprehensive Language Enhancement.

.

OBJECTIVES OF THE COURSE

On completion of the course, the students should be able:

1. To develop communicative skills, which will enable them to prepare for a career and function effectively in it.
2. To equip themselves in oral and written communication to enhance their academic and professional use of language.
3. To train themselves in making effective presentations.

COURSE OUTLINE

Module 1[Oral and Written Skills for Jobs and Careers] (18 hours)

a. Applying for jobs—Preparing Resumes—Writing Cover letters.
b. Preparing for interviews—Taking Interviews—Post-Interview follow-up-Promotion
c. Interviews—Group Discussions

Module 2[Correctness of Language Usage] (18 hours)

a. Common errors in communication and how to avoid them.
b. Some Notions—Conventional and idiomatic expressions.
c. Today's Vocabulary
d. Grammar for Grown-ups

Module 3 [Facing People] **(18 hours)**

a. Structuring and delivering a presentation.
b. Communication in the Management context.
c. Importance of Words/Language.
d. Horizontal and Democratic Communication.

Module 4 [**Keeping the Job]** **(18 hours)**

a. Human relationships in academic and professional life.
b. Front Office Management and Keeping public relations (Telephone Skills)
c. Soft Skills for Team Building.
d. Keeping the Job—Professional Ethics
e. Managing Multiple Roles- Healthy Balancing of family and career.

Reading List

1. Samson et al. *English for Life - 4***.** New Delhi: Cambridge UP.

2. Vasudev, Murthy. *Effective Proposal Writing***.** New Delhi: Response, 2006.

3. *Towards Academic English: Developing Effective Writing Skills***.** New Delhi: Cambridge UP, 2007.

4. *Oxford Guide to Effective Writing and Speak*ing. OUP, 2007.

5. Bhatnagar, R. P. *English for Competitive Examinations***.** New Delhi: Macmillan, 2009.

6. *English for Careers***.** *Pearson*.

7. *ABC of Common Grammatical Errors*. Macmillan, 2009

8. Kaul, Asha. *The Effective Presentation*. New Delhi: Response

9. Shepherd, Kerry. *Presentations at Conferences, Seminars and Meetings***.** New Delhi: Response.

10. Vilanilam, J. V. *More Effective Communication: a Manuel for Professionals.* Response 2008

11. *English for Career Development***.** Orient Longman, 2006.

Core Text: *English for Careers*

Choice Based Courses

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR CHOICE BASED COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 1 – Comparative Literature

Course Code	**EN6CB01**
Title of the course	**Comparative Literature**
Semester in which the course is to be taught	**6**
No. of credits	**4**
No. of contact hours	**72**

AIM OF THE COURSE

To introduce the student to the various concepts relating to comparative study of literature and to promote an international approach to the study of literature.

OBJECTIVES OF THE COURSE

On completion of the course, the student should be able to:
1. Develop strategies and methodologies in the study of literatures in comparison.
2. Undertake a methodological investigation of problems involving more than one literature so that she/he may acquire a broader sense of literary history and tradition.
3. Critically analyze literary texts in a broader perspective of World Literature.

.

COURSE OUTLINE

Module 1 [Themes and Contexts] (18 hours)

K. M. Krishnan: 'Introduction' in the anthology *Between the Lines*
Susan Bassnett: 'What is Comparative Literature Today' from *Comparative Literature: An Introduction*

Module 2 [Envisioning] (18 hours)

Part A: Writing

Ted Hughes: The Thought Fox
Seamus Heaney: Personal Helicon

Part B: Death Wish

Sylvia Plath: Tulips
Dorothy Parker: Resume

Part C: Hamlets

Anna Akhmatova: Reading Hamlet
C. P. Cavafy: King Claudius
Salman Rushdie: Yorick

Module 3 [Nuance] **(18 hours)**

Part A: Myth

Rabindranath Tagore: Karna Kunti Samvad
G. Sankarapilla: Wings Flapping, Somewhere

Part B: Sleuthing

Arthur Conan Doyle: The Adventure of the Blue Carbuncle
V. K. N.: Sherlock Holmes

Module 4 [Motif] **(18 Hours)**

Carlo Collodi: The Adventures of Pinocchio
Nikolai Gogol : The Nose
Vaikom Muhammad Basheer : The World Renowned Nose

Core Text: *Comparative Literature*

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR CHOICE BASED COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 2 – Modern Malayalam Literature in Translation

Course Code	**EN6CB02**
Title of the course	**Modern Malayalam Literature in Translation**
Semester in which the course is to be taught	**6**
No. of credits	**4**
No. of contact hours	**72**

AIM OF THE COURSE

The students will be introduced to a selection of literature translated from Malayalam into English. The student will be able to establish an endearing rapport with the cultural aspects of the living environs.

OBJECTIVES OF THE COURSE

On completion of the course, the student should be able to comprehend the following:
1. An understanding of a selection of much discussed writers/literary pieces in Malayalam.
2. The various genres in Malayalam.
3. The modern trends in Malayalam literature.
4. Experiments with form in Malayalam poems and prose.

.

COURSE OUTLINE

Module 1 (Poetry) **(18 hours)**

Balamani Amma: The Pen
Ayyappa Paniker: Theft
Kadamanitta: Feline Fancies
Satchidanandan: The Mad
Balachandran Chullikkad: Possessed
V. M. Girija: A Tree I Was Long Back
S. Joseph: Group Photo
Anitha Thampi: Sweeping the Front Yard
Bindu Krishnan: Certain Days, Like This

Module 2 (Short Fiction) **(18 hours)**

M. T. Vasudevan Nair: For You
Madhavikutti: Neypayasam
M. Mukundan: The Eyesight of the Mirror
Paul Zacharia: Last Show
N. S. Madhavan: Afterword
Santhosh Echikkanam: The Hunters in a Picture Story
Subhash Chandran: Bloody Mary
Anvar Abdulla: Sea-Roar

Module 3 (Novel) **(18 hours)**

O. V. Vijayan: *The Legends of Khasak*

Module 4 (Novella/Memoir/Prison Narrative) **(18 hours)**

Vaikom Muhammad Basheer: Walls

Background Reading

1. Sujit Mukherjee, 'Translation as Discovery' (139-150 in *Translation as Discovery*)
2. A K Ramanujan, 'Three Hundred Ramayanas: Five Examples and Three Thoughts on Translation.' (131 – 160 in *The Collected Essays of A K Ramanujan*)
3. Gayatri Chakravorty Spivak, 'The Politics of Translation.' (397- 416 in *The Translation Studies Reader*)
4. G N Devy, "'Translation and Literary History: An Indian View (pp 182 – 88 in *Postcolonial Translation: Theory and Practice*)
5. Walter Benjamin, 'The Task of the Translator.' (15 - 25 in *The Translation Studies Reader*)

Core Text: *Modern Malayalam Literature in Translation*

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR CHOICE BASED COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 3 – Regional Literatures in Translation

Course Code	**EN6CB03**
Title of the course	**Regional Literatures in Translation**
Semester in which the course is to be taught	**6**
No. of credits	**4**
No. of contact hours	**72**

AIM OF THE COURSE

The students will be introduced to a selection of regional literatures translated into English.

OBJECTIVES OF THE COURSE

On completion of the course, the student should be able to comprehend the following:
1. An understanding of much discussed writers/literary pieces in the vernaculars.
2. The modern trends in regional literatures.

.

COURSE OUTLINE

Module 1 [Prose] (18 hours)

Susan Bassnett: Introduction to *Translation Studies*
Keya Majumdar: Appropriating the Other - Some Challenges of Translation and its Theories"
Romila Thapar: 'The Abhijnana-Sakuntalam of Kalidasa' from *Shakuntala: Texts, Readings and History*

Module 2 [Poetry] (18 hours)

Jibanananda Das: Banalata Sen
Kedarnath Agarwal: Freedom of the Writer
Amin Kamil: Naked Thoughts
P Lankesh: Mother (Avva)
P. P. Ramachandran: Iruppu
S Joseph: Fish Monger

Module 3 [Drama] (18 hours)

C. J. Thomas: *Crime 27 in 1128*

Vijay Tendulkar: *Kanyadaan*

Module 4 [Short Story] **(18 hours)**

Saadat Hasan Manto: Toba Tek Singh
Amrita Pritam: The Weed
Annabhau Sathe: Gold from the Grave
Sujatha: Washing Machine
Devanuru Mahadeva: Tar Arrives

Core Text: *Regional Literatures in Translation*

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR CHOICE BASED COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 4 – Voices from the Margin

Course Code	**EN6CB04**
Title of the course	**Voices from the Margins**
Semester in which the course is to be taught	**6**
No. of credits	**4**
No. of contact hours	**72**

AIM OF THE COURSE

To introduce "voices" from the margins to the students, as an attempt to understand suppressed histories and discourses.

OBJECTIVES OF THE COURSE

On completion of the course, the student will have critically encountered subaltern voices, Dalitness and indigeneity.

COURSE OUTLINE

Module 1 **(36 Hours)**

'Subaltern' - Entry in *Routledge Dictionary of Literary Terms* by Peter Childs and Roger Fowler

Poikayil Appachan. "Remembering the Travails." *Writing in the Dark: A Collection of Malayalam Dalit Poetry*. Eds. M. B. Manoj and George K. Alex. Mumbai: VAK. 2008. 21-25.

Sharankumar Limbale. "Dalit Literature: Form and Purpose." *Towards an Aesthetics of Dalit Literature.* Hyderabad: Orient Longman. 2004. 23-39.

Kallen Pokkudan. *My Life* (Excerpts). *The Oxford India Anthology of Malayalam Dalit Writing*. New Delhi: OUP. 2012. 185-195.

Hira Bansode. "Yashodhara." *Posioned Bread*. Ed. Arjun Dangle. Hyderabad: Orient Blackswan. 2009. 36-37.

M. B. Manoj. “Anonymous.” *No Alphabet in Sight: New Dalit Writing from South India: Dossier 1: Tamil and Malayalam*. Eds. K. Satyannarayana and Susie Tharu. New Delhi: Penguin. 532-533.

Bama. *Sangati*. New Delhi: OUP. 2005.

Module 2 **(36 Hours)**

Ramanika Gupta. “Adivasi Literature: An Emerging Consciousness.” *Indigeneity: Culture and Representation.* Hyderabad: Orient Blackswan. 2009. 191-202.

G. N. Devy. “Aphasia: The Fate of the Indigenous Languages” Introduction to *The Language Loss of the Indigenous*. Eds. G. N. Devy, Geoffrey V. Davis and K. K. Chakravarty. New Delhi: New York: Routledge. 2016. 1-6.

Dakxin Bajrange. “Budhan” in. *Painted Words: An Anthology of Tribal Literature.* Ed. G. N. Devy. Vadodara: Purva Prakash. 2012. 245-272.

Narayan/Catherine Thankamma. “We want to be understood . . . and allowed to live with dignity.” Interview. *Kocharethi: The Araya Woman.* New Delhi: OUP. 2011. 208-216.

Bhaskaran. *Mother Forest*: *The Unfinished Story of C.K. Janu*. New Delhi: Kali for Women. 2004.

Core Text: *Voices from the Margins*

Department of English 2021-22

2Tax SJ 1Eco SB 2PCZ NC 1MA ASK 2Eng RML 3M NS 2MA SS	2Eco MM 1Eng SS 2M SB 1PCZ RP 3M RML 1MA PCS 2MA NC	2Mkt SS 1Eng ASK 2Bot SJ 1Eco NC 3M PCS 1MA NS 2MA SB	2M MM 1Tax NS 3M RML 1Bot SB 2MA RP 1MA SJ	2M RML 1M NC 3M RP 1PCZ ASK 2MA PCS 1Mkt SS 1MA MM
2Mkt SS 1Eco ASK 2Bot RP 1PCZ SB 3M SJ 1Mkt PCS 2MA NC 1MA RML	2M ASK 1Eng PCS 3M NC 1Eco RP 2MA SJ 1Tax NS 1 MA SS	2M RP 1Bot SS 3M NS 1MA SB 2MA MM	2Eco SB 1Eng RML 2M ASK 1PCZ NC 3M MM 1 MA PCS 2MA AN	2Eng SJ 1MA MM 2PCZ RML 3M NS 2MA RP
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2Eco SJ 1MA MM 2M PCS 3M NC 2MA NS	2 Tax RML 1M SJ 2Eng RP 1Eco PCS 3M MM 1PCZ NC 2MA ASK 1MA SS	2PCZ ASK 1MA SB 2Bot SS 2Mkt NS 2M AN 3M PCS 2MA RML	2M MM 1M SS 3M RML 1PCZ SB 2MA SJ 1Bot RP 1MA NS	3M MM 1Eng NC 2MA SB 1Mkt ASK 1Tax AN 1MA RP
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MM- Mrudula Menon V. NS- Neena Simon NC- Navya Chandran AN- Asmin N

SB- Soney Bhageeradhan SJ- Sabitha Joseph SS- Sarah Santhosh

PCS- C.S. Prabha RP- Reethi P ASK- Amrutha S. Kumar

RML- Remya M.L.

SYLLABUS AND CURRICULUM DOCUMENT

M.A. English

Master of Arts in English

PROGRAMME STRUCTURE AND SYLLABUS IN AFFILIATED COLLEGES
2019-20 ADMISSIONS ONWARDS

(UNDER MAHATMA GANDHI UNIVERSITY PG-CSS REGULATIONS 2019)

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2019

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Table of Contents

I.Factual Details of the Programme:Page 6

II.The Programme Structure: Page 7

III.Guidelines for Research Methodology and Project Writing: Page 9

IV.Norms and Guidelines for Paper Presentation:Page 10

V.Semester-wise Details of the Syllabus: Page 11

VI.Model Question Papers

M.A. English Degree Programme

(Mahatma Gandhi University Regulations PGCSS2019 from 2019-20 Academic Year)

1. **Aim of the Programme**: The programme aims to develop students' competence with reference to Literatures/Narratives in English, and also an awareness regarding both the historicity and contemporaneity of 'language/communication' and its interdisciplinary and global cultural aftermaths. The programme prepares students to reflect on the social and ethical dimensions of research and for careers in secondary and higher education, content development, creative visualizations, publishing, and translation.

2. **Eligibility for Admissions**: Graduation in English under (Model I/II/III) or graduation inother faculties of language and literature, social science, science, oriental studies are eligible for applying for MA programme in English provided they satisfy the eligibility criteria as detailed below.
I. For CBCCS 2013 pattern - CCCPA of 4.5 out of 10.00 in the Core Group (core + open + complementary courses or if the CCPA scored by the graduate for common course is greater than the CCPA scored for core course and is 5.0 or above.
II. For CBCSS 2009 pattern – CGPA of 1.80 out of 4 or if the CGPA for common course if greater and is 2 or above. III. For Other patterns – 45% marks in core + subsidiary under part III or if the marks for Part I English is greater than the marks in Part III and is 50% or above.

3. **Medium of Instruction and Assessment**: The medium of instruction will be English and Evaluation of core &elective components and the project will be done in two parts, that is, through continuous internal assessment and end semester external examination.The marks of the paper presentation will be accorded by the externals of the project evaluationbased on the documents verified.

4. **Faculty under which the Degree is Awarded**: Faculty of Language & Literature(MGU-CSS).

5. **Specializations offered, if any**: Electives offered in the IV semester are specialized courses. A college can select a cluster of three courses for specialization.

6. **Note on compliance with the UGC Minimum Standards for the conduct and award of Post Graduate Degrees**: The programme is strictly in compliance with the UGC Minimum Standards for the conduct and award of Post Graduate Degrees.

7. THE PROGRAMME STRUCTURE

Course Code	Title of the Course	Type of the Course	Hours per week	Credits
FIRST SEMESTER				
EN010101	Up Until Chaucer: Early Literatures in English	CORE	5	4
EN010102	Literatures of the English Renaissance	CORE	5	4
EN010103	Literatures of the English Revolution/ Enlightenment	CORE	5	4
EN010104	19th Century English Literatures	CORE	5	4
EN010105	Literary Criticism	CORE	5	4
SECOND SEMESTER				
EN010201	Modernity and Modernisms	CORE	5	4
EN010202	Postmodernism and Beyond	CORE	5	4
EN010203	American Literatures	CORE	5	4
EN010204	English Language History and Contemporary Linguistics	CORE	5	4
EN010205	Thinking Theory	CORE	5	4
THIRD SEMESTER				
EN010301	Reading India	CORE	5	4
EN010302	Post Colonial Fiction	CORE	5	4
EN010303	Body, Text and Performance	CORE	5	4
EN010304	Literature and Gender	CORE	5	3
EN010305	Ethics in/as Literature	CORE	5	3
FOURTH SEMESTER				
EN010401	Cultural Studies	CORE	5	4
EN010402	Post Colonial Poetry	CORE	5	3
	<Elective>	ELECTIVE	5	3
	<Elective>	ELECTIVE	5	3
	<Elective>	ELECTIVE	5	3
Project				3
Viva				2
National/ International Seminar (Presented in any one of the semesters)				1

ELECTIVES

+3 Electives [Choose **One**from the**FourClusters**given below]:

Cluster 1	**Cluster 2**	**Cluster 3**	**Cluster 4**
18. Post Colonial Theatres - [EN800401]	**21**. Trauma Narratives and Memory [EN810401]	**24**. Modern European Fiction [EN820401]	**27**. English Language Teaching (ELT) [EN830401]
19. Shakespeare Across Cultures [EN800402]	**22**. The Island in Literature [EN810402]	**25**. Modern European Drama [EN820402]	**28**. Translation Studies [EN830402]
20. Public Domain Writings [EN800403]	**23**. Literature and Film [EN810403]	**26**. Indian Poetics: Theories and Texts [EN820403]	**29**. Dalit Studies [EN830403]

Special Note:

Quite a few of the papers whose syllabi are given below have a special interim section titled '**Specific Additional Readings**' that comes before the final '**Texts for Consultation**' lists. The teachers/facilitators and the learners/students are hereby entreated to seriously treat this section as a **'resource-pool/tool-kit'** that is specifically oriented towards the texts included within the ambit of the respective papers.

Research Methodology and Project Writing

Students need to expose themselves to the theory & mechanics of project writing. They need to familiarize with the basic aspects of research and get well-versed with the technicalities of writing a PG project. Formulate a topic and write the project observing the conventions of writing. A familiarity with the basic parameters will also chisel originality of thought and conception, nurturing an attitude and aptitude for Research in Postgraduate Students. Before writing a project students need to be familiar with the following:

- Definition and Scope of Research: Kinds of Research, Formulation of Research Problems, Key Concepts, Investigation, Exploration, Examination, Analysis

- Research in Language and Literature: 1.Methods in Language Research, 2.Trends and Approaches in Literary Research, 3. Selection of Topic:(i)Area of Research: Genre, Period, Region, Author, Texts, Approach, (ii)Intra-disciplinary/Interdisciplinary, (iii)Background Study, (iv)Studies of Literatures, (v)Framing of Topic-statement.

- Research Mechanics: 1. Tools, Language and Plagiarism:
  Primary and Secondary Sources(i)Print: Books, Journals etc., (ii)Audio-visual resources(iii)Interviewing(iv)Field Studies(v)Web resources 2.Research Language (Clarity, Correctness, Coherence) 3.Research Ethics

- Different Style Sheets: MLA, APA (latest editions) etc.; Documentation, in text, Parentheticals, footnotes, endnotes, citation, references, bibliography, Use of Quotations

- Writing: Framing of Topic-statement, Abstract, and Keywords for Research Paper, A Brief Literature Review/ Review of Scholarships in the area, Paper margin, Spacing Drafting, Revising, Heading, Pagination, Proof-Reading.

References:

Joseph Gibaldi. *MLA Handbook for Writers of Research Papers*. 8thed. New York: MLA Publications, 2004.

C. R. Kothari. *Research Methodology-Methods and Techniques*. New Age International, 1985

The Art of Literary Research, 4thed. New York: Norton, 1993

B. Allison. *The Students' Guide to Preparing Dissertations and Theses*. London: Kogan Page, 1997.

National/ International Seminar (Presented in any Semester) – Norms and Guidelines

1. A paper has to be presented in any of the four semesters at a National or International Seminar organised by English Departments anywhere in the world, before the date fixed for the project viva in the final semester.

2. The marks of the same will be added to the whole only in the last semester.

3. One credit is alloted for the seminar presentation.

4. The topic should be related to English/Cultural Studies, and can be the topic of any of the seminars conducted by Departments of English across the world.

5. The norms of preparing the paper for the seminar will be the norms prescribed by the respective National/International seminars organised.

6. The supervising teacher for project should also supervise the seminar paper. The list of **Supervising Teachers forProjects and Seminar Papers** have to be decided at the start of the course of a batch of students.

7. The students will bear the sole responsibility of preparing, submitting, travelling, attending and presenting the abstracts/full papers at the National/International Seminars.

8. The attendance of students for the days of the Seminar should be provided by the department/college concerned.

9. The student will have to submit a signed copy of the abstract and the full paper bearing name and register number, the brochure and a copy of the Certificate of Presentation from relevant authorities to the Head of the Department, and all the documents have to be produced to the external examiners conducting project viva in the fourth semester for verification.

10. The marks of the paper presentation will be accorded by the externals based on the documents verified, and the externals and the Head of the Department have to sign the mark list before submitting to the University.

11. Those who fail to produce the relevant documents prescribed in 9 will be marked ‘AB’ (Absent) or ‘F’ (Failed) in the mark list.

12. The department concerned should keep the documents safe for a period of three years at least, for further verification if necessary.

FIRST SEMESTER CORE COURSES

EN010101	Up Until Chaucer: Early Literatures in English	1
EN010102	Literatures of the English Renaissance	2
EN010103	Literatures of the English Revolution/ Enlightenment	3
EN010104	19th Century English Literatures	4
EN010105	Literary Criticism	5

Semester 1 - Core Course 1:
[EN010101] - Up Until Chaucer: Early Literatures in English

Total Credits: 4

Total Hours: 25

Weightage:

Objectives:
At the end of this course, the student will be able to make senseof the major themes in Ancientand Medieval English literature as an expression of Anglo-Saxon culture and society as it emerges into a Britain-consciousness; also, the student will be equipped to access and understand the personal experiences of people living in a society very different from our own.

Course Description:
What was *English* Literature like before Shakespeare? Before Chaucer? And from our current vantage point what *was* Chaucer and his peers *doing*? Through 5 modules, this paper offers a two-fold bird's eye-view: first, the literature of the Anglo-Saxons written over a thousand years ago and then, the standardising creative consolidation initiated by Chaucer and his peers; a paradigm shift that made possible the emergence of English literature with a purpose and identity of its own.

Module I is a sampling of early poetry.
Module 2 offers a selection of early Prose and Drama.
Module 3 wades through extracts from the first epic *Beowulf* and the iconic Romance *Le Morte D'arthur* along with a choice sequence of the early English Lyric.
Module 4 is exclusively designated to familiarise the student with the varied oeuvre of Geoffrey Chaucer.
Module 5 gives a feel of Chaucer's peers, JohnGower, Thomas Hoccleve and William Langland.

Crucial Note: The texts/readings slotted for seminars are not to be elaborated upon. The onus is on the teacher to be a judicious facilitator who will initially provide a purview of the texts' crux and then proactively generate topics/themes, which the students can develop and share with their peers. The thrust should be upon illuminating how these texts/readings proactively link up with the other texts/readings in the module. Also, it should be kept in mind that this paper is, in a very specific sense, a 'translation course' – we are dealing with both the Anglo-Saxons and the medieval writers in 'Modern English' versions of the text.

Module I [Early Poetry]:
1.1 Exeter Book Riddle 11, 'Wine' [21 lines]; cf Riddle 25, 'Onion' & Riddle 45, 'Dough'.
1.2'The Dream of the Rood' [156 lines]
1.3'Deor's Lament' [42 lines]
1.4 'The Husband's Message' [53 lines]

Seminar:
1.5 'The Wanderer' [113 lines]
1.6 'The Seafarer' [124 lines]
1.7 'The Wife's Lament' [53 lines]

Module 2 [Early Prose and Drama]:
2.1 Bede: On Caedmon [including Caedmon's hymn...]
2.2 Julian of Norwich: *Revelations of Divine Love* [Chapter LX - "The Kind, Loving, Mother"]
2.3"Noah's Flood" from the *Chester Mystery Cycle*
2.4 "The York Play of the Crucifixion"
Seminar:
2.5 King Alfred: Preface to *Pastoral Care*
2.6 The Robin Hood Play-fragments

Module 3 [Epic, Romance and Lyric]:
3.1 Selection from *Beowulf* [Part 11 to 18 – Grendel's Battle With Beowulf]
3.2 Sir Thomas Malory: *Le Morte D'arthur* [Book 5 – King Arthur defeats Roman Emperor Lucius]
Seminar:
3.3*Sir Orfeo*
3.4'The Cuckoo Song,' 'Sunset on Calvary,' 'I Sing of a Maiden,' 'Maiden in the mor lay' [short Middle English lyrics from the Norton Anthology]

Module 4 [Geoffrey Chaucer]:
4.1 General Prologue to *Canterbury Tales*: Introduction
4.2 General Prologue to *Canterbury Tales*: Wife of Bath [Thumbnail Profile]
4.3 From *The Canterbury Tales*: 'The Wife of Bath Prologue and Tale.'
Seminar:
4.4'Troilus and Criseyde'

Module 5 [Chaucer's Peers]:
5.1 JohnGower: *Confessio Amantis* – The Tale of Narcissus: Book 1. Lines 2275-2380
5.2 Thomas Hoccleve: 'Lament for Chaucer'
Seminar:
5.3 William Langland's *Piers Plowman* – Prologue

Specific Additional Readings:
1. W.W. Norton and Company's *The Norton Anthology of English Literature*: "Introduction to The Middle Ages"
2. Regia Anglorum Publication's "A Brief History of Anglo-Saxon England."
3. The ORB: Online Reference Book for Medieval Studies: Steven Muhlberger's *Medieval England*: "The Age of Bede"; *Catholic Encyclopedia*'s "The Venerable Bede"; Excerpt from

Bede's *Conversion of England*)
4.Blend of Oral-Formulaic Verse and Christian Values in "Caedmon's Hymn"
5. Bede's *Ecclesiastical History of the English Nation*, Book IV: "Chapter XXIV"
6. F.W. Garforth's "Bede's Account of the Poet Caedmon"
7.Excerpts from Dr. Jonathan A. Glenn's Translations of "The Seafarer" and "The Wanderer"
9.W.W. Norton and Company's *The Norton Anthology of English Literature*: "The Linguistic and Literary Contexts of *Beowulf*"
10.*The Norton Anthology of English Literature*'s version of "Seamus Heaney on *Beowulf*"
11. Dream-vision/Dream Poetry, Apocalypse, and Pagan-Christian Hybridity in "The Dream of the Rood"
12. Jeannette C. Brock's "'The Dream of the Rood' and the Image of Christ in the Early Middle Ages"
13. William Langland's "Piers Plowman" and the Social and Religious Issues of the Day
14.Everyman and Thematic and Generic Conventions of Middle English Drama

Texts for Consultation:

1. Bruce Mitchell and Fred C. Robinson: *A Guide to Old English*, Wily Blackwell, 8th ed. (2012)
2. R. M. Liuzza: *Old English Poetry: An Anthology*, Broadview Press. (2014)
3. Malcolm Godden and Michael Lapidge (eds): *The Cambridge Companion to Old English Literature*, Cambridge University Press. (1986)
4.R. D. Fulk: *A History of Old English Literature*. Blackwell. (2003)
5. Phillip Pulsiano and Elaine Treharne (eds): *A Companion to Anglo-Saxon Literature*, Blackwell. (2001)
6. Richard North and Joe Allard (eds): *Beowulf and Other Stories*, Pearson. (2007)
7.M. H. Abrams, Stephen Greenblatt, et al (eds): *The Norton Anthology of English Literature*, 9th ed, [Vol. 1], (2012) - Introductions to the specific Texts/Pieces.
8. Corinne Saunders (ed): *A Concise Companion to Chaucer*, Blackwell. (2006)
9. Laurel Amtower and Jacqueline Vanhoutte (eds): *A Companion to Chaucer and His Contemporaries: Texts and Contexts*, Broadview Press. (2009)
10. Andrew Sanders:*The Short Oxford History of English Literature*. 2nd ed. OUP. (2000)

Semester 1 - Core Course 2:
[EN010102] -Literatures of the English Renaissance

Total Credits: 4
Total Hours: 25
Weightage:

Objectives:The course is designed to familiarise the students with the literature, thought and culture of the Renaissance period in England, a historical watershed marking the transition from the medieval to the modern. It is also designed as a theoretical/critical reading of the era and the texts in the light of recent theoretical interventions like New Historicism and Cultural Materialism which had a special interest in Renaissance texts. Representative works of the period have been selected with a view to instilling in the students a capacity to appreciate Renaissance writings bearing the stamp of radical changes in the outlook and ways of life.

Course Description:The course comprising major genres like Drama, Poetry and Prose provides an introduction to the literature of the English Renaissance studied in a variety of historical contexts and discusses how the confluence of social, political and economic forces culminated in conditions conducive to the creation of an impressive volume of literature. It highlights how literary luminaries like William Shakespeare and Christopher Marlowe emerged and influenced each other leaving their mark on their own time and the time to come. The completion of the course has to enable the students to imbibe the true spirit of Renaissance and Humanism making them capable of identifying the relationship between Renaissance writings and its socio-political context.

Module I:
1.1 Wilson Knight: "The Shakespearean Metaphysic" Chapter 13 of*The Wheel of Fire*.
1.2 Jonathan Dollimore and Allan Sinfield:" Culture and Textuality: Debating Cultural Materialism"*Textual Practice*, vol 4, 1990
1.3 Stephen Greenblatt: "Improvisation of Power", Chapter 6 of*Renaissance Self Fashioning*.

Module 2:
2.1 William Shakespeare: *Hamlet*
2.2 "Hamlet and His Problems" Essay by T.S. Eliot

Seminar:
2.3 William Shakespeare: *The Tempest*

Module 3:
3.1 William Shakespeare: *Hamlet*
3.2"A Psycho-analytic Study of Hamlet" Essay by Ernest Jones

Seminar:
3.3 William Shakespeare: *King Henry IV* Part I

Module 4:
4.1 Christopher Marlowe: *Doctor Faustus*
4.2 Ben Jonson: *The Alchemist*

Seminar:
4.3 Thomas Kyd: *The Spanish Tragedy*

Module 5:
5.1 William Shakespeare: Sonnets - 18, 73, 98, 129
5.2 Edmund Spenser: Prothalamion
5.3 John Donne: Canonization
5.4 Andrew Marvell: To his Coy Mistress
5.5 Francis Bacon: Of Studies, Of Marriage and Single Life

Seminar:
5.6 Thomas More: *Utopia*

Texts for Consultation

1. J.R. Brown: *Discovering Shakespeare*

2. EMW Tillyard: *Shakespeare's Last Plays*

3. A C Bradley: *Shakespearean Tragedy*

4. Harold Bloom: *Elizabethan Drama*

5. John Dover Wilson: *What Happens in Hamlet*

6. G. Wilson Knight: *The Imperial Theme*

7. Caroline Spurgeon: *Shakespearean Imagery*

8. Jocelyn Hunt: *The Renaissance*

9. Graham Holderness: *Nine Lives of Shakespeare*

10. Terry Eagleton: *Shakespeare and His Age*

11. Ania Loomba: *Race, Gender and Renaissance Drama*

12. C. Marydass. *Shakespearean Aesthetics for University Wits*

13. John Fuller: *The Sonnet*

Semester 1 - Core Course 3:
[EN010103] -Literatures of the English Revolution/ Enlightenment

Total Credits: 4
Total Hours: 25
Weightage:

Objectives: This course familiarizes the learner with the English literary texts which reflect the austere Puritan ideals of the late seventeenth century, the neoclassical vigour of the eighteenth century considerably influenced by the philosophy of the Enlightenment and the perspectival shift manifested in the transitional literature towards the end of this era.

Course Description: Module 1 offers a comprehensive account of the late seventeenth and the eighteenth century literary scenario drawing upon the significant social and the political developments of the times. How such events fostered the rise of new genres like the novel is unravelled. Further, the learners are familiarised with Ian Watt's perspective on the inception of this new genre in England. This module also introduces the learners to an in-depth critique of the philosophy of the Enlightenment.
Module 2 acquaints the learners with the poetry of John Milton the epic poet of the late seventeenth century, the neoclassical satirists such as John Dryden and Alexander Pope, Aphra Behn the first professional woman writer of England, and Thomas Gray, the transitional poet.
Module 3 dwells on the drama written during this span of time.
Module 4 presents the acclaimed fiction of the aforementioned period.
Module 5 accommodates the ground-breaking nonfictional works of the period.

Module 1:
1.1 Pramod Nayar: "Introduction" to *English Poetry 1660-1780* Ed. Pramod Nayar
1.2 Ian Watt: "Realism and the Novel Form" (Chapter I from*Rise of the Novel*)
1.3 Michel Foucault: "What is Enlightenment?" from *The Foucault Reader*, 1984 (pp. 32-50)

Module 2:
2.1 John Milton : The Fall of Man (**Lines 850-1055**) from *Paradise Lost: Book IX*
2.2 John Dryden : The Portrait of Achitophel (**150-174**) from *Absalom and Achitophel*
2.3 Alexander Pope: The Portrait of Atticus (**193-214**) from *An Epistle to Dr.Arbuthnot*
2.4 Aphra Behn : "To the Fair Clarinda"

Seminar:
2.5 Thomas Gray: *Elegy Written in a Country Churchyard*

Module 3:
3.1 William Congreve: *Way of the World*
3.2 Oliver Goldsmith: *She Stoops to Conquer*

Seminar:
3.3 Richard Brinsley Sheridan: *The Rivals*

Module 4:
4.1 Daniel Defoe*: Robinson Crusoe*
4.2 Samuel Richardson: *Pamela*
4.3 Henry Fielding*: Tom Jones*

Seminar:
4.4 John Bunyan: *Pilgrim's Progress*

Module 5:
5.1 Mary Wollstonecraft: *A Vindication of the Rights of Woman*
5.2 Samuel Johnson: *Preface to Shakespeare*

Seminar:
5.3 John Locke: *An Essay Concerning Human Understanding*

Specific Additional Readings:
1. Immanuel Kant: "An Answer to the Question: What is Enlightenment?"(Trans. from Part I of *Eighteenth Century Answers and Twentieth Century Questions* by James Schmidt (Ed.) pp. 58-64)
2. Ernst Cassirer: *Philosophy of Enlightenment*
3. T W Adorno: *Dialectic of Enlightenment*

Texts for Consultation:
1. Martin Evans: *John Milton: Twentieth Century Perspectives*
2. Kaufman, U. Milo. *The Pilgrim's Progress and Traditions in Puritan Meditations*
3. Janet Todd: *Aphra Behn: A Secret Life*
4. John Sitter: *The Cambridge Companion to Eighteenth Century Poetry*
5. Ronald W. Vince: *Neoclassical Theatre: A Historiographical Handbook*
6. J. A. J. Downie: *The Oxford Handbook of the Eighteenth Century Novel* (Part I)
7. N. Hudson: *Samuel Johnson and Eighteenth-Century Thought*

Semester 1 - Core Course 4:
[EN010104] -Nineteenth Century English Literatures

Total Credits: 4
Total Hours: 25
Weightage:

Objectives:
The course aims to familiarize students with the fundamental premises of the Romantic Movement and Victorian literature, their theoretical and ideological frameworks, and the major trends and offshoots across various genres. A rough time span of one and a half centurywhich witnessed an initial flowering of Romanticism, followed by the rapid growth of industrialization, scientific thinking and materialism all of which find expression in the texts chosen for study.

Course Description:
The first module introduces the theoretical premises of the British Romantic Movement as well as the Victorian Age that chronologically follows the Romantic Era. The second module throws light on the historical significance of the Ode as a poetic form best suited to examine the subjective and individualistic imagination of the romantic poet which finds expression as most of the poems in this section are odes. The Third Module marks the shift to the Victorian Sensibility with increased attention being paid to the decline of the romantic sensibility, the growth of reason, ascent of materialism etc. The fourth module deals with the best novels in the English language while the last one focuses on prose and Drama

Module 1:
1.1C.M. Bowra: The Romantic Imagination
2.2 Raymond Williams: "The Romantic Artist" *Culture and Soicety, 1780-1950*
3.3 Isobel Armstrong: "Introduction: Rereading Victorian Poetry" *Victorian Poetry: Poetry, Poetic, politics,* London, 1993

Module 2:
2.1 Wordsworth: Immortality Ode
2.2 Coleridge: Dejection: An Ode
2.3 Shelley: Ode to the Skylark
2.4 John Keats: Ode on a Grecian Urn

Seminar:
2.5 William Blake: "The Tyger", "The Lamb"

Module 3:
3.1 Lord Tennyson: The Lotos Eaters
3.2 Robert Browning: Andrea Del Sarto

3.3 Matthew Arnold: The Scholar Gypsy
3.4D.G.Rossetti: The Blessed Damozel

Seminar:
3.5 Elizabeth Barett Browning:
"If thou must love me"(Sonnet 14),
"When our two souls stand up erect and strong" (Sonnet 22)

Module 4:

4.1 Jane Austen: Mansfield Park
4.2 Charles Dickens: A Tale of Two Cities
4.3 Emily Bronte: Wuthering Heights
4.4 Thomas Hardy: Tess of the d'Urbervilles

Seminar:
4.5 Charlotte Bronte: Jane Eyre

Module 5:
5.1 Charles Lamb: Old China & "A Dissertation Upon A Roast Pig"
5.2 William Hazlitt: On Reading Old Books
5.3 Lytton Strachey: Thomas Arnold (From *Eminent Victorians*)
5.4 Oscar Wilde: The Importance of Being Earnest

Seminar:
5.6 Carlyle: Hero as Poet

Texts for Consultation:
1. M.H.Abrahms:*The Mirror and the Lamp*
2. C.M.Bowra: *The Romantic Imagination*
3. Duncan (ed):*A Companion to Romanticism*, Blackwell, 1998
4. Walter Allen: *The English Novel*
5. Terry Eagleton:*The English Novel: An Introduction*
6. Hugh Walker:*The English Essay and Essayists*
7. Graham Hough:*The Last Romantics*
8. Boris Ford(ed): *From Blake to Byron: The New Pelican Guide to English Literature* (Vol 5)
9. M.H. Abrams(ed); *English Romantic Poets: Modern Essays in Criticism*. OUP London,1975
10. Harold Bloom:*The Visionary Company*, Cornell University Press, 1971
11. Patricia MeyerSpacks: *The Female Imagination*
12. Joseph Bristow (ed); *The Cambridge Companion to Victorian Poetry*, 2000
13. Dierdre David (ed):*The Cambridge Companion toVictorian Novel*, 2001

Semester 1 – Core Course 5:
[EN010105] – Literary Criticism

Total Credits: 4
Total Hours: 25
Weightage:

Objectives:
To familiarize the students with the key concepts and texts of literary criticism ever since its emergence, and to provide theoretical familiarity with the range, approaches, and mechanics of critique.

Course Description:
The course should help the student to recognize the historical, political and aesthetic dimensions of the growth of literary criticism. Issues like canon formation, evolution of the genres, methods of literary analysis will all be discussed in the different modules. Concepts being discussed include classical western criticism from Plato, Aristotle Horace and Longinus, English Renaissance and neoclassical criticism, the 18th century trends, the romantic revolt, the Victorian tradition, the new critics, Eliot's critical positions, Psychoanalysis, myth/archetypal criticism, Russian Formalism, and Reader response theories.

Module 1:

1.1 Andrea Nightingale: "Mimesis: Ancient Greek Literary Theory"

1.2 Andrew Bennet: "The Romantic Theory of Authorship"

(Both from Patricia Waugh. Ed. Literary Theory and Criticism. (OUP), Ch.1 and 2. PP 38-58)

1.3 David Ayers: "The New Criticism and Beyond." (Ch.2 of Literary Theory: A Reintroduction. PP. 28-54)

Module 2:

2.1 Plato: The Republic (Excerpt). (From William Harmon. Ed. Classic Writings on Poetry. PP.1-30)

2.2 Aristotle: Poetics

2.3 Longinus: On the Sublime

Seminar:

2.4 Horace: Ars Poetica

Module 3:

3.1 Philip Sidney: An Apology for Poetry

3.2 Arnold: The Function of Criticism at the Present Time

3.3 T. S. Eliot: Tradition and the Individual Talent

Seminar:

3.4 Coleridge: Biographia Literaria Ch. XIV

Module 4:

4.1 Cleanth Brooks: The Language of Paradox

4.2 Northrop Frye: The Archetypes of Criticism

4.3 Frank Kermode: The Classic

Seminar:

4.4I.A. Richards: The Metaphor

Module 5:

5.1 Viktor Shklovsky: Art as Technique
5.2 Eric Auerbach: Odysseus' Scar
5.3 Stanley Fish: Is There a Text in the Class?

Seminar:

5.4 Jerome McGann: Interpretation

Texts for Consultation:

1. D. A. Russell and Winterbottom (eds.): Classical Literary Criticism. [OUP]

2. Enright and Chickera (eds.): English Critical Texts. [OUP]

3. David Lodge (ed.): Twentieth Century Literary Criticism: A Reader [Longman]

4. V.S. Seturaman (ed.): Contemporary Criticism: An Anthology [Macmillan]

5. K. Pomorska and R. Rudy (eds.): Language and Literature. [HUP]

6. Harry Blamires: A History of Literary Criticism

7. Wimsatt and Brooks: Literary Criticism: A Short History

8. David G. Nichols (Ed): Introduction to Scholarship in Modern languages and Literatures, MLA, 2007.

SECOND SEMESTER CORE COURSES

EN010201	Modernity and Modernisms	6
EN010202	Postmodernismand Beyond	7
EN010203	American Literatures	8
EN010204	English Language History and Contemporary Linguistics	9
EN010205	Thinking Theory	10

Semester 2 – Core Course 6:
[EN010201] – Modernity and Modernisms

Total Credits: 4
Total Hours: 25
Weightage:

Objectives:
To familiarize the students with the literary trends of the early twentieth century in the context of the sensibility of literary modernism in the wake of the World War.

Course description:
The course includes an introduction to the changed literary perspectives in the twentieth century, along with the social, economic and political background. Imperial expansion which had reached a boiling point, the onset of the World War I coupled with the attempts at creating a new world order remained some of the key issues. The impact of the Soviet experiment at the global level that needs to be read against the backdrop of the spread and influence of Marxism on a global scale calls for a radical review of world politics. This was followed by the rise of Fascism and Nazism, followed curiously by the shadow of doubt cast over communism. In the literary field reaction against Romanticism and Victorianism led to experimentation in writing in all genres. Starting from the poetry of World War I the movement traverses a wide range of concerns topics and forms of writing. The discussion also includes movements like the Avant Garde, the Pink Decade and so forth.

Module I:

1.1 Georg Lukacs: "The Ideology of Modernism"

1.2 Malcolm Bradbury and James McFarlane: "The Name and Nature of Modernism" (Ch. 1 of Modernism: A Guide to European Literature1890-1930)

1.3 David Harvey: "Modernity and Modernism" [in David Harvey: The Condition of Postmodernity – An Enquiry into the Origins of Cultural Change(Blackwell); also available in Tim Middleton (ed.): Modernism – Critical Concepts in Literary and Cultural Studies (Routledge)]

Module 2:

2.1 G.M.Hopkins :The Windhover

2.2 Wilfred Owen :Strange Meeting

2.3W.B.Yeats :Easter 1916

2.4W.H.Auden :In Memory of W.B. Yeats

2.5 Dylan Thomas :Poem in October

2.6 Philip Larkin : Next, Please

Seminar:

2.7 Ted Hughes :Thrushes

Module 3:

2.1T.S.Eliot :The Waste Land

Seminar:

2.2 Robert Graves :Ulysses

Module 4:

4.1 Bernard Shaw :The Apple Cart

4.2 Samuel Beckett :Waiting for Godot

Seminar:

4.3J.M.Synge :Riders to the Sea

Module 5:

5.1 Virginia Woolf :Mrs. Dalloway

5.2 James Joyce :A Portrait of the Artist as Young Man

5.3 D.H.Lawrence : Rainbow

Seminar:
5.4 Joseph Conrad :Heart of Darkness

Texts for Consultation:
1. James Frazer:The Golden Bough
2. Frank Kermode: The Sense of an Ending: Studies in the Theory of Fiction

3. Malcolm Bradbury and James McFarlane: Modernism 1890-1930

4. D. H. Lawrence: Selected Literary Criticism

5. G M Hopkins:The Wreck of the Deutschland

6. George Orwell: 1984
7. Louis MacNiece: Snow
8. Tim Middleton (ed.): Modernism – Critical Concepts in Literary and Cultural Studies Vols.1-5 (Routledge)]

Semester 2– Core Course 7:
[EN010202] –Postmodernism and Beyond

Total Credits: 4
Total Hours: 25
Weightage:

Objectives: This course aims to acquaint the learners with the postmodern works of literature which defy categorisation and prove to be experimental in nature, subverting what is conventionally revered as the norm. The learners are to be familiarised with the eclectic dimensions of postmodern thought as reflected in these literary works in which the boundaries that demarcate the different genres are often blurred. Such literature eludes fitting into the rigid frames of nomenclature and rejects the concepts of objectivity, absolute truth and the notion of the stratification into the high and the low culture. Further, it is keenly perceptive and critical of the underlying ideologies that nurture oppressive institutions. The emphasis is on acknowledging the heterogeneity of thought and articulation.

Course Description: Module I familiarises the learners with the theoretical concepts of postmodernism drawing upon Jean Francois Lyotard's notions. Barry Lewis's essay dwells on the stylistic aspects of postmodern literature. Jeffrey T. Nealon's "Preface" considers the concept of post-postmodernism and briefly explores the current scenario. The second module offers a compilation of the diverse postmodern poetry by Frank O'Hara, John Ashberry, Tony Harrison, Michael Palmer, Allen Ginsberg, Carol AnnDuffy and Adrienne Rich. The third and the fourth modules present novels by writers from Kurt Vonnegut to William Gibson, which facilitate the learners to trace the evolution of postmodern fiction over the decades with its culmination in the cyberpunk. The fifth module presents postmodern playsby Edward Bond, Sam Shepard and Tom Stoppard, which employ significant themes and novel techniques.

Module 1:

1.1 Jean Francois Lyotard: "Answering the Question: What is Postmodernism?" from *The Postmodern Condition: A Report on Knowledge*. Trans. Regis Durand (pp.71-82)
1.2 Barry Lewis: "Postmodernism and Literature (or: Word Salad Days, 1960-1990)" from *The Routledge Companion to Postmodernism.* Ed. Stuart Sim (pp. 121-133)
1.3 Jeffrey T. Nealon: "Why Post-Postmodernism?"Preface to*Post-Postmodernism*:*Or, The Cultural Logic of Just-in-Time Capitalism* (ix-xii)

Module 2:

2.1 Frank O'Hara : "The Day Lady Died"
2.2 John Ashberry : "But What Is the Reader to Make of This"

2.3 Tony Harrison : "National Trust"
2.4 Michael Palmer : "Sun"

Seminar:
2.5 Allen Ginsberg : "Homework"
2.6 Carol Ann Duffy : "Anne Hathaway"
2.7 Adrienne Rich : "Diving into the Wreck"

Module 3:

3.1 Kurt Vonnegut: *Slaughterhouse- Five*
3.2 John Fowles : *The French Lieutenant's Woman*

Seminar:
3.3 Milan Kundera: *The Joke*

Module 4:

4.1 Angela Carter: *Nights at the Circus*
4.2 Ishmael Reed: *Mumbo Jumb*o

Seminar:
4.3 William Gibson: *Neuromancer*

Module 5:

5.1 Edward Bond: *Lear*
5.2 Sam Shepard: *The God of Hell*

Seminar:
5.3 Tom Stoppard: *Arcadia*

Specific Background Reading:

1. Jonathan Holden: "Postmodern Poetic Form: A Theory" from *New England Review and BL Quarterly* Vol.6, No.1 (Autumn 1983), pp.1-22
2. Keith Booker: "Technology, History and the Postmodern Imagination: The Cyberpunk Fiction of William Gibson" from *Arizona Quarterly* Vol.50, No.4 (Winter 1994), pp.63-87
3. Bran Nicol: *The Cambridge Introduction to Postmodern Fiction*
4. Stephen Watt: *Postmodern/Drama: Reading the Contemporary Stage*

Texts for Consultation:

1. Fredric Jameson: *Postmodernism or the Cultural logic of Late Capitalism*
2. Linda Hutcheon: "Postmodernism" from The Routledge Companion to Critical Theory edited by Simon Malpas and Paul Wake (pp.115-126)and "Historiographic Metafiction: The Pastime of Past Time" (Part II, Chapter7) from *A Poetics of Postmodernism: History, Theory, Fiction*
3. Michael W. Messmer: "Making Sense of/with Postmodernism" (from *Postmodernism – Critical Concepts*: Volume III)
4. Ihab Hassan: "Toward a Concept of Postmodernism" (from *The Postmodern Turn*)

Semester 2 – Core Course 8:
[EN010203] -American Literatures

Total Credits: 4
Total Hours: 25
Weightage:

Course Objectives:
This course seeks to introduce the students to the most important branch of English literature belonging to the non- British tradition, The course attempts to provide detailed information to the student regarding the processes and texts chiefly responsible for the evolution of American Literature as a separate branch possessing characteristic features which sets it apart from others

Course Description:
To acquaint the students with some of the major conflicts, struggles and movements that are closely connected with the experiences of a group of people struggling to establish themselves as a nation

Module One:
1.1 Robert E. Spiller: "Architects of Culture: Edwards, Franklin, Jefferson" (Chapter 1 of *The Cycle of American Literature*)
1.2 Leslie Fiedler: *Love and Death in American Fiction* (Chapter I)
1.3 John Paul Pritchard: 'The Early Nineteenth Century Cultural Scene', chapter I of *Criticism in America* (3-13)

Module Two:
2.1 Edgar Allen Poe: "Raven"
2.2 Walt Whitman: "Out of the Cradle Endlessly Rocking"
2.3 Emily Dickinson:
''The Soul Selects Her Own Society"
"Success is Counted Sweetest"
"Safe in Their Alabaster Chambers"
"A Narrow Fellow in the Grass"
2.4 Robert Frost: "Birches"
2.5 Wallace Stevens: "The Emperor of Ice-cream"
2.6 Marge Tindal: "Cherooke Rose"
2.7 e. e. cummings : "Anybody Lived in a Pretty How Town"
2.8 Gloria Anzaluda: "To live in the Borderlands"

Seminar:
2.9 Edgar Allen Poe: "Philosophy of Competition"

Module Three:
3.1 Arthur Miller: Death of a Salesman
3.2 Eugene O'Neill: Emperor Jones

Seminar:
3.3 Amiri Baraka: Dutchman

Module Four:
4.1 Herman Melville : "Bartleby the Scrivener"
4.2 Nathaniel Hawthorne: "Young Goodman Brown"
4.3 Ernest Hemingway: "The Snows of Kilimanjaro"
4.4 Mark Twain: *Adventures of Huckleberry Finn*
4.5 Saul Bellow: *Herzog*

Seminar:
4.6 Susan Abulhawa: *Mornings in Jenin*

Module Five:
5.1 Ralph Waldo Emerson : "Self-Reliance"
5.2 Martin Luther King: "I Have A Dream"
5.3 Henry David Thoreau: *Walden* (Chapter 1 &2)

Seminar:
5.4 Ralph Ellison: *Invisible Man*

Texts for Consultation:

1. George Parker Anderson: *American Modernism*
2. Daniel Hoffman: *The Harvard Guide to Contemporary American Writing*
3. Linda Tinh Morser: *Contemporary Literature: 1970 to the Present*
4. Jennifer Ashton: *From Modernism to Postmodernism*
5. Alan Bilton: *An Introduction to Contemporary American Fiction*
6. Robert .E. Spiller: *The Cycle of American Literature*
7. F.O. Matthiessen: *The American Renaissance*
8. Marcus Cunliffe: *The Literature of the United States*
9. Ihab Hassan: *Radical Innocence*
10. Paul .C. Conkins: *Puritans and Pragmatists*
11. C. W. Bigsby*: Modern American Drama 1945- 2000*
12. Leslie. A. Fiedler: *Love and Death in the American Novel*

Semester 2 – Core Course 9:
[EN010204] -English Language History and Contemporary Linguistics

Total Credits: 4
Total Hours: 25
Weightage:

Objectives:

To inculcate in the students awareness about the basic concepts of linguistics, the scientific study of language after initiating them into the history of English language.

Course Description:

The course, divided into five modules covers the important areas in linguistics and updates the pupil on the most recent advances in the theory of language study. The course has also taken into consideration the necessity to introduce the historical perspective of English language though not in detail. This should ideally prepare the student at one level with modern notions and concerns in the field of linguistics.

Module 1 Linguistics: Tradition and History with Reference to English

1.1 The Indo-European language family

1.2 Old English, Middle English, Modern English: Comparative linguistic features and evolution.

1.3A descriptive and a prescriptive view on linguistic phenomena- emphasis on scientific study and analysis of language.

1.4 Basic Introduction to major sub disciplines of linguistics: Phonetics and phonology, Morphology, Semantics, Syntax, Pragmatics.

Module 2 Phonetics and Phonology:

2.1 General Phonetics, Cardinal Vowels, Consonants, Phonetic Transcription in practice

2.2 The phonemic theory: Phoneme, allophones, contrastive and complementary distribution, free variation, phonetic similarity, pattern congruency

2.3 Plurals & past tense in English as examples for phonologically conditioned alternation,

2.4 Rules and rule ordering in phonology (some examples)

2.5 Syllable, onset nucleus and coda, foot, prosody, stress, stress rules, intonation, rhythm

Seminar:

2.6 "Phonetics and phonology: understanding the sounds of speech"(Chapter 1, pages 1-30), Robert Kirchner, Department of Linguistics, University of Alberta, https://sites.ualberta.ca/~kirchner/Kirchner_on_Phonology.pdf

Module 3 Syntax

3.1 Traditional grammar – fallacies – Saussure, system and structure, language as a system of signs, Saussurean dichotomies: synchronic -diachronic, signifier- signified, syntagmatic – paradigmatic, langue – parole, form – substance,

3.2 Structuralism: Contributions of Bloomfield – IC Analysis – disambiguation using IC analysis, limitations of IC analysis –

3.3PS grammar – PS rules: context free and context sensitive rules, optional and obligatory rules

3.4TG Grammar Components – transformational and generative – Standard Theory

Seminar:

3.5"Phrasal Structure and Verb Complementation", Chapter 7, pages 163-190,The Structure of Modern English:A linguistic introduction, Laurel J. Brinton University of British Columbia.

Module 4 Morphology and Semantics

4.1 The notion of a morpheme, allomporphy, zero morph, portmanteau morph

4.2 Inflection and derivation, level I and Level II affixes in English, ordering between derivation and inflection, + boundary (morpheme level) and # boundary (word level) in affixation,

4.3 Word formation techniques: blending, clipping, back formation, acronyms, echo word formation, abbreviation etc.

4.4 Semantic relationsComponential analysis, prototypes,

4.5 Implication, entailment, and presupposition

4.6 Semantic theories: sense and reference, connotation and denotation, extension and intension,

4.7 Truth Conditional semantics: propositions, truth values, determining the semantic value of a proposition, compositional procedure, terms and predicates, predicate logic, possible worlds semantics.

Seminar:

4.8 The Structure of a Semantic Theory, Jerrold J. Katz; Jerry A. Fodor, Language, Vol. 39, No. 2. (Apr. - Jun., 1963), pp. 170-210.http://links.jstor.org/

Module 5 Branches of Linguistics

5.1 Psycholinguistics: Definition and scope - child language acquisition – Innateness hypothesis – speech production, speech recognition – aphasia – slips – gaps

5.2 Socio Linguistics: definition and scope – structural and functional approach – speech community – speech situation – speech event – speech act – language planning – bilingualism- multilingualism-diglossia - (Language and gender & Language and politics - overview)- Pragmatics.

5.3 Applied linguistics: Definition and scope – language teaching and learning – contrastive analysis – error analysis –Translation-Computational linguistics.

5.4 Other Schools/ Approaches: Brief discussion about Case Grammar, Systemic Grammar, Stratification Grammar, Tagmemics, Indian Contribution to Linguistics, Paninian Phonology and the Karaka theory

Seminar:

5.5 Of Minds and Language, Noam Chomsky, http://www.ucd.ie/artspgs/meaningthree/mindslanguage.pdf

Texts for Consultation:

1. Charles Barber: The English Language: A Historical Introduction. Cambridge:Cambridge University Press, 2000.
2. A. C. Baughand T. Cable: A History of the English Language. London:Routledge. [fifthedition], 2002.
3. G. Cardona: Panini: His Work and its Tradition, vol. 1. MotilalBanarasidas, Delhi, 1988.
4. Gennaro Chierchia and Sally McConnell-Ginet: Meaning and Grammar: An Introduction to Semantics. MIT Press, 1990.
5. Noam Chomsky: Knowledge of Language: Its Nature, Origin and Use. New York: Praeger, 1986
6. Noam Chomsky: Syntactic Structures, Berlin: Moutonde Gruyter, 1957/2002
7. Noam Chomsky: Aspects of the Theory of Syntax, Cambridge,Massachusetts: MIT Press, 1965.
8. Noam Chomsky: "Linguistics and Philosophy", in Languageand Philosophy: A Symposium, Sidney Hook, (ed.), New York:New York University Press, 1969, 51–94.
9. Noam Chomsky: Lectures on Government and Binding,Dordrecht: Foris, 1982.

10. Noam Chomsky: The Science of Language, Cambridge:Cambridge University Press, 2012.
11. J. D. Fodor: Semantics: Theories of Meaning in Generative Grammar. Hassocks, Sussex: Harvester Press, 1977.
12. D. Freeborn: From Old English to Standard English. A course book in languagevariation across time. Houndsmill: Palgrave. [second edition], 1998
13. V. Fromkin et al: Linguistics: an introduction to linguistic theory. Oxford: Blackwell, 2000.
14. Geoffrey Leech: Semantics - The Study of Meaning. Second Edition. Penguin Books.
15. Liliane Haegeman: Introduction to Government and Binding theory. Oxford & Cambridge, MA: Basil Blackwell, 1991.
16. Henry Widdowson: Explorations in Applied Linguistics. Oxford: Oxford University Press, 1984.
17. R. Jackendoff: Foundations of Language. Oxford University Press, 2002.
18. Andreas H.Jucker: History of English and English Historical Linguistics. Stuttgart:Klett, 2004
19. Krishnaswami, S.K.Verma, M. Naga Rajan: Modern Applied Linguistics: An Introduction. Madras: MacMillan, 1992.
20. Leonard Bloomfield: Language. Great Britain, London and Aylesbury: Compton Printing Ltd., 1967, (8th Reprint).
21. J. Lyons: Introduction to Theoretical Linguistics. Cambridge: CUP, 1977.
22. S. Pinker: The Language Instinct, New York, NY: Harper Perennial Modern Classics, 1994/2007.
23. E. Sapir: Language - An Introduction to the Study of Speech. New York Harcourt, Brace & World, 1921
24. D. I. Slobin: Psycholinguistics. Glenview, IL Scott, Foresman and Company, 1974.

Semester 2 - Core Course 10:
[EN010205] -Thinking Theory

Total Credits: 4
Total Hours: 25
Weightage:

Objectives:
This course aims at introducing students to certain core aspects of what is currently designated as 'literary theory' and also provideexposure to select current developments in this domain.

Course Description:
Conceived as interfaces, the course has 5 modules; ideally to be taught in the order in which the readings are listed.

*Module 1*puts forth 3 readings which will serve as signposts that mark the moments that retrospectively are termed as turns to/within 'theory' – Jonathan Culler's 'over-view essay' on the emergence of 'Theory', Levis-Strauss' application of Saussurean Theory, and Derrida's critique of Levis-Strauss.

*Module 2*situates the theoretical ruminations on Authorship and Discourse:Roland Barthes' "The Death of the Author" and Michel Foucault's "What Is an Author?" problematises the hallowed assumptions of Literary Criticism; Robert J. C. Young's "Poems That Read Themselves" takes the unsettling deconstructive project of Poststructuralism forward.

*Module 3*seeks to frame a reference wherein Psychoanalysis tackles issues pertaining to the Unconscious and Cognition:Shoshana Felman's "Beyond Oedipus: The Specimen Story of Psychoanalysis" traces the shift from Freud to Lacan; "The Phantom of Hamlet or the Sixth Act: Preceded by the Intermission of "Truth"" by Nicolas Abraham and Nicholas Rand is an interface where Literary Creativity takes Theory *per se* as its content!; Julia Kristeva's "Approaching Abjection" throws light on how insights from psychoanalysis enrich our understandings of contemporary [literary] cultures.

*Module 4*has three readings, which in tandem present a discussion platform that goes beyond the normative heterosexual assumptions of Identity and even Feminism – in fact it *Queers* the Gender dynamic**:** Judith Butler's "Performativity, Precarity and Sexual Politics", Judith Halberstam's "Queer Temporality and Postmodern Geographies" and Eve Sedgwick's"Paranoid Reading and Reparative Reading",all are focused on the Liminality and Transitivity that are often overlooked to shore up the normative Male-Female dynamic.

*Module 5*is in many ways a 'Post-postcolonial Turn': Critical Race/Ethnic Studies.Inencounteringbell hooks'two short pieces, "Postmodern Blackness" & "Marginality as a Site ofResistance." along with Stuart Hall's "Gramsci's Relevance for the Study of Race and Ethnicity" and Barbara Christian's "The Race for Theory", it is hoped that the student/reader will be illumined as to the way the [dominant-normative] Self *disavows* its encounter with the Othered-Marginal.

Module 1 [Change of Stance - 'Criticism to Theory']:

1.1 Jonathan Culler: 'What is Theory?' in *Literary Theory: A Very Short Introduction*

1.2 Claude Levi-Strauss: "The Structural Study of Myth"

1.3 Jacques Derrida:"Structure, Sign and Play…" in *Margins of Philosophy*

Module 2 [Post-StructuralDeconstructions – 'Authorship and Discourse']:
2.1 Roland Barthes: "The Death of the Author"
2.2 Michel Foucault: "What Is an Author?"
Seminar:
2.3 Robert J. C. Young: "Poems That Read Themselves."

Module 3 [Psychoanalysis – 'Unconscious and Cognition']:
3.1 Shoshana Felman: "Beyond Oedipus: The Specimen Story of Psychoanalysis."
3.2 Nicolas Abraham and Nicholas Rand: "The Phantom of Hamlet or the Sixth Act: Preceded by the Intermission of "Truth"" in Diacritics, Vol. 18, No. 4 (Winter, 1988)
Seminar:
3.3 Julia Kristeva: "Approaching Abjection" in *Powers of Horror: An Essay on Abjection*

Module 4 [Queering Gender – 'Liminality and Transitivity']:
4.1 Judith Butler: "Performativity, Precarity and Sexual Politics" in *Powers of Horror*
4.2 Judith Halberstam: "Queer Temporality and Postmodern Geographies" in *In a Queer Time and Place*: *Transgender Bodies, Subcultural Lives*
Seminar:
4.3 Eve Kosofsky Sedgwick:"Paranoid Reading and Reparative Reading" from *Touching Feeling*

Module 5 [Critical Race/Ethnic Studies – 'Self and the Othered-Marginal']:
5.1 bell hooks: "Postmodern Blackness" in *Norton Anthology of Theory and Criticism,* 1990 **&** "Marginality as a Site of Resistance." in Russell Ferguson, Martha Gever, Trinh T. Minh-ha, Cornel West (eds) *Out there: marginalization and contemporary cultures*, MIT Press, New York, 1990
5.2 Stuart Hall: "Gramsci's Relevance for the Study of Race and Ethnicity," in Journal of Communication Inquiry (1986)
Seminar:
5.3 Barbara Christian: "The Race for Theory"

Specific Additional Readings:
0.Frederic Jameson: "'End of Art or 'End of History'?" in *The Cultural Turn*.
1. Michel Foucault: "Nietzsche, Genealogy, History," In Donald F. Bouchard (ed.), *Language, Counter-memory, Practice*
2. Jacques Derrida:"Différance" in *Margins of Philosophy*
3. Kwame Anthony Appiah: "Is the Post- in Postmodernism the Post- in Postcolonial?"*Critical Inquiry*Vol. 17, No. 2 (Winter, 1991), pp. 336-357
4. Edward Said: "Travelling Theory" in *The Edward Said Reader*
5.Terry Eagleton: "The Politics of Amnesia" in *After Theory*

6.Andrzej Warminski: "The Future Past of Literary Theory" Canadian Review of Comparative Literature, September-December, 2006
7. Dr. Vince Brewton:"Literary Theory" - University of Tennessee's *Internet Encyclopedia of Philosophy*
8. Louis Althusser: "Ideology and Ideological State Apparatuses"
9. Theodore Adorno: "Commitment"
10. Frantz Fanon:"Racism and Culture". *(African Philosophy: An Introduction* AP: A1)
11. Paul Gilroy:"The Black Atlantic" (Rivkin & Ryan)
12. Cornel West:"Moral Reasoning vs Racial Reasoning" (AP: A1)
13. Toni Morrison:"Playing in the Dark" (Rivkin & Ryan)
14. bell hooks:"Racism and Feminism" (AP : A1)
15. Jotiba Phule:"Racism Exposed in India Under the Guise of Brahmanism"
16. Andrew Bennett and Nicholas Royle: "Uncanny" [pp 34 – 42] in *An Introduction to Literature, Criticism and Theory* [*Third edition*]
17. Vince Brewton: 'Literary Theory'.

Texts for Consultation:
1. Kwame Anthony Appiah: *In My Father's House: Africa in the Philosophy of Culture*
2. Gregory Castle: *The Blackwell Guide to Literary Theory*, 2007
3. Andrew Bennett and Nicholas Royle: *An Introduction to Literature, Criticism and Theory* [*Third edition*]
4. M. A. R. Habib: *Literary Criticism from Plato to the Present: An Introduction*
5. David Lodge ed.: *Modern Criticism and Theory: A Reader*
6. Terry Eagleton: *Literary Theory: An Introduction*
7. Hans Bertens: *Literary Theory* [The Basics series]
8. Catherine Belsey: *Critical Practice*
9. Peter Barry: *Beginning Theory*
10. Graham Allen: *Roland Barthes*
11. Sara Mills: *Michel Foucault*
12. Christopher Norris: *Deconstruction: Theory and Practice*
13. Gerald Graff: *Professing Literature*
14. Terence Hawkes: *Structuralism and Semiotics*
15. Kiernan Ryan: *New Historicism and Cultural Materialism: A Reader*
16. Raymond Williams: *Marxism and Literature*
17. Michael Payne & John Schad (eds): *Life.after Theory*
18. Robert Rogers: *A Psychoanalytical Study of the Double in Literature*
19. Lillian Feder: *Madness in Literature*
20. Phyllis Chesler: *Women and Madness*
21. Susan Sontag- *Illness as Metaphor*

THIRD SEMESTER CORE COURSES

EN010301	Reading India	11
EN010302	Post Colonial Fiction	12
EN010303	Body, Text and Performance	13
EN010304	Literature and Gender	14
EN010305	Ethics in/as Literature	15

Semester 3 - Core Course 11:
[EN010301] -Reading India

Total Credits: 4
Total Hours: 25
Weightage:

Objectives:
The course is intended to provide an insight to the historical, cultural and literary heritage of India by acquainting the students with major movements and figures of Indian literature in English. Questions of language, nation and aesthetics figure prominently among the objectives of this course.

Course Description:
The course explores the origin and growth of Indian writing in English especially in the colonial and post colonial context. Representative selections from all the four major genres of Poetry, Prose, Novel and Drama which highlight the evolution of the coloniser's language in the native soil, the differences in the thematic and stylistic aspects between the pre independence and post independence periods will be studied in detail. The problem of modernisation in Indian writing in English, the Diaspora and the quest for identity also will be focussed. A close study of select literary texts including translations of regional literatures is expected to acquaint the students with the cultural diversity of the country as well as the Indian philosophy reflected in these writings.

Module 1 [Essays]:
1.1 A.K. Ramanujan: "Is there an Indian Way of Thinking?"
1.2P.P Raveendran: "Genealogies of Indian Literature". Economic and Political Weekly. Vol 41. No. 25. June 24-26, 2006.Pp 2558-2563.
1.3 Meenakshi Mukherjee:"The Anxiety of Indianness'' in *The Perishable Empire*. PP 166-185.

Module 2 [Poems]:
2.1 Toru Dutt: Our Casuarina Tree
2.2 Sarojini Naidu: An Indian Lovesong
2.3 Rabindranath Tagore: The Child, *Gitanjali* (section 35)
2.4 Nissim Ezekiel: Minority Poem
2.5K. Sachidanandan: How to go to the Tao Temple
2.6 Jayanta Mahapatra: The Whorehouse in a Calcutta Street
2.7 Kamala Das: The Old Playhouse
2.8 Ranjit Hosekote: Madman
2.9C.P. Surendran: At the Family Court

Seminar:
2.10 Syed Amaruddin: Don't Call Me Indo-Anglian
2.11 Sujata Bhatt: Muliebrity

Module 3 [Plays]:
3.1 Girish Karnad: *The Fire and the Rain*
3.2 Mahesh Dattani: *Tara*

Seminar:
3.3G.P. Deshpande: *A Man in Dark Times*

Module 4 [Fiction]:
4.1R.K. Narayan: *The Guide*
4.2 Salman Rushdie: *Midnight's Children*
4.3 Amitav Ghosh: *The Shadow Lines*
4.4 Arundhati Roy: *God of Small Things*

Seminar:
4.5 Living Smile Vidya: *I am Vidya: A Transgender's Journey*

Module 5 [Regional Writings]:
5.1 Bankim Chandra Chatterjee: *Ananda Math*
5.2U.R. Ananthamurthy: *Samskara*
5.3 Anand: *Vyasa and Vigneshwara*
5.4 Sharan Kumar Limbale: *Akkarmashi*

Seminar:
5.5K.R. Meera: *Hangwoman*

Texts for Consultation:
1. K.R Sreenivasan Iyengar :*Indian writing in English*
2. Salman Rushdie: *Imaginary Homelands*
3. Meenakshi Mukherjee:*Twice Born Fiction : Indian Novel in English*
4. Rajeswari Sunder Rajan: *Lie of the Land*
5. Susie Tharu: *Subject to Change: Teaching Literature in the Nineties*
6. Ashish Nandi: *The Intimate Enemy*
7. G N Devy: *After Amnesia*
8. Sujit Mukherjee: *Translation as Discovery*
9. R. Pardhasaradhy (ed.):*Ten Twentieth Century Indian Poets*
10. A K Mehrotra (ed.):*An Illustrated History of Indian Literature in English*
11. Eunice D' Souza (ed.): *Nine Indian Women Poets: an Anthology*
12. M.K.Naik: *Aspects of Indian Writing in English*

Semester 3 - Core Course 12:
[EN010302]-Postcolonial Fiction

Total Credits: 4
Total Hours: 25
Weightage:

Objectives:
To introduce the students to the discursive nature of colonialism, and the counter-discursive impulses of postcolonial theory, narratives and texts.

Course Description:
The course attempts to cover through representative texts the writing, reading and critical-theoretical practices based on the (post)colonial experience. While a segment of the course addresses the consequences of European expansion and the creation and exploitation of the 'other' worlds, the course also addresses 'internal colonisations' of diverse kinds.
Module 1 is a conceptual orientation; it includes extracts from three of the 'seminal' writings on what 'postcoloniality' is all about.
Module 2 is India-specific; it has a slight slant towards 'hybridity' 'spectrality' and 'subalternity' - as the texts by Gayatri Spivak, Homi Bhabha, Salman Rushdie, and C Ayyappan would amply attest.
Module 3 is a choice take on West Asia; alongside the unavoidable Edward Said, this section tries to tease out a familiarity with 'Arabic' literature as it engages itself in postcolonial concerns.
Module 4 is on Africa. It might appear that this section is in a curious sense 'patriarchal'! However, the selection-choice has to do with the weight of cultural capital that these authors bring, and also the understanding that non-male voices have adequate representation in other courses within the same syllabus.
Module 5 is on South America/Carribean. Here the effort is to try and wrench this writing corpus from the analytical frame that reduces it to the Magic Realist/Fabulist mode.

Module 1 [Conceptual]:
1.1 Bill Ashcroft, Gareth Griffiths & Helen Tiffin: "Cutting the Ground: Critical Models of Post-Colonial Literatures" in *The Empire Writes Back: Theory and Practice in Post- Colonial Literatures*. Routledge, 1989. (Chapter 1 PP.15-37)
2.2 Dipesh Chakrabarty: "Introduction: The Idea of Provincialising Europe" in *Provincialising Europe: Postcolonial Thought and Historical Difference*
3.3 Ania Loomba: "Feminism, Nationalism and Postcolonialism" in *Colonialism/Postcolonialism*

Module 2 [India]:
2.1 Homi K. Bhabha: "Of Mimicry and Man: The Ambivalence of Colonial Discourse" in Homi K. Bhabha. *Location of Culture.* Routledge, 1994. (PP.85-92)
2.2 Gayatri Chakravorty Spivak: "The Burden of English" in Gregory Castle (ed) *Postcolonial Discourses: An Anthology*

Seminar:
2.3 Salman Rushdie: *East, West* ["The Prophet's Hair" & "Yorick"]
2.4C Ayyappan: "Spectral Speech" & "Madness" [V. C. Harris translation…]

Module 3 [West Asia]:

3.1 Edward W. Said: "Narrative and Social Space" in *Culture and Imperialism*
3.2 Tayeb Salih: *Season of Migration to the North*
Seminar:
3.3 Assia Djebar: *Women of Algiers in Their Apartment* ["Day of Ramadan"]
3.4 Najwa Qa'war Farah: *For Whom Does Spring Come* ["The Worst of Two Choices or The Forsaken Olive Trees"]
3.5 Khayriyah Ibrahim as-Saqqaf: "The Assassination of Light at the River's Flow"

Module 4 [Africa]:
4.1 Frantz Fanon: "On National Culture" in *The Wretched of the Earth*.
4.2 Chinua Achebe: "An Image of Africa: Racism in Conrad's *Heart of Darkness*" in *Hopes and Impediments*.
Seminar:
4.3 Ngugi wa Thiong'o: *Secret Lives and Other Stories* ["Minutes of Glory"] & Hellen Nyana ["Waiting"]
4.4 J.M. Coetzee: *Waiting for the Barbarians*

Module 5 [Americas/Carribean]:
5.1 José Rabasa: Allegories of Atlas in *The Postcolonial Studies Reader*
5.2 Juan Rulfo*: Pedro Páramo*
Seminar:
5.3 Clarice Lispector (Brazil): "Looking for Some Dignity"& Maria Virgina Estenssoro (Bolivia): "The Child That Never Was" in Celia Correas de Zapata (ed): *Short Stories by Latin American Women: The Magic and the Real*
5.4 Jean Rhys: *Wide Sargasso Sea*.

Specific Additional Readings:
1. Waïl S. Hassan: "Postcolonial Theory and Modern Arabic Literature: Horizons of Application", *Journal of Arabic Literature*, Vol. 33, No. 1 (2002), pp. 45-64
2. Waïl S. Hassan: "Postcolonialism and Modern Arabic Literature: Twenty-First Century Horizons" in Anna Ball, Karim Mattar (eds): *The Edinburgh Companion to the Postcolonial Middle East*
3. Graham Holderness: "Arab Shakespeare: Sulayman Al-Bassam's *TheAl-Hamlet Summit*", *Culture*, Language and Representation, Vol IV, 2007, pp. 141-150
4. Graham Huggan: "Decolonizing the Map" in *The Postcolonial Studies Reader*
5. Gayatri Chakravorty Spivak: "A Literary Representation of the Subaltern" in *In Other Worlds/ Subaltern Studies 5*
6. Gayatri Chakravorty Spivak: "Can the Subaltern Speak?"

7. George Lamming: “A Monster, a Child, a Slave” in *Pleasures of Exile*. Univ. of Michigan Press, 1960. (PP. 95-117)
8. P. A. Aborisade: “National and Revolutionary Consciousness: Two Phases of Ngugi's Artistic Praxis”, *Ufahamu: A Journal of African Studies,* 18(2) 1990
9. Udayakumar: "The Strange Homeliness of the Night: Spectral Speech and the Dalit Present in C. Ayyappan's Writings," Studies in Humanities and Social Sciences, XVII: 1 and 2 (2010, pub. 2013) pp. 177-91.
10. Ngugi wa Thiong’o: ‘The Language of African Fiction’ in *Decolonising the Mind*

Texts for Consultation:

1. Bill Ashcroft, Gareth Griffiths, Helen Tiffin: *Key Concepts in Post-Colonial Studies,* Routledge
2. Bill Ashcroft, Gareth Griffiths, Helen Tiffin (eds.): *The Post-Colonial Studies Reader,* Routledge
3. Bill Ashcroft, Gareth Griffiths & Helen Tiffin: *The Empire Writes Back: Theory and Practice in Post- Colonial Literatures*. Routledge
4. John McLeod: *Beginning Postcolonialism*. Manchester Univ. Press
5. Ania Loomba:*Colonialism/Postcolonialism*. Routledge
6. Leela Gandhi:*Postcolonial Theory: An Introduction*. Edinburgh Univ. Press
7. Elleke Boehmer:*Colonial and Postcolonial Literature*. OUP
8. Gregory Castle (ed.):*Postcolonial Discourses: An Anthology*. Blackwell
9. Padmini Mongia (ed.):*Contemporary Postcolonial Theory: A Reader*. Arnold
10. Francis Barker, Peter Hulme & Margaret Iversen (eds.):*ColonialDiscourse/Postcolonial Theory*. Manchester Univ. Press
11. Homi K. Bhabha (ed.):*Nation and Narration*. Routledge
12. Donna Landry & Gerald MacLean (ed.):*The Spivak Reader.* Routledge
13. Edward Said:*Orientalism*. Penguin
14. Aijaz Ahmed:*In Theory: Classes, Nations, Literatures*. Verso
15. Robert Young:*Colonial Desire: Hybridity in Theory, Culture and Race*. Routledge
16. Helen Gilbert: *Postcolonial Plays: An Anthology*
17. Sarankumar Limbale: *Towards an Aesthetics of Dalit Literature*
18. Cornel West: *Race Matters*
19. Frantz Fanon: *The Wretched of the Earth*
20. Paul Gilroy: *There Ain’t Any Black in the Union Jack*
21. bell hooks: *Ain’t a Black Woman*
22. Paul Gilroy: *Small Acts*

Semester 3 - Core Course 13:
[EN010303] -Body, Text and Performance

Total Credits: 4
Total Hours: 25
Weightage:

Objectives:
The objectives of the course include facilitating an understanding of the basic structural, thematic and theoretical patterns which govern the poetic process, especially in its relation to the performative or the theatrical.

Course Description:
The interface between the verbal and the visual is the area under discussion here. Drama, Theatre, Body, Performance and performativity need to undergo close scrutiny here. The way the aspects of power and powerlessness are constructed and performed have to be analyzed. One cannot disregard the cinematic medium in a study of performance. Theatres, dealing with issues like gender, ethnicity, caste etc. need to be introduced. Anti-Aristotelian notions like Alienation Effect, modern dramatic modes like Comedy of Menace, the techniques of cinematic adaptations, etc. are also to be discussed in connection with the texts. Though seemingly different, Expressionism and similar modes of theatrical performance should be made part of classroom discussion. Other performance patterns like dance, performance in the form of gender/transgender/autobiography have also to be seriously considered within the gamut of this paper.

Module 1 [Theoretical]:
Discusses the theories of body, performance, gender, power needed for critical deliberations in the ensuing modules.

1.1 Richard Schechner: "What is Performance Studies?" **&** "What is Performance?" (Performance Studies: An Introduction (Third Edition), Chapter 1, PP. 1-5 **&** Chapter 2, PP 28-31)
1.2 Judith Butler: Performative Acts and Gender Constitution: An Essay in Phenomenology and Feminist Theory (Theatre Journal, Vol.40 PP. 519-531)
1.3 Jen Pylypa: Power and Bodily Practice: Applying the Work of Foucault to an Anthropology of the Body (Arizona Anthropologist, Vol. 13, PP. 21-36, 1998.)

Module 2 [Desire]:
Here is desire dramatized in terms of expressive, subtle and didactic modes. The first play presents elements of Expressionism, the second gives an idea of Comedy of Menace, and the third introduces Epic Theatre, Alienation Effect and the musical Opera. They all speak about violence on the body and mind of desire in myriad forms.

2.1 Tennessee Williams: *A Street Car Named Desire*
2.2 Harold Pinter: *The Birthday Party*

Seminar:
2.3 Bertolt Brecht: *The Three-penny Opera*

Module 3 [Gender/Transgender]:
This module is about gender/transgender and its theatrical dimensions. "Lysistrata" provides a slice of the classical Greek comedy playing again in an arguably subversive mode the male gaze through feminine eyes."Ruined" is set in Congo, a reworking on the lines of Brecht's *Mother Courage*, yet surely a deviation, speaking about the horrors of rape at the time of an African civil war. "A Friend's Story" mediates a love triangle involving a lesbian relation, set in Mumbai, at a time when homosexuality in India was a crime. "A Mouthful of Birds" is an ensemble of unnatural plots and theatrical performances, staged in an avant-garde fashion, discussing female violence and transgressions of gender norms through madness correlated with one another using themes from *The Bacchae* of Euripides.

3.1 Aristophanes: *Lysistrata*
3.2 Lynn Notage: *Ruined*
3.3 Vijay Tendulkar: *A Friend's Story* (Mitrachi Goshta)
Seminar:
3.4 Caryl Churchill and David Lan: *A Mouthful of Birds*

Module 4 [Autobiography/Performance]:
Other performances in the sense of gender as performance: Isadora Duncan's dance, seen through her autobiography- even autobiography as performance; a Bollywood sports biopic on Mary Kom; American Queer Theatre struggling to carve a niche in the popular Broadway as narrated through the personal experiences of playwright, performance artiste and gender theorist Kate Bornstein, an avowed gender non-conformist, along with her play that appears as a chapter of the autobiography.

4.1 Isadora Duncan: *My Life* (Autobiography)
4.2 Omung Kumar: *Mary Kom* (Biopic)
Seminar:
4.3 Kate Bornstein: *Queer Life/Queer Theatre***&***Hidden: A Gender, a play in two acts* ("Gender Outlaw: On Men, Women and the Rest of us", Chapters 14 & 15, PP. 187-275) – (Autobiography)

Module 5 [Cinematic Dimensions; Race/Caste]:
Cinematic tellings/adaptations dealing with the issues of race, slavery and caste feature in this module. The problematizing of the binaries of villain and superhero, the black and the white etc., and the play and the critique of stereotypes are all ingredients which spice up the module. The debates are set to tone in the deftly crafted "Unbreakable" by the Indian-American Director Manoj Nelliyattu Shyamalan. William Shakespeare's play *Othello* adapted into the Indian

context in Vishal Bhardwaj's "Omkara" throw light on the dark recesses of racism and caste politics. Set against the brutal and vulgar feudal system in Kerala, scripted by P. Balachandran and directed by Rajeev Ravi, "Kammattipaadam", the third film, marks the ways in which the human bodies here have been socially and culturally constructed, cutting through time and space.

5.1 Andrew Dix: "Films and Ideology" (Ch. 8 of *Beginning Film Studies* PP.229-268)
5.2M. Night Syamalan: *Unbreakable*
5.3 Vishal Bhardwaj: *Omkara*
Seminar:
5.4 Rajeev Ravi: *Kammattipaadam*

Specific Additional Readings:
1. Descartes: Mind-body dualism (The Principles of Philosophy, PP.60-65)
2. Richard Schechner: *Performance Studies: An Introduction* (Third Edition)
3. Philip C. Kolin: Roland Barthes, Tennessee Williams, and "A Streetcar Named Pleasure/Desire": JSTOR.
4. Aloysia Rousseau: Harold Pinter's *The Birthday Party* (1958) and *The Dumb Waiter* (1960) or the Intermingling of Farce and Menace.
5. Alice Rayner: Harold Pinter: Narrative and Presence. JSTOR.
6. Bertolt Brecht: The Street Scene: The Basic Model of an Epic Theatre
7. Kim H. Kowalke: Singing Brecht vs. Brecht Singing: Performance in Theory and Practice. **8**. Alexander G. Harrington: Directing "The Three-penny Opera"
9. Emily B. Klein. *Sex and War on the American Stage: Lysistrata in Performance, 1930-2012.*
10. Carmen Mendez Garcia: "This is my Place, Mama Nadi's": Feminine Spaces and Identity in Lynn Nottage's *Ruined*.
11. Rebecca Ashworth and Nalini Mohabir: *Ruined*: From Spectacle to Action
12. Fatimah Saleh Ali Al-Humoud: Violence against Women: A Feminist Study of Women's Situation during the Civil War of the Democratic Republic of Congo in Lynn Nottage's *Ruined*.
13. Rohini Hattingady: Note on *A Friend's Story*. Collected Plays in Translation. **14**. Priyanka Chandel: Engendered Subjectivities: Construction of Queer Identity in Vijay Tendulkar's *A Friend's Story* and Mahesh Dattani's *On a Muggy Night in Mumbai* (Thesis).
15. Hidden: A Gender, a play in two acts https://www.youtube.com/watch?v=fFD8NpA3hec
16. Bina Toledo Freiwald: Becoming And Be/Longing: Kate Bornstein's *Gender Outlaw* and *My Gender Workbook*
17. Ann Daly: Isadora Duncan's Dance Theory (Dance Research Journal, Vol. 26, No. 2 (Autumn, 1994), pp. 24-31)
18. Sudhish Kamath: Mary Kom, about the Heroine, not the Boxer. The Hindu. Sept. 05, 2014.
19. M.C. Mary Kom: *Unbreakable: An Autobiography*
20. Valerie Bonnet: Sport in Films: Symbolism versus Verismo. Film Genre Theory, Sports Films, Towards Defining Sports Films (The French Journal of Media Studies)
21. Laura Nutten: Madness and Signification in *A Mouthful of Birds*

22. Ronald L. Jackson II: "Black Masculine Scripts" (*Scripting the Black Masculine Body: Identity, Discourse and Politics in Popular Media*, Chapter 3, PP. 73-102).
23. Dave Schilling: Unbreakable: The Film that Launched our Modern Superhero Renaissance.
24. Brinda Charry and Gitanjali Shahani: The Global as Local/Othello as "Omkara"
25. Rebecca Dmello: Constrained Women in "Omkara": Marriage, Mythology, and Movies.
26. SakshamSharda: Black Skin, Black Castes: Overcoming a Fidelity Discourse in Bhardwaj's "Omkara"
27. Sonali Pattnaik: Adaptation as 'Becoming Other': A Study of the Film "Omkara"
28. Sreedhar Pillai: How Malayalam film "Kammatipaadam" shatters stereotypes about caste and complexion
29. Siddhant Adlakha: Fantastic Fest: "Kammatipaadam" is a Crime Masterpiece.
30. Latha V.K and Remya R.: Historical Revisionism in "Kammattippadam": A Regional Chronicle Of Dalit History
31. Interviews with Vinayakan:
https://www.youtube.com/watch?v=e1sFQoReIechttps://www.youtube.com/watch?v=zk1MUQiQUAg&t=173s

Texts for Consultation:

1. Philip B. Zarilli: Acting (Re) Considered: A Theoretical and Practical Guide
2. Philip Auslander: From Acting to Performance ("Just be your Self": Logocentrism and Differance in Performance Theory)
3. Philip Auslander: Liveness: Performance in a Mediatized Culture
4. David Krasner and David Z. Saltz: Staging Philosophy: Intersections of Theatre, Performance, and Philosophy
5. Deidre Heddon: Autobiography and Performance (Theatre and Performance Practices).
6. Robert Scholes et. al. (Ed.): "The Elements of Film" Elements of Literature
7. Keir Elam: Semiotics of Theatre and Drama
8. Alex Siers Ed.: The Metheun Drama Book of Twenty-First Century Plays
9. Shohini Chowdhuri: Feminist Film Theorists: Laura Mulvey, Kaja Silverman, Terese de Lauretis, Barbara Creed
10. Eric Lane Ed.: Telling Tales: New One Act Plays
11. Kenneth Pickering: Studying Modern Drama
12. Christian Metz: Film Language
13. Henry Bial (Ed.): The Performance Studies Reader
14. Julie Sanders: Adaptation and Appropriation
15. Marvin Carlson: Performance: A Critical Introduction
16. Johan Huizinga: Homo Ludens
17. Women's Theatre Group (WTG) & Elaine Feinstein: Lear's Daughters (Adaptations of Shakespeare: A Critical Anthology of Plays from the Seventeenth Century to the Present (Eds.) Daniel Fischlin, Mark Fortier)

Semester 3 – Core Course 14:
[EN010304] -Literature and Gender

Total Credits: 3
Total Hours: 25
Weightage:

Objectives:
The course seeks to highlight the historic, thematic and cultural concerns that literature attempts against the backdrop of gender issues. A theoretical framework is provided whereby gender issues are examined, paying special attention to the fundamental political, religious and social issues that shape gender relations, thereby viewing gender as a fluid rather than a *mere* fixed hetero-normative Male-Female concept.

Course Description:
The 'woman quotient' in Gender Studies is mapped in the first module where the concept of Masculinity which looms large in a patriarchal social order is also examined .The learner is taken on a poetic voyage through *ecriture feminine* in the second module. The third section interrogates the social stakes involved in being a woman and addresses the issue of Gender and Community Identity. The fourth section addresses the problematic issues of Lesbian and Black identity. The last module is an exclusive study of the issue of patriarchal oppression portrayed in various Indian languages over the decades.

Module 1:
1.1 Elaine Showalter; "The Female Tradition" from *A Literature of their Own.*(*Feminisms*: *An Anthology of Literary Theory and Criticism* Ed. Robyn R. Warhol & Diane Price Herndl. pp 269-88)
1.2 Patricia Hill Collins: "The Power of Self-Definition". (*Black Feminist Thought* pp 107-32)
1.3 Susan Jeffords: "Masculinity as Excess in Vietnam Films: The Father/Son Dynamic of American Culture". (*Feminisms*: *An Anthology of Literary Theory and Criticism* Ed. Robyn R. Warhol& Diane Price Herndl 988-1010)

Module 2:
2.1 Sappho**:** Ode to Aphrodite
2.2 Auvaiyar: "Real Freedom"
2.3 AkkaMahadevi: "It was like a Stream"
2.4 Phyllis Wheatley: "On being brought from Africa to America"
2.5 Margaret Atwood: "Helen of Troy does Countertop Dancing"
2.6 Kamala Das: "An Introduction
2.7 Imtiaz Dharker: "Purdah"

Seminar:

2.8 Taslima Nasrin: "Things Cheaply Had"

2.9 Kishwar Naheed: "The Grass Is Really Like Me"

2.10 Meena Kandaswamy: "Princess in Exile'

2.11 Meena Alexander: "Illiterate Heart"

Module 3:

3.1 Bapsi Sidwa: The Ice Candy Man

3.2 Sylvia Plath: The Bell Jar

3.3 Alice Walker: Color Purple

Seminar:

3.4 Virginia Woolf: The Hours

Module 4:

4.1 Revathy. A.: The Truth About Me: A Hijra Life Story

4.2 Maya Angelou: I know Why the Caged Bird Sings

4.3 Lorraine Hansberry: Raisin in the Sun

Seminar:

4.4 Chimamanda Adichie: "We should all be Feminists," Ted talk, (https://www.ted.com/talks/chimamanda_ngozi_a dichie_we_should_all_be_feminists#t-181958)

4.5 Rebecca Walker: "Becoming the Third Wave" (United States 1992){ *The Essential Feminist Reader* Ed. Estelle. B. Freedman 397-401}

Module 5:

5.1 Lalithambika Antharjanam: Pratikaradevatha (Transl. Gita Krishnankutty *Women Writing in India Vol: I*)(490-501)

5.2 Prathibha Ray: The Blanket (Transl. Jayanta Mahapatra. *Women Writing in India Vol: II*) (512-23)

5.3 Ajeet Cour: Dead End (*Speaking for Myself: An Anthology of Asian Women's Writing*) (369-85)

5.4 Rokeya Sakhwat Hossain: Sultana's Dream (*Women Writing in India Vol: I*) (342-351)

5.5 Hamsa Wadkar: I'm Telling You Listen (*Women Writing in India Vol: I*) (190-196)

5.6 Sajitha Madathil: Kaalinaadakam (Translated by Anand Haridas in *Indian Literature* No 303, January/February 2018, Vol LXI No. 1)

5.7 Susie Tharu & J. Lalitha: The Twentieth Century: Women Writing the Nation (43-78)

Seminar:

5.8 Sara Joseph: Black Chinks (Translated by J. Devika in *The Oxford Anthology of Modern Malayalam Literature* Ed. P. P. Raveendran &. G. S. Jayasree) (280-88)

5.9 S. Sithara: Fire (Translated by Jayasree Ramakrishnan in *The Oxford Anthology of Modern Malayalam Literature* Ed. P. P. Raveendran & G. S. Jayasree) 393-98

Texts for Consultation:

1. Robyn R. Warhol& Diane Price Herndl (eds): *Feminisms*: *An Anthology of Literary Theory and Criticism*
2. Estelle B. Freedman (ed): *The Essential Feminist Reader*
3. Susie Tharu & J. Lalitha (ed): *Women Writing in India*, vols I& 2
4. Patricia Hill Collins: *Black Feminist Thought*
5. Sukrita Paul Kumar and Malashri Lal (eds): *Speaking for Myself: An Anthology of Asian Women's Writing*
6. Shosanna Feldman; "Women and Madness: the Critical Fallacy" in *The Feminist Reader: Essays in Gender and the Politics of Literary Criticism*. Ed, Catherine Belsey & Jane Moo

7. P. P. Raveendran & G. S. Jayasree Ed. *The Oxford Anthology of Modern Malayalam Literature (Vol I&II)*
8. J. Devika: *En-gendering Individuals: The Language of Re-forming in Early Twentieth Century Keralam* (Orient Black Swan)
9. Claire Colebrook: *Gender* (transitions - Gen Editor Julian Wolfreys)
10. Toril Moi: *Sexual/Textual Politics*
11. Simone de Beauvoir: *The Second Sex*
12. Kate Millet: *Sexual Politics*
13. Elaine Showalter: *A Literature of Their Own*
14. Isobel Armstrong: *New Feminist Discourses*
15. Judith Butler: "Imitation and Gender Insubordination" in Diana Fuss(ed) *Inside Out : Lesbian Theories*
16. Helene Cixous: "The Laugh of the Medusa" in Elaine Marks & Isabelle de Courvitron (Ed) *New French Feminism*
17. Monique Wittig: *The Straight Mind and Other Essays*
18. Rebecca Walker: "How my mother's fanatical views tore us apart," http://www.dailymail.co.uk/femail/article1021293/How-mothers-fanatical-feministviews-tore-apart-daughter-The-Color-Purpleauthor.html
19. Bell hooks: "Black Women Shaping Feminist Theory," *Feminist Theory: From Margin to Center*, 1984
20. Virginia Woolf: "Professions for Women," in *Women and Writing*&*A Room of One's Own*

Semester 3 - Core Course 15:
[EN010305]-Ethics in/as Literature

Total Credits: 3
Total Hours: 25
Weightage:

Course Objectives:
The main objective of this course is to familiarise the student with certain 'ethics' that narrative fiction has adopted across centuries, continents and languages. It is expected that the student will be introduced to the various ethical, formal choices that schools, influences and narrative devices have upheld so as to shape narrative fiction into its present expressive plurality.

Course Description:
Module I includes reading from some of the major theoretical interpretations of the narrative and narrative mores: Roland Barthes' 'Authors and Writers', Milan Kundera's 'The Depreciated Legacy of Cervantes', Orhan Pamuk's Preface to *Tristram Shandy* and Franco Moretti's "History of the Novel, Theory of the Novel".
Module 2 takes a walk down the fabulist lane that stretches beyond what we usually understand as fictional/narrative realism:Miguel de Cervantes's *Don Quixote* (*Part 2*), Lawrence Sterne's *Tristram Shandy*,Donald Barthelme's post-modern reworking of the *Snow White* – fairy tale, Jorge Luis Borges' 'The Garden of Forking Paths' and Gabriel Garcia Marquez' 'The Handsomest Drowned Man in the World'
Module 3 is an attempt to sample how fiction has dealt with the issue of disabilities at different levels. Starting with the perennial classic,Victor Hugo's *The Hunchback of Notre-Dame, the module also includes* Nikos Kazantzakis' *God's Pauper: St Francis of Assisi*,José Saramago's*Blindness*,W. Somerset Maugham's 'The *Man with the Scar'* and Raymond Carver's 'Cathedral'
Module 4 is all about the environment – the natural and the human and the intersectionality between them. The module starts off with the phenomenal Malayalam work bySubhash Chandran, *A Preface to Man*, followed byOrhan Pamuk's *Snow*,Margaret Atwood's *Oryx and Crake*,J. M. Coetzee's 'The Lives of Animals' and Mahasweta Devi's 'Dopti/Draupadi'
Module 5 looks into issues of Otherness, as it has been tackled by narrative fiction.The selection includes Fyodor Dostoyevsky's *The Possessed*,Ama Ata Aidoo's parody of Joseph Conrad's *Heart of Darkness - Our Sister Killjoy*,Arundhati Roy's *The Ministry of Utmost Happiness*,John Henrik Clarke's 'The Boy Who Painted Christ Black' and the Malayalam Dalit masterpiece, Paul Chirakkarode's '*Eli Eli Lama Sabachthani*?' [My God, My God, Why Hast Thou Forsaken Me?]

Note: As is evident from a perusal of the syllabus, all the seminar fields have been assigned 'short stories'; this is a tacit nod to acknowledging the trajectories which this 'other' prose fictional genre has traversed in the last two hundred odd years.

Module 1 [On Narrative Ethics]:
1.1 Roland Barthes: 'Authors and Writers' (*Critical Essays*)
1.2 Milan Kundera: 'The Depreciated Legacy of Cervantes' (Part 1 of: *The Art of the Novel*)
1.3 Orhan Pamuk: '*Everyone Should Have* an *Uncle Like This' (Other Colours)*
1.4 Franco Moretti: "History of the Novel, Theory of the Novel" *New Left Review 52*, July-August 2008

Module 2 [Beyond Realism]:
2.1 Miguel de Cervantes: *Don Quixote* (*Part 2*) [Edith Grossman Translation]
2.2 Lawrence Sterne: *Tristram Shandy*
2.3 Donald Barthelme: *Snow White*
Seminar:
2.4 Jorge Luis Borges: 'The Garden of Forking Paths'
2.5 Gabriel Garcia Marquez: 'The Handsomest Drowned Man in the World'

Module 3 [Disabilities]:
3.1 Victor Hugo: *The Hunchback of Notre-Dame*
3.2 Nikos Kazantzakis: *God's Pauper: St Francis of Assisi*
3.3 José Saramago:*Blindness*
Seminar:
3.4W. Somerset Maugham: 'The *Man with the Scar'*
3.5 Raymond Carver: 'Cathedral'

Module 4 [The Human (and the) Environment]:
4.1 Subhash Chandran: *A Preface to Man*
4.2 Orhan Pamuk: *Snow*
4.3 Margaret Atwood: *Oryx and Crake*
Seminar:
4.4J. M. Coetzee: 'The Lives of Animals'
4.5 Mahasweta Devi: 'Dopti/Draupadi'

Module 5 [Otherness]:
5.1 Fyodor Dostoyevsky*: The Possessed (The Devils/ Demons)*
5.2 Ama Ata Aidoo: *Our Sister Killjoy*
5.3 Arundhati Roy: *The Ministry of Utmost Happiness*
Seminar:
5.4 John Henrik Clarke: 'The Boy Who Painted Christ Black'
5.5 Paul Chirakkarode: '*Eli Eli Lama Sabachthani*?'

Specific Additional Readings:
1. Mark DeStephano on *Don Quixote*

2. Ignacio Arellano on *Don Quixote*
3. Oana-Roxana Ivan on *Tristram Shandy*
4. Daniel Thomières on *Tristram Shandy*
5. Shaghayegh Mohammadi on *Snow White*
6. Alina Leonte on *Snow White*
7. Gemma Curto on 'Garden of Forking Paths'
8. Ethan Weed on 'Garden of Forking Paths'
9. David Holland on Marquez
10. Anupa Lewis on Marquez
11. Fiona Whittington-Walsh on *Hunchback of Notre Dame*
12. Alex J Novikoff on *Hunchback of Notre Dame*
13. Frederick Sontag on Kazanthzakis and St Francis
14. Paulo C Chagas on Saramago
15. Hayfa Chenini on Saramago
16. On –'The Man with the Scar'
17. Ala Eddin Sadeq on Raymond Carver
18. Libe García Zarranz on Raymond Carver
19. Sandhya Suresh V on *A Preface to Man*
20. Jyothi lekshmi G on *A Preface to Man*
21. Alver Ahmet on Orhan Pamuk's *Snow*
22. Pritha Mukherjee on Orhan Pamuk's *Snow*
23. Beth Irwin on *Oryx and Crake*
24. Valeria Mosca on *Oryx and Crake*
25. Alan Northover on Coetzee
26. Wolfe on 'Lives of Animals'
27. Huma Yaqub on Mahasweta Devi
28. Ranita Chakraborty on Mahasweta Devi
29. Eva M Meyersson on Dostoevsky
30. Christine Smoley on Dostoevsky
31. Lhoussain Simour on *Our Sister Killjoy*
32. Aisha Al Matari on *Our Sister Killjoy*
33. Alex Tickell on Arundhati Roy
34. Angelo Monaco on Arundhati Roy

Texts for Consultation:

1. Georg Lukacs: *TheTheory of the Novel*
2. Lucien Goldmann: *Towards a Sociology of the Novel*
3. David Lodge: *The Art of Fiction*
4. Wayne C. Booth: *The Rhetoric of Fiction*
5. Patricia Waugh: *Metafiction*
6. Jeremy Hawthorn: *Studying the Novel*
7. Shlomith Rimmon-Kenan: *Narrative Fiction: Contemporary Poetics*

8. Joyce Carol Oates: *Telling Stories – An Anthology for Writers*
9. Linda Hutcheon: *A Poetics of Postmodernism: History, Theory, Fiction*
10. Mikhail Bakhtin: *The Dialogic Imagination*
11. Susan Lohafer & Jo Ellyn Clarey (eds): *Short Story Theory at a Crossroads*
12. *Edgar V. Roberts* and *Henry E. Jacobs: Literature:* An *Introduction to Reading and Writing*

FOURTH SEMESTER CORE COURSES

EN010401	Cultural Studies	16
EN010402	Post Colonial Poetry	17
	<Elective>	18
	<Elective>	19
	<Elective>	20

Semester 4 - Core Course 16:
[EN010401]-Cultural Studies

Total Credits: 3
Total Hours: 25
Weightage:

Objectives:To introduce students to certain interpretive strategies commonly employed in Cultural Studies. Emphasis is on overt interdisciplinary approaches to exploring how cultural processes and artifacts are produced, shaped, distributed, consumed, and responded to in diverse ways.

Course Description:

"It is —a tendency across disciplines rather than a discipline itself." By transgressing disciplinary boundaries, Cultural Studies suggests a "remapping of the humanities."

*Module 1*is axiomatic in the sense that the 3 readings taken from Raymond Williams, Stuart Hall, and John Storey set the stage for the subsequent engagements.

*Module 2*draws attention to the pervading cultural semiosis that one can discern in societies the world over. The readings from Guy Debord, R. Nandakumar, and David Forgacs offer ways by which one can understand the methodologies of representation and the decoding of such social signs as such.

*Module 3*is all about the different modes that Lifestyles assume.The readings from Michel de Certeau, Pierre Bourdieu,and George Simmel offer means by which we can and 'read' the various negotiations of socio-cultural identities.

Module4 is the terrain of 'Homo Ludens' – the playing human. The writings of Roland Barthes, Abilash Nalapat/Andrew Parker, and Amanda Roth/Susan A. Basowdraw attention to the poetics and politics of sports-as-myth.

*Module 5*is an assemblage that can be termed 'Manifestoes.'The readings fromArjun Appadurai, Achille Mbembe, and *Jacques Rancière* form an inter-textual deep-play network that constellates to draw attention to the horizon of cultural certitudes, expectations and anxieties that deserve thorough academic scrutiny.

Module 1 [Axioms]:

1.1 Raymond Williams: "The Analysis of Culture"
1.2 Stuart Hall: "The Emergence of Cultural Studies and the Crisis of the Humanities.'
1.3 John Storey: "What is Popular Culture?" (pp 1-16 in *Cultural Theory and Popular Culture*)

Module 2 [Representations]:

2.1 Guy Debord: "The Commodity as Spectacle."
2.2R Nandakumar: "The Missing Male: The Female Figures of Ravi Varma and the Concepts of Family, Marriage and Fatherhood in Nineteenth century Kerala" (*South Indian Studies*, No.1, Jan-June, 1996)

Seminar:

2.3 David Forgacs: "National-popular: Genealogy of a concept" in Simon During (ed) *The Cultural Studies Reader*.

Module 3 [Lifestyles]:
3.1 Michel de Certeau: "Walking in the City" in Simon During (ed) *The Cultural Studies Reader*.
3.2 Pierre Bourdieu: "Distinction: A Social Critique of the Judgement of Taste" in Carole Counihan and Penny van Esterik (eds), *Food and Culture: A Reader*, Routledge, 2013, pp 31-40

Seminar:
3.3 George Simmel: "Fashion"

Module 4 [Homo Ludens]:
4.1 Roland Barthes: 'The World of Wrestling' (From *Mythologies*, selected and translated by Annette Kavers, London, Jonathan Cape, 1972)
4.2 Abilash Nalapat and Andrew Parker: 'Sport, Celebrity and Popular Culture: Sachin Tendulkar, Cricket and Indian Nationalisms.'
Seminar:
4.3 Amanda Roth &Susan A. Basow: 'Femininity, Sports, and Feminism.'

Module 5 [Manifestoes]:
5.1 Arjun Appadurai: 'The Thing Itself'
5.2 Achille Mbembe: 'Necropolitics'
Seminar:
5.3*Jacques Rancière: '*Preface to *Proletarian Nights'*

Specific Additional Readings:
1. Raymond Williams: "Culture is Ordinary" (*Resources of Hope: Culture, Democracy, Socialism*)
2. Stuart Hall: "Cultural Studies: Two Paradigms" (*Media, Culture and Society* vol.2)
3.Simon During: "Postmodernism or Post-colonialism Today" (in Bill Ashcroft etal: *The Post-colonial Studies Reader*)
4. Chandra Mukerji & Michael Schudson: "Introduction: Rethinking Popular Culture." in Rethinking Popular Culture: Contemporary Perspectives in Cultural Studies. Berkeley: University of California Press, 1991.
5. Simon During: 'Value' in Simon During: Cultural Studies: A Critical Introduction. London; New York: Routledge (2005)
6. Susan Sontag: *On Photography*
7. Janet Murray: *Hamlet On the Holodeck.* New York: Free Press, 1997. Pp. 273-283.
8. Bhaskar Mukhopadhyay: "Cultural Studies and Politics in India Today," *Theory Culture Society*, 2006 (SAGE, London, Thousand Oaks and New Delhi), Vol. 23(7–8): 279–292

9. Ashis Nandy: "Introduction: Indian Popular Cinema as a Slum's Eye View of Politics" in *The Secret Politics of Our Desires: Innocence Culpability and Indian Popular Cinema*, Ashis Nandy (ed) Delhi: OUP, 1998)
10. John Fiske: "The Signs of Television."
11. Pierre Bourdieu: 'How can one be a sports fan?'
12. Udayakumar: "Autobiography as a Way of Writing History: Personal Narratives from Kerala and the Inhabitation of Modernity" (in *History in the Vernacular*, eds. Partha Chatterjee and Raziuddin Aquil, Delhi: Permanent Black, 2008.)
13. Raadhika Gupta: 'Bowled Out of the Game: Nationalism and Gender Equality in Indian Cricket.'
14. Lorenzo Magnani: 'Ritual Artifacts as Symbolic Habits.'
15. Arjun Appadurai: 'Playing with Modernity: The Decolonization of Indian Cricket.'
16. Arjun Appadurai: 'Architecture and Amnesia in Indian Modernity.'
17. Roland Barthes: "Rhetoric of the image."*Image, Music. Text.*
18. Jacques Lacan: "Sign, Symbol, Imagery." *On Sign*. Ed. Marshall Blonsky.
19. John Fiske: "Television Culture" *Literary Theory: An Anthology*.(Rivkin and Ryan).
20. Raymond Williams. *Television; Technology and Cultural Form.*
21. Ann Keplan:" Feminist Criticism and Television" from *Channels of DiscourseReassembled* (Robert Allen)
22. Aravind Rajagopal: "Hindu Nationalism and the Cultural Forms of Indian Politics."
23. Carole M. Cusack: "The Gods on Television: Ramanand Sagar's Ramayan", in *Politics and Popular Piety in Late Twentieth-Century India* by Alex Norman and Cusack, 2012.
24. Aarttee Kaul Dhar: "The Ramayana and Sita in Films and Popular Media: The Repositioning of a Globalised Version" in *The Return of the Epic Film*,
25. Prabha Krishnan: "In the Idiom of Loss: Ideology of Motherhood in Television Serials." Economic and Political Weekly 25, no. 42/43 (1990): WS103–16.
26. ShantiKumar:*Gandhi Meets Primetime: Globalization and Nationalism in Indian Television* Chicago: University of Illinois Press, 2006.
27. Purnima Mankekar:*Screening Culture, Viewing Politics: An Ethnography of Television, Womanhood, and Nation in Postcolonial India*. Durham: Duke University Press, 1999.
28. Clifford Geertz: 'The Balinese Cockfight."
29. Helena Tolvhed : 'Sex Dilemmas, Amazons and Cyborgs: Feminist Cultural Studies and Sport.'

Texts for Consultation:
1. Theodor Adorno: *The Culture Industry: Selected Essays on Mass Culture* (ed., with intro.), J.M. Bernstein. London: Routledge (1991)
2. Elaine Baldwin: *Introducing Cultural Studies.* New York: Pearson/Prentice Hall (2004)
3. Roland Barthes: *Mythologies.* London: Paladin (1973)
4. Catherine Belsey: *Culture and the Real: Theorizing Cultural Criticism* London; New York: Routledge (2005)

5. Walter Benjamin, W.: *Illuminations*. New York: Schocken Books (1968)
6. Tony Bennett, L. Grossberg: *New Keywords: A Revised Vocabulary of Culture and Society*. Blackwell (2005)
7. Tony Bennett: *Outside Literature*. London: Routledge (1990)
8. Pierre Bourdieu: *The Field of Cultural Production*. Cambridge: Polity Press (1993)
9. Simon During (ed.): *The Cultural Studies Reader*. London: Routledge (1993)
10. Simon During: *Cultural Studies: A Critical Introduction*. London; New York: Routledge (2005)
11. Antony Easthope: *Literary into Cultural Studies*. London: Routledge (1991)
12. Antony Easthope: *A Critical and Cultural Theory Reader*. Open University Press (1992)
13. John Fiske: *Understanding Popular Culture*. Boston, MA: Unwin Hyman (1989)
14. Toby Miller (ed): *A Companion to Cultural Studies*. Blackwell (2001)
15. Nelson, Cary and Dilip Parameshwar Gaonkar (eds.): *Disciplinarity and Dissent in Cultural Studies*. New York: Routledge, 1996.
16. Johan Huizinga:*Homo Ludens*

Semester 4 - Core Course 17:
[EN010402]-Postcolonial Poetry

Total Credits: 3
Total Hours: 25
Weightage:

Objectives:
To introduce the students to the diversityof poetry coming from the erstwhile coloniesof the European Colonial Empires. To clear the ground from where the student can see how, beyond the general discursive constellations, there are regional specifics that 'in a hybrid mode' negotiate issues of sovereignty, language, race, gender, identity and place.

Course Description:
"Here we stand at the messiest point of our time // someone should write us, if we don't / who will." - Gülten Akın (2007).

The course attempts to cover, through representative texts, the entire gamut of poetrythat has emerged from and still addresses the (post)colonial experience, the world over.

Module 1 is a conceptual orientation; it tries to situate, in a somewhat general way, certain contours that 'Poetic Postcolonialisms' assume.

Module 2 is a collection of poems that are South Asia & Australasia-specific.

Module 3 is a choice take on West & East Asia.

Module 4 is solely representative of poems from Africa.

Module 5 brings together myriad yet 'intertwined' verses from South America & Caribbean.

Special Note: A detailed delving into the poems is not expected vis-à-vis the Seminar Fields. Questions pertaining to these sections will be Generic: issues like Identity, Gender, Cultural Poetics and Language Politics.

Module 1[Poetic Postcolonialisms]:

1.1 Jahan Ramazani: "Contemporary Postcolonial Poetry" in Neil Roberts (ed): *A Companion to Twentieth-Century Poetry*, Blackwell Publishing, 2007

1.2 Sudipta Kaviraj: "A Strange Love of the Land: Identity, Poetry and Politics in the (Un)Making of South Asia."

Module 2[South Asia & Australasia]:

2.1 India: Kamala Das: "Someone Else's Song" **&** Agha Shahid Ali: "I See Kashmir From New Delhi at Midnight"

2.2 Pakistan: Faiz Ahmad Faiz: "Black Out" **&** Kishwar Naheed: "We Sinful Women"

2.3 Sri Lanka: Yasmine Gooneratne: "There was a Country" **&**R. Cheran: "Yaman"

2.4 Bangladesh: Taslima Nasrin: "Can't I have a homeland to call my own?" **&**Kaiser Haq: "Ode on the Lungi"

Seminar:
2.5 Australia: A D Hope: "Australia" **&** Judith Wright: "Eve to her Daughters"
2.6 New Zealand: Selina Tusitala Marsh**:** "naming myself"**&**"The Young and the Restless"
2.7 Fiji: Konai Helu Thaman: "Living Amongst the Trees" **&** "Kakala Folau (a gift of love)"

Module 3[West & East Asia]:
3.1 Israel: Yehuda Amichai: "National Thoughts" **&** Dahlia Ravikovitch: "Hovering at a Low Altitude"
3.2 Palestine: Mahmoud Darwish: "The Earth is Closing on Us," **&**Hanan Mikha'il 'Ashrawi : "*From* TheDiary of an Almost-Four-Year-Old"
3.3 Iran: Forugh Farrokhzad: "I Will Greet the Sun Again" **&***Simin Behbahani: "And Behold"*
3.4 Turkey: Orhan Veli: "For Free" **&**Gülten Akın: "Woman's Song"

Seminar:
3.5 Philippines: Cirilo F. Bautista: "Written in Stratford-Upon-Avon"**&**Marjorie Evasco: "Caravan of the Waterbearers"
3.6 Singapore:Arthur Yap: "The Correctness of Flavour" **&**Lee Tzu Pheng*: "Singapore River"*
3.7 Hong Kong: Nicholas YB Yong: "Toys 'R' Us" & Tammy Ho Lai-ming: "Leftovers"

Module 4[Africa]:
4.1 Nigeria: Chinua Achebe: "Vultures" **&** Mabel Segun: "The Pigeon-Hole"
4.2 Egypt: Iman Mersal: "Sometimes Wisdom Possesses Me" **&** Fatima Naoot: "Blind"
4.3 Mozambique: Noémia de Sousa: "Black Blood" **&**Ana Mafalda Leite: "Liquid Frontier"
4.4 Algeria: Muhammad Dib: "Guardian Show" **&**Djamal Amrani: "Beneath a Pile of Rubble"

Seminar:
4.5 South Africa: Dennis Brutus: "A poem about Sharpeville" & Antjie Krog: "Country of Grief and Grace"
4.6 Kenya: Shailja Patel: "Shilling Love" &*Micere Githae Mugo: "I Want You To Know"*
4.7 Ghana: Kofi Awoonor: "The Weaver Bird" & Ama Ata Aidoo: "For My Mother in Her Mid-90s"

Module 5[South America & Caribbean]:
5.1 Argentina: Jorge Luis Borges: "Borges and I" **&** Alfonsina Storni: "They've Come"
5.2 Brazil: Olavo Bilac: "Milky Way: Sonnet 13" **&** Hilda Hilst: "Poems for the Men of Our Time,"
5.3 Uruguay: Mario Benedetti: "Little Stones at My Window" **&** Selva Casal: "the last angels of the evening."
5.4 Chile: Pablo Neruda: "The Poet" **&** Gabriela Mistral: "To See Him Again"

Seminar:
5.5Columbia: José Asunción Silva: "Sonnet"

5.6Saint Lucia: Dereck Walcott: "The Lost Empire"
5.7Guyana: John Agard: "Prospero Caliban Cricket"
5.8 Barbados: Edward Kamau Brathwaite: "Bread"
5.9Trinidad and Tobago: Surya Vahni Priya Capildeo: "I Love You"
5.10Jamaica: Louise Bennett: "Colonisation in Reverse"

Specific Additional Readings:
1. Anna Bernard: "Poetry, Translation, and Postcolonial Criticism…"
2. Muneeza Shamsie: South Asian Muslims: Fiction and Poetry in English, *Religion & Literature* Vol. 43, No. 1 (spring 2011), pp. 149-157
3. Priya Satia: Poets of Partition, *Tanqeed*: A magazine of politics and culture, Jan 2016
4. Omer Tarin, Ilyas Khan, and K. Majied: Pakistani English Literature – A Brief Introduction, 1947 to the Present, *Prachya Review*, Dec 30, 2015
5. Kaiser Haq: An Apology for Bangladeshi poetry in English
6. Mohammad Ali Ghazalsofli: A Political Review of Iranian Contemporary Poetry
7. Bulend Ecevit: Poetry in Turkey - A Nation's Most Popular Art
8. Müesser Yeniay: Turkish Women's Poetry: Ottoman to Contemporary
9. J. Neil C. Garcia: Postcolonialism and Filipino Poetics
10. Barbara Jane Reyes: Filipina Lives and Voices in Literature
11. Cyril Wong: An interview
12. Irving Goh: Promising 'Post-Colonialism': Deleuze-Guattari's 'Minor Literature' and the Poetry of Arthur Yap
13. Thow Xin Wei: Arthur Yap: Uniquely Singaporean
14. Odimegwu Onwumere: The Evolution of Nigerian Poetry
15. Mick Delap: Nigerian Poetry – Black Star or Black Hole?
16. Gemma Robinson: "Postcolonial Poetry of Great Britain: a poetics of contradictory affinity."
17. Ngugi Wa Thiongo: 'The Quest for Relevance' in *Decolonising the Mind*

Texts for Consultation:
1. Neil Roberts (ed): *A Companion to Twentieth-Century Poetry*, Blackwell Publishing, 2007
2. Rajeev S. Patke: *Postcolonial Poetry in English*, Oxford University Press, 2006
3. Ashok Bery: *Cultural Translation and Postcolonial Poetry*, Palgrave Macmillan, 2007.
4. Jahan Ramazani (ed): *The Cambridge Companion to Postcolonial Poetry*, Cambridge University Press, 2017
5. Jahan Ramazani: *The Hybrid Muse: Postcolonial Poetry in English*, University of Chicago Press, 2001
6. Robert Stilling: *Beginning at the End: Decadence, Modernism, and Postcolonial Poetry*, Harvard University Press, 2018
7. Ato Quayson (ed): *The Cambridge History of Postcolonial Literature: Volume 1*, Cambridge University Press, 2012

ELECTIVES

Semester Four

+3 Electives [Choose **One from** the**FourClusters**given below] :

Cluster 1	**Cluster 2**	**Cluster 3**	**Cluster 4**
18. Post Colonial Theatres [EN800401]	**21**. Trauma Narratives and Memory [EN810401]	**24**. Modern European Fiction [EN820401]	**27**. English Language Teaching (ELT) [EN830401]
19. Shakespeare Across Cultures [EN800402]	**22**. The Island in Literature [EN810402]	**25**. Modern European Drama [EN820402]	**28**. Translation Studies [EN830402]
20. Public Domain Writings [EN800403]	**23**. Literature and Film [EN810403]	**26**. Indian Poetics: Theories and Texts [EN820403]	**29**. Dalit Studies [EN830403]

ELECTIVES

CLUSTER 1

18. Postcolonial Theatres[EN800401]
19. Shakespeare Across Culture [EN800402]
20. Public Domain Writings [EN800403]

Semester 4 - Elective Course:
[EN800401]-PostcolonialTheatres

Total Credits: 3
Total Hours: 25
Weightage:

Objectives:
To consider the nature of post-colonial drama as a theatrical, cultural, social, and political concept. Also, to 'show' how the idea of 'empire' is deconstructed by the playwrights; and thereby explore the cultural diversities and pluralities that constitute a post-colonial 'national' drama. Further, the attempt is to examine the paradoxes and hybridities in the forms and styles of post-colonial drama and to exemplify how indigenous folk and /or mythical styles and themes inform post- colonial drama to constitute a syncretism of cultures.

Course Description:
Module 1 is an 'inter-textual narrative drama! Here one encounters pieces by George Lamming and Eduardo Galiano. Lamming opens up the discussion on colonial exploitation by using Shakespeare's text as a litmus-metaphor and Galieano narrates the neo-colonial/imperial drama that makes the very notion of the 'third world' possible. Together they subsume most of the issues that postcolonial drama 'stages.'
Module 2 is Asia-specific; it includes works by Girish Karnad, Sulayman Al-Bassam and Kuzhanthai M. Shanmugalingam.
Module 3 is set apart for Africa; it includes works by Athol Fugard, Efua Sutherland and Wole Soyinka.
Module 4 sets the platform for the two trans-Atlantic continents [north and south] under the overarching title – The Americas. It brings together works by Griselda Gambaro, *Rodolfo Usigli and* Howard Zinn.
Module 5 brings up the Caribbean Quotient. The representative works included are those by Aime Cesaire, Errol John and Derek Walcott.

Module I [Conceptual]:

1.1 George Lamming: "A Monster, a Child, a Slave" in *Pleasures of Exile*.
1.2 Eduardo Galiano: 'Introduction: 120 Million Children in the Eye of the Hurricane' in *Open Veins of Latin America*.

Module 2 [Asia]:

2.1India: Girish Karnad: *The Dreams of Tipu Sultan*

2.2Kuwait: Sulayman Al-Bassam: *TheAl-Hamlet Summit* in the *Arab Shakespeare Trilogy*,Bloomsbury, 2014
Seminar:
2.3Sri Lanka: Kuzhanthai M. Shanmugalingam: *The Land of Our Parents*

Module 3 [Africa]:

3.1South Africa: Athol Fugard: *Blood Knot*
3.2Ghana: Efua Sutherland: *The Marriage of Anansewa*
Seminar:
3.3Nigeria: Wole Soyinka: *The Lion and the Jewel*

Module 4 [The Americas]:

4.1Argentina: Griselda Gambaro: *Information for Foreigners*
4.2Mexico: *Rodolfo Usigli: The Impostor: A Play for Demagogues*
Seminar:
4.3U.S.A: Howard Zinn: Marx in Soho

Module 5 [Carribean]:

5.1Martinique: Aime Cesaire: *A Tempest*
5.2Trinidad: Errol John: *Moon on a Rainbow Shawl*
Seminar:
5.3 Saint Lucia: Derek Walcott: *Dream on Monkey Mountain*

Specific Additional Readings:
1. Graham Holderness: 'Arab Shakespeare: Sulayman Al-Bassam's *TheAl-Hamlet Summit*', *Culture, Language and Representation*, Vol IV, 2007, pp. 141-150
2. Graham Huggan: 'Decolonizing the Map' in *The Postcolonial Studies Reader*
3. George Lamming: The Occasion for Speaking
4. Dennis Walder: on Athol Fugard
5. Ashis Sengupta: Contemporary South Asian Theatre
6. Selena Burns: Griselda Gambaro's Theatre
7. Nina L. Molinaro: Panoptic Theatre and Griselda Gambaro's El campo
8. Erroll Hill: Caribbean Theatre
9. Awam Amkpa: Post Colonial Theatre and Ethics
10. Al Bassam Sulayman: PhD thesis on his own adaptations
11. Patrice Pavis (Paris) - Intercultural Theatre
12. Austin O. Asagba: on Efua Sutherland's *The Marriage of Anansewa*
13. Philomena Abakah: on Efua Sutherland's *The Marriage of Anansewa*
14. On *Rodolfo Usigli*

15. Vance Savage: Rodolfo Usigli's Idea of Mexican Theatre
16. Aaron Cooley: on Howard Zinn's Dissent
17. Philip Crispin: A Tempestuous Translation: Aimé Césaire's *Une tempête*
18. Shelley Cole-Nimblett: on Errol John's *Moon on a Rainbow Shawl*
19. Claire Westall: on Errol John's *Moon on a Rainbow Shawl*
20. Lynette Goddard: Errol John's *Moon on a Rainbow Shawl*
21. Ngugi Wa Thiongo: 'The Language of African Theatre' in *Decolonising the Mind*

Texts for Consultation:
1. Bill Ashcroft, Gareth Griffiths, Helen Tiffin: *Key Concepts in Post-Colonial Studies*, Routledge
2. Bill Ashcroft, Gareth Griffiths, Helen Tiffin (eds.):*The Post-Colonial Studies Reader*, Routledge
3. Bill Ashcroft, Gareth Griffiths & Helen Tiffin: *The Empire Writes Back: Theory and Practice in Post- Colonial Literatures*. Routledge
4. John McLeod: *Beginning Postcolonialism*. Manchester Univ. Press
5. Ania Loomba:*Colonialism/Postcolonialism*. Routledge
6. Leela Gandhi:*Postcolonial Theory: An Introduction*. Edinburgh Univ. Press
7. Elleke Boehmer:*Colonial and Postcolonial Literature*. OUP
8. Gregory Castle (ed.):*Postcolonial Discourses: An Anthology*. Blackwell
9. Padmini Mongia (ed.):*Contemporary Postcolonial Theory: A Reader*. Arnold
10. Francis Barker, Peter Hulme & Margaret Iversen (eds.):*ColonialDiscourse/Postcolonial Theory*. Manchester Univ. Press
11. Robert Young:*Colonial Desire: Hybridity in Theory, Culture and Race*. Routledge
12. C.L.R James:*The Black Jacobins*
13. Shirley Chew:*Concise Companion to Postcolonialism*
14. Hans Thies Lehmann:*Postdramatic Theatre*
15. *The Black Jacobins Reader*
16. Lee Maracle: *I Am Woman*

Semester 4 – Elective Course:
[EN800402] -Shakespeare Across Cultures

Total Credits: 3
Total Hours: 25
Weightage:

Objectives:

The course is designed as one that situates the timeless genius of Shakespeare across cultures, literatures and authors. Indeed, Shakespeare has inspired more authors than any other writer. This is reflected in the number of rereading of his plays down the centuries in various genres including theatre and film. This course addresses the impact of Shakespeare at the theoretical and textual levels.

Course Description:

The course outlines the transfigurations of Shakespeare's plays as they were received in diverse cultures and the resonances and responses they evoked. It explores Shakespeare from a variety of critical positions ranging from discourses of race, gender, nation and geopolitics. The course focuses on the theoretical and creative reworking of Shakespearean plays, especially The Tempest, Macbeth, Hamlet,and Othello. These plays have been adapted/ re-written from the postcolonial, feminist, postmodern and queer perspectives in diverse media from theatre to the celluloid, from manga to pop art. Its national and regional adaptations have been incorporated too. Thus, it brings in theoretical analyses and creative interrogations of the conspicuous absences, racial prejudices, and ethnic intolerances in Shakespearean drama revealing the power structures, and delineates the modes in whichdiverse cultures reacted to the Eurocentric representations and imperial overtones in Shakespearean drama. The course is arranged in five modules. Module one comprises of essays that deal with various aspects of Shakespearean theatrical universe. Module two consists of diverse rereadings of Shakespeare's *The Tempest* and *Macbeth.* The Third Module consists of adaptations of and rereadings on Othello and Hamlet. Module four showcases celebrated fictional rewritings of Shakespeare. Module five explores the onscreen adaptations of the Shakespearean universe.

Module 1 [Theoretical]:

1.1 Harold Bloom: 'Shakespeare's Universalism' from *Shakespeare: The Invention of the Human*. New York: Riverhead, 1998. (Available in kupdf.net)

1.1 Alan Sinfield: 'Royal Shakespeare: Theatre and the Making of Ideology' from Political Shakespeare: Essays in Cultural Materialism. Ed. Jonathan Dollimore and Alan Sinfield.

1.3 Christopher Hoile: "*King Lear* and Kurosova's *Ran* .Splitting, Doubling and Distancing". *Pacific Coast Philology Vol*. 22, No. 1/2 (Nov., 1987), pp. 29-34 (6 pages) (available in Jstor)

Module 2 [Tempest and Macbeth]:

2.1 Aime Cesaire: Une Tempeste (A play translated as A Tempest)

2.2 Welcome Msomi: uMabatha(in Adaptations of Shakespeare: A Critical Anthology of Plays. Routledge,2000)

Seminar:

2.3 Stephen Orgel: "Prospero's Wife." *Representations*8 (1984): 1-13 (available in JStor)

2.4 Sandra M. Gilbert: '"Unsex Me Here": Lady Macbeth's 'Hell Broth'in *Discovering literature: Shakespeare and Renaissance*, April 2016

Module 3 [Othello and Hamlet]:

3.1 Bernard Jackson: Iago

3.2 Tom Stoppard: Rosencrantz and Guildenstern are Dead

Seminar:

3.3 Kezia Vanmeter Sproat: 'Rereading *Othello*, II, 1'*The Kenyon Review*New Series, Vol. 7, No. 3 (Summer, 1985), pp. 44-51

2. Elaine Showalter: "Ophelia, Gender and Madness"Shakespearean Criticism: Hamlet (Vol. 59)

Module 4 [Shakespeare and Fiction]:

4.1 Anthony Burgess: Nothing Like the Sun

4.2 Margaret Atwood: Hagseed

4.3 Ian McEwan: Nutshell

Seminar:

4.4 Valeria Luiselli: "Shakespeare, New Mexico" (tr. Christina MacSweeney **)**

4.5 Soledad Puértolas:"The Secret Life of Shakespeareans" (tr. Rosalind Harvey)

[The stories are taken from*Lunatics, Lovers and Poets: Twelve Stories After Cervantes and Shakespeare,* (And Other Stories, 2016) Edited by Daniel Hahn and Margarita Valencia.]

Module 5 [Shakespeare on Screen]:

5.1 Shakespeare in Love (John Madden)

5.2 Ran(Akira Kurosawa)

5.3 Hamlet(Michael Almereyda)

5.4 Angoor (Gulzar)

Seminar:

5.5 Ania Loomba: "Shakespeare and the Possibilities of Postcolonial Performance" in Barbara

5.6 Hodgdon and W. B. Worthen (eds), *A Companion to Shakespeare and Performance*, 2005

Texts for Consultation:

1. Mark Thornton Burnett and Ramona Wray, eds. *Screening Shakespeare in the Twenty-First Century*

2. Russell Jackson ed. *The Cambridge Companion to Shakespeare on Film*

3. Ania Loomba , and Martin Orkin, eds. *Postcolonial Shakespeares*

4. Kenneth Rothwell.*A History of Shakespeare on Screen*

5. Jonathan Dollimore and Alan Sinfield, eds. *Political Shakespeare: Essays in Cultural Materialism*

6. Emily C Bartels. "Making more of the Moor: Aaron, Othello, and Renaissance Refashionings of Race. Shakespeare Quarterly. 41.4 (1990): 433-54.

7. Rob Nixon. "Caribbean and African Appropriations of *The Tempest*"Critical Inquiry13 (1987)557-78

8. Katherine E. Kelly,ed. *The Cambridge Companionto Tom Stoppard*

9. Anthony Jenkins. *The Theatre of Tom Stoppard*

10. Jenny S. Spencer. *Dramatic Strategies in the Plays of Edward Bond*

11. Samuel Crowl. “The Bow Is Bent and Drawn: Kurosawa's Ranand the Shakespearean Arrow of Desire,” Literature/ Film Quarterly 22. 2. (1994): 109-16I

12. Kathy Howlett, “Are You Trying to Make Me Commit Suicide? Gender, Identity, and Spatial Arrangement in Kurosawa's Ran.” Literature/ Film Quarterly 24. 4. (1996): 360-66.

13. R. B. Parker. The Use of Mise-en-Scène in Three Films of King Lear." Shakespeare Quarterly42. 1 (1991): 75-90

14. Christine Mangala Frost. “30 Rupees for Shakespeare: a Consideration of Imperial Theatre in India.” Modern Drama, Volume 35, Number 1, Spring 1992, pp. 90-100

15. Ayanna Thompson. “Unmooring the Moor: Researching and Teaching on YouTube.” Shakespeare Quarterly, Volume 61, Number 3, Fall 2010, pp. 337-356

16. Gitanjali Sahani and Brinda Charry: “The Bard in Bollywood: The Fraternal Nation and Shakespearean adaptation in Hindi Cinema” in *Shakespeare and the Ethics of Appropriation*, edited by Alexa Huang and Elizabeth Rivlin.

17. Marydass C. *What Yokes Shakespeare and Tagore*.

18. Paul Brown. “This thing of Darkness I acknowledge Mine: The Tempest and the Discourse of Colonialism” from Political Shakespeare: Essays in Cultural Materialism. Ed. Jonathan Dollimore and Alan Sinfield

19. James Tweedie. “Caliban's Books: The Hybrid Text in Peter Greenaway's Prospero's Books.” Cinema Journal, 40, Number 1, Fall 2000, pp. 104-126.

Semester 4 – Elective Course:
[EN800403] -Public Domain Writings

Total Credits: 3
Total Hours: 25
Weightage:

Objectives:
To introduce to the student to the concept of the public sphere, and to enable him/her to reflect on critical issues related to everyday life, events, locales, opinions and individual/social rights.

Course Description:
The concept of the public sphere is introduced through a short article (encyclopaedia article) by Habermas. Habermas's later writings amplify and clarify the positions (Structural Transformation of the Public Sphere. "Further Reflections on the Public Sphere"). This is accompanied by articleson recent trends in media studies and cultural policy studies. The texts included in different modules represent sampling of issues/temporalities/spaces: censorship, counterculture, museums andspatialization. The selections examine neoliberal impulses, changing dynamics of democracy, the media and art, new models of commerce, urban planning, environment and nation-building. Relevant movies, novels, poems, docu-movies, music, graphic-non-fiction, graffiti and documentaries have been interspersed in the study along with articles from diverse sources across the world.

Module I [Conceptual]:

1.1 Jürgen Habermas; Sara Lennox; Frank Lennox: "The Public Sphere: An Encyclopaedia Article (1964)" New German Critique, No. 3. (Autumn, 1974), PP. 49-55.
1.2 Edward Herman and Robert McChesney: Introduction to "The Global Media: The New Missionaries of Corporate Capitalism". PP. 1-10.
1.3 Douglas Kellner: Reading Images Critically: Toward a Postmodern Pedagogy (Journal of Education. Volume 170. Number 3. 1988. PP.31-52.
1.4 Jim McGuigan: Cultural Policy Studies (Critical Cultural Policy Studies: A Reader, Ed. Justin Lewis and Toby Miller, Blackwell, PP. 23-28)

Module 2 [Censorship/Surveillance]:
2.1 Someshwar Bhowmik: "A Medium in Chains?". (Cinema and Censorship: The Politics of Control in India, PP. 325 - 346)
2.2 Pramod K. Nayar. "I Sing the Body Biometric: Surveillance and Biological Citizenship," (EPW.11 August 2012) **&**"Our Data, Their Data" (Telangana Today. p. 8. January 24, 2019)
2.3 Kamila Shamsie: Home Fire (Novel)

Seminar:
2.4T.K. Rajeevkumar: "Thalsamayam Oru Penkutty" (A Girl on Live) – Movie - https://www.youtube.com/watch?v=R6tlonMmsxg

Module 3 [Counterculture]:
3.1 Meena T. Pillai: "The Many Misogynies of Malayalam Cinema" (EPW, Vol. 52, Issue No. 33, 19 Aug, 2017)
3.2 T. M. Krishna: "'Our Music is About Raw Primal Instinct' - 60 Minutes: with the Casteless Collective" (Magazine. The Hindu. 20/01/2019)
3.3 Manu S. Pillai: "Muddupalani, the Woman who had no Reason for Shame". (The Hindu. 02 June 2018.)
3.4 Jack Kerouac: On the Road (Novel)

Seminar:
3.5 Aja Romano: "Bohemian Rhapsody" loves Freddie Mercury's Voice. It Fears his Queerness. (https://www.vox.com/2018/11/16/18071460/bohemian-rhapsody-queerphobia-celluloid-closet-aids)
3.6 Thierry Guta and Banksy: "Exit through the Gift Shop: A Banksy Film" (Docu-movie on Graffiti, https://www.youtube.com/watch?v=IqVXThss1z4)

Module 4 [Exhibitions/Collections/Memories]:
4.1 Tony Bennett: "The Political Rationality of the Museum" (Critical Cultural Policy Studies: A Reader, Ed. Justin Lewis and Toby Miller, Blackwell, PP. 180-187)
4.2 Lola Mac Dougall: "The Photographer as Collector: Four Women Photographers at Serendipity Recast the Past in Unpredictable Ways" (Magazine. The Hindu. 20/01/2019)
4.3 Aanchal Malhotra: A Ghaz for my father and a Ghara for my Mother – a multidisciplinary book- (Chapter 1, *Remnants of a Separation: A History of the Partition through Material Memory*)

Seminar:
4.4 OrhanPamuk: The Museum of Innocence (Novel)

Module 5 [Spatialisation]
5.1 Kenneth T. Jackson: "All the World's a Mall: Reflections on the Social and Economic Consequences of the American Shopping Center" (Critical Cultural Policy Studies: A Reader, Ed. Justin Lewis and Toby Miller, Blackwell, PP. 327-334)
5.2 Joe Sacco: Palestine (Non-fiction Graphic Novel)

Seminar:
5.3 Mary Oliver: Sleeping in the Forest (Poem)
5.4 S. Joseph: On the College Wall (Poem translated from Malayalam by Ajay Sekher)
5.5 Killer Whale Attack: Documentary (https://www.youtube.com/watch?v=vAaHUg0wSzo)

Specific Additional Readings:

1. JűrgenHabermas: The Structural Transformation of the Public Sphere. MIT, 1989.
2. JűrgenHabermas: "Further Reflections on the Public Sphere" (Calhoun)
3. Danielle Kutner: "Aura, Technology and society: Theodor Adorno and Walter Benjamin on the Revolutionary Potential of Art"
4. Edward Herman and Robert McChesney: The Global Media: The New Missionaries of Corporate Capitalism
5. Douglas Kellner: Media Culture: Cultural Studies, Identity, and Politics between the Modern and the Postmodern
6. Justin Lewis and Toby Miller (Eds): Critical Cultural Policy Studies: A Reader
7. Someswar Bhowmik: Cinema and Censorship: The Politics of Control in India
8. KabirAltaf: 'Kamila Shamsie's*Home Fire*: A Modern Antigone'
9. Margarita Alario: 'Environmental Destruction and the Public Sphere: On Habermas' Discursive Model and Political Ecology. *Social Theory and Practice*,Vol. 20, No. 3 (Fall 1994), PP. 327-341

Texts for Consultation:

1. Craig Calhoun: Habermas and the Public Sphere. MIT, 1996.
2. Arturo Escobar: Encountering Development: The Making and Unmaking of the Third World. Princeton UP, 1996.
3. Susie Tharu and K. Lalita eds., Women Writing in India: 600 B.C. to the Present, Volume I: 600 B.C. to the Early 20th Century, The Feminist Press at the City University of New York, 1991
4. Vandana Shiva: Staying Alive
5. MadhavGadgil and RamachandraGuha: This Fissured Land: An Ecological History of India. Univ. of California Press, 1993.
6. MadhavGadgil and RamachandraGuha: The Use and Abuse of Nature. OUP, 2005.
7. Edward S. Herman and Noam Chomsky: Manufacturing Consent:The Political Economy of the Mass Media. Pantheon, 1988.
8. Paulo Freire: The Pedagogy of the Oppressed. Penguin, 1996.
9. Eduardo Galeano: Open Veins of Latin America

ELECTIVES

CLUSTER 2

21. Trauma Narratives and Memory [EN810401]
22. The Island in Literature [EN810402]
23. Literature and Film [EN810403]

Semester 4 - Elective Course:
[EN810401]-Trauma Narratives and Memory

Total Credits: 3
Total Hours: 25
Weightage:

Objectives:

This paper will examine a range of 'texts' from the critical perspective of trauma theory; this domain is relatively recent field which touches upon narrative, historical, theoretical, psychoanalytic and aesthetic categories.

Course Description:

This course attempts a familiarization of the interface between narratives, trauma and memory. *Module 1* is a conceptual orientation; it tries to situate, in a somewhat general way, the issue of 'the uncanny' through the readings of Ernst Jentsch, Sigmund Freud, Colin Davis, and Cathy Caruth. Inevitably E. T. A. Hoffman's story 'The Sandman' also gets a slot.
Module 2 is a 'one-of-a-kind' list that showcases 'Graphic literature'; it is felt that such a selection will highlight the issue of newer modes of representation that surpasses what is usually discussed under the rubric of 'literary representation', especially with regard to traumatic and uncanny events -Marjane Satrapi, Art Spiegelman, Kate Evans, and Malik Sajad take us through a route which is anything but 'comic.'
Module 3 is all about prose fiction; Elisabeth M. Loevlie, Anne Whitehead, Catalina Botez, W. G. Sebald, Toni Morrison, andCaryl Philips bring together myriad fictional and academic attempts at contextualizing the issue of trauma.
Module 4 is brings together the works of Ariel Dorfman, Sara Kane, and Joshua Sobol; all these texts are 'instances of theatre' tackling trauma.
Module 5 is the domain of cinema. The works/readings of Cathy Caruth, Shohini Chaudhuri, Paulo De Medeiros, Alain Resnais, Alfonso Cuaron, Margarida Cardoso, and Teresa Prata reveal the dogged cinematic determination that is evident when cinema 'cans' the uncanny and the traumatic.

Module 1[Uncanny]:

1.1 E. T. A. Hoffman: 'The Sandman'
1.2 Ernst Jentsch: 'On the Psychology of the Uncanny.'
1.3 Sigmund Freud: 'The Uncanny'
1.4 Cathy Caruth: 'Traumatic Awakenings (Freud, Lacan and the Ethics of Memory)' in *Unclaimed Experience: Trauma, Narrative, and History*. (The Johns Hopkins University Press, 1996)
1.5 Colin Davis: 'Hauntology, Spectres and Phantoms'

Module 2[Graphic Novels]:

2.1 Marjane Satrapi: *The Complete Persepolis* (2007)

2.2 Malik Sajad: *Munnu*: *A Boy From Kashmir* (2015)
Seminar:
2.3 Kate Evans: *Red Rosa: A Graphic Biography of Rosa Luxemburg* (2015)
2.4 Art Spiegelman: *The Complete Maus* (1973; 1986)

Module 3[Fiction]:
3.1 Elisabeth M. Loevlie: 'Faith in the Ghosts of Literature. Poetic Hauntology in Derrida, Blanchot and Morrison's *Beloved*'.
3.2 Anne Whitehead: 'Othello in the Ghetto: Trauma and Intertextuality in Caryl Philip's *The Nature of Blood'*in *Trauma Fiction* (Edinburgh University Press, 2016)
3.3 Catalina Botez: 'Trauma Obscura Revealed: Revisiting Loss in W. G. Sebald's *Austerlitz*'
Seminar:
3.4 W.G. Sebald: *Austerlitz*
3.5 Toni Morrison: *Beloved*
3.6 Caryl Philips: *The Nature of Blood*

Module 4[Drama]:
4.1 Ariel Dorfman: *Death and the Maiden* (1990)
4.2 Sara Kane: *4.48 Psychosis* (2000)
Seminar:
4.3 Joshua Sobol: *Ghetto* (1984)

Module 5[Cinema]:
5.1 Cathy Caruth: 'Literature and the enactment of Memory (Dura, Resnais, *Hiroshima mon amour*)' in *Unclaimed Experience: Trauma, Narrative, and History*. (The Johns Hopkins University Press, 1996)
5.2 Shohini Chaudhuri: 'Unpeople: postcolonial reflections on terror, torture and detention in *Children of Men*' in Sandra Ponzanesi & Marguerite Waller (eds), *Postcolonial Cinema Studies* (Routledge, 2012)
5.3 Paulo De Medeiros: 'Spectral postcoloniality: lusophone postcolonial film and the imaginary of the nation' in Sandra Ponzanesi & Marguerite Waller (eds), *Postcolonial Cinema Studies* (Routledge, 2012)
Seminar:
5.4*Hiroshima mon amour* (Alain Resnais, 1959)
5.5*Children of Men* (Alfonso Cuaron, 2006)
5.6*The Murmuring Coast* (Margarida Cardoso, 2004), *Sleepwalking Land* (Teresa Prata, 2007)

Specific Additional Readings/Viewings:
0. *Testamento* (Francisco Manso, 1997),*Angola, Saudades from the One who Loves You* (Richard Pakleppa, 2005)
1. Jacques Derrida: "The Double Session", in Dissemination, London, 1981

2. Jacques Derrida: *Spectres of Marx*,
3. Michelle Balaev: 'Literary Trauma Theory Reconsidered'
4. Judit Pieldner: 'The Topography of Memory in W. G. Sebald's *Austerlitz*'
5. Catalina Botez: 'Exploring the Edge of Trauma in W. G. Sebald's novel *Austerlitz*'
6. Sara Soncini: "A horror so deep only ritual can contain it": The art of dying in the theatre of Sarah Kane'
7. Carolina Sanches on Sara Kane
8. Ivo Cermac on Sara Kane
9. David Luban: On Dorfman's *Death and the Maiden*,
10. David Schroeder: Dorfman, Schubert, and *Death and the Maiden*,
11. Alan Bern on Joshua Sobol's *Ghetto*
12. Notes on Marjan Satrapi's *Persepolis*
13. Art Spiegelman - Teachers Guide
14. Michael Cromer: Getting Graphic with the Past: Graphic Novels and the Teaching of History
15. Sohini Kumar - Study on *Munnu*…
16. Astrid Erll on Trauma and Media Memory Studies
17. Jacques Lacan: "The Symbolic Order" (Rivkin and Ryan)
18. Slavoj Zizek: *Mapping Ideology*

Texts for Consultation:

1. Roger Luckhurst: *The Trauma Question,* London: Routledge, 2008
2. Geoffrey Hartman (ed.): *Holocaust Remembrance: The Shapes of Memory*, Oxford: Blackwell, 1994)
3. Shoshana Felman and Dori Laub: *Testimony: Crises of Witnessing in Literature, psychoanalysis, and history.*
4. Lawrence Langer: *Holocaust Testimonies: The Ruins of Memory,* New Haven; London: Yale University Press, 1991.
5. Robert Antelme: *The Human Race (*1947)
6. Charlotte Delbo: *None of us will Return (*1965)
7. Primo Levi: *If this is a Man*;and*TheTruce (*1958)
8. Theodor Adorno: 'Commitment' 1962 in *The Essential Frankfurt School Reader,* New York: Urizen Books, 1978
9. Theodor W. Adorno: 'After Auschwitz' [1966] in *Negative Dialectics*, trans. E. B. Ashton Routledge, 1973.
10. Hannah Arendt: *Eichmann in Jerusalem: a Report on the Banality of Evil*, New York, N.Y. : Penguin Books, 2006
11. Shoshana Felman: *The Juridical Unconscious:Trials and Traumas in the Twentieth Century*, Cambridge, MA: Harvard University Press, 2002.

Semester 4 - Elective Course:
[EN810402] -The Island in Literature

Total Credits: 3
Total Hours: 25
Weightage:

Objectives: This course aims at introducing students to select instances of how 'islands' have been portrayed as symbols, metaphors, motifs and themes in literature. Broadly, the intended focus will be on how these portrayals have been understood, situated and subsequently discussed in relation to contemporary theories, especially post-colonial, and self-refexive perspectives.

Course Description: The course has 5 modules.
Module 1 provides a broad framework within which one can discern the whole notion of 'literary islands.' The essays by Stephanos Stephanides/Susan Bassnett,Ashleigh Harris and Ioana Andreescu chart out the domain of the subsequent discussions.
Module 2 brings together three authors who 'rewrite', 'negotiate' the canonical Island Narrative *Robinson Crusoe*: J. M. Coetzee, Michel Tournier and Derek Walcott.
Module 3 is a constellation of the reworkings of William Shakespeare's *The Tempest*: The works by Marina Warner, Jamaica Kincaid and David Malouf are undergirded by both postcolonial and island-geographic cultural concerns.
Module 4 is a select 'deep focus' on the ways in which 'Europe' has created the 'island-as-metaphor'. The political and semiotic layers of this endeavor are reflected in the works of D H Lawrence, Jose Saramago and Joseph Conrad.
Module 5 puts forth a selection that has 'meta-ramifications'; the works of Adolfo Bioy Casares, Umberto Eco and John Fowles all retain an onus on self-reflexivity with regard to the literary notion of 'the island.'

Module 1[Frameworks]:
1.1 Stephanos Stephanides and Susan Bassnett: 'Islands, Literature, and Cultural Translatability.'
1.2 Ashleigh Harris: '"The island is not a story in itself": apartheid's world literature.'
1.3 Ioana Andreescu: 'Narratives of the Literary Island: European Poetics of the Social System after 1945.'

Module 2[*Robinson Crusoe*]:
2.1 J. M. Coetzee: *Foe* [novel]
2.2 Michel Tournier: *Friday, or, the Other Island* [novel]
Seminar:
2.3 Derek Walcott: *Pantomime* [play]

Module 3[*The Tempest*]:
3.1 Marina Warner: *Indigo* [novel]
3.2 Jamaica Kincaid: *Annie John* [novel]
Seminar:
3.3 David Malouf: *Blood Relations* [play]

Module 4[Europe]:
4.1D H Lawrence: *The Man Who Loved Islands* [short story]
4.2 Jose Saramago: *The Tale of the Unknown Island* [short story]
Seminar:
4.3 Joseph Conrad: *Victory: an Island Tale* [novel]

Module 5[Self-reflexive]:
5.1 Adolfo Bioy Casares: *The Invention of Morel* [novel]
5.2 Umberto Eco: *The Island of the Day Before* [novel]
Seminar:
5.3 John Fowles: *The Magus* [novel]

Specific Additional Readings:
1. David Schalkwyk: *Hamlet's Dreams: The Robben Island Shakespeare*
2. Christopher Landrum: 'Robinson Crusoe – Metaphors'
3. Donata van der Rassel: 'What is left behind – The role of Friday in J.M. Coetzee's *Foe*'
4. Susan Naramore Maher: 'Confronting Authority: J.M. Coetzee's *Foe* and the Remaking of *Robinson Crusoe*'
5. A. Effe: 'Coetzee and the Ethics of Narrative Transgression: *Foe*'
6. Sandra Beckett: 'Michel Tournier's *Friday*'
7. Ioana Andreescu: 'Postwar Rewritings of *Robinson Crusoe* as an Act of Collective Memory'
8. Rick Dolphijn: 'Undercurrents and the Desert(ed): Negarestani, Tournier and Deleuze Map the Polytics of a 'New Earth''
9. Megan K Ahern:'Mimicry as Bourdieuian Heterodoxy in Walcott's *Pantomime*'
10. Giselle A Rampaul: 'Carnivalesque Reversals in Derek Walcott's *Pantomime*'
11. Xiana Vázquez Bouzó :'Overview of postcolonial re-writings from *Tempest* to *Indigo*'
12. Sofia Munoz:'Double Erasure in *Tempest* – Miranda'
13. Erin M. Presley:'Understanding Sycorax's Island in Marina Warner's *Indigo*'
14. Candice A. Pitts: 'Challenges to Nationhood in Kincaid's *Annie John*'
15. Rebecca Ashworth: "Writing Gender, Re-Writing Nation: *Wide Sargasso Sea, Annie John, Jane and Louisa Will Soon Come Home* and *Myal*"
16. Chinmoy Banerjee: 'Postcolonial Self-Fashioning in *Annie John*'
17. James Marland:'David Malouf,*Blood Relations*and *The Tempest*'
18. Helen Gilbert:'Topographies of the Body in the Writings of David Malouf'
19. Stefania Michelucci: 'D. H. Lawrence's Islands'
20. Johannes Riquet: 'D. H. Lawrence's Island Imaginaries'
21. Braudel papers:'on Saramago's *Unknown Island*'
22. Hania Nashef:'on Jose Saramago'
23. Robert Hampson: 'Silence and Secrets in Joseph Conrad's *Victory*'
24. George A. Panichas: 'Moral Warfare in Joseph Conrad's *Victory*'
25. Matt Bernico: 'on Adolfo Bioy Casares' novel *The Invention of Morel*'

26. Virgilio Fernandes Almeida: 'on Adolfo Bioy Casares' novel *The Invention of Morel*'
27. Krešimir Purgar: 'on Umberto Eco's *Island of the Day Before*'
28. Rama Kundu: 'on Umberto Eco's *Island of the Day Before*'
29. Barbara Hussey: 'on John Fowles's *The Magus*'
30. Aleks Matosoglu: 'on John Fowles's *The Magus*'
31. Daniel Graziadei: 'Island metapoetics and beyond: introducing island poetics'

Texts for Consultation:

1. Michel Houellebecq: *The Possibility of an Island*
2. Sarah Murphy: *The Measure of Miranda*
3. Michelle Cliff: *No Telephone to Heaven*
4. Gilles Deleuze: *Desert Islands*
5. Peter Abrahams's *This Island Now*
6. Michael Gilkes: *Prospero's Island*
7. Athol Fugard, John Kani and Winston Ntshona: *The Island*
8. Daniel Defoe: *Robinson Crusoe*. Ed. John J Richetti. Penguin.
9. John R Gillis: *Islands of the Mind: How the Human Imagination Created the Atlantic World*. Palgrave Macmillan.
10. William Shakespeare: *The Tempest*. Ed. Stephen Orgel. Oxford University Press.
11. Elizabeth McMahon:*Islands, Identity and the Literary Imagination*, Anthem Studies in Australian Literature and Culture

Semester 4 - Elective Course:
[EN810403] -Literature and Film

Total Credits: 3
Total Hours: 25
Weightage:

Objectives:
Cinema and Literature are connected /related to each other but still they are different in their own ways. This love-hate interface is amply embodied in the terrain of 'Adaptation' – of Literature into Film. This domain has always been one of the most fascinating forms of knowledge which has made great impact on human psyche. This course seeks to familiarise students with the nitty-gritty of Film Adaptations of Literature and the concomitant theoretical discussions.
Course Description:
Apart from the 3 introductory readings of *Module 1*, the course is schematized to represent film adaptations of literature in the following domains: Epic/Myth (*Module 2*), Theatre (*Module 3*), and Novel (*Module 4*). The last module (*Module 5*) is customized to accommodate film adaptations from Kerala.
Special Note 1: *Module 3* merits a specific mention. In many ways, it is Shakespeare who is the point of discussion: 3 Hamlet-films, 3 Macbeth-films and 2 Othello-films. **Also,do note** that the questions will not only be oriented in accordance with the 'accompanying reading', but it will also include 'comparative' analysis, especially with reference to the so-called 'original' Shakespearean texts.
Special Note 2: Questions on the films included in the Seminar Fields will be derivative of the films in the main sections of the respective modules.

Module 1[Film (as) Adaptation]:
1.1 Robert Stam: 'Beyond Fidelity: The Dialogics of Adaptation'
1.2 Brian McFarlane: *Novel to Film: An Introduction to the Theory of Adaptation*;
Part I - Backgrounds, Issues, and a New Agenda
1.3 Lindiwe Dovey: 'Towards an Art of Adaptation: Film and the New Criticism-as-Creation.'

Module 2[Epic/Myth]:
2.1*The Godfather* [Francis Ford Coppola, 1972] /
- Nick Browne: 'Fearful A-Symmetries: Violence as History in the Godfather Films.'
2.2*Troy* [Wolfgang Petersen, 2004] /
- Ruby Blondell: 'Third cheerleader from the left': fromHomer's Helen to Helen of Troy.'
2.3*Beowulf* [Robert Zemeckis, 2007] /
- Eleanor Grigg: 'Beowulf, the film.'
Seminar:
2.4*Mother India* [Mehboob Khan, 1957] /
- Vijay Mishra: 'The Texts of *Mother India*'
2.5*Raavan* (Hindi) / *Ravanan* (Tamil) [Mani Ratnam, 2010] /
- Amit Basole: 'Subverting Our Epics: Mani Ratnam's Retelling of the *Ramayana*.'

Module 3[Theatre]:
3.1*Hamlet* [Michael Almereyda, 2000] / *Hamlet* [Franco Zeffirelli, 1990] /
- Elsie Walker: 'A "Harsh World" of Soundbite Shakespeare:Michael Almereyda's *Hamlet*.'

3.2*Throne of Blood* [Akira Kurosawa, 1957] /*Macbeth* [Justin Kurzel, 2015]
- Dolores P. Martinez:'From 'Scottish' Play to Japanese Film: Kurosawa's*Throne of Blood*.'
- Louise D'Arcens: 'Feeling Medieval: Mood and Transhistorical Empathy in Justin Kurzel's *Macbeth*.'
3.3*Jarum Halus* [Mark Tan, 2008] / *O* [Tim Blake Nelson, 2001] / *Othello*
- Su Mei Kok: 'Malaysian Moors: Ethnicity, Speech, and Identity in *JarumHalus*.'
- Brittany Rowland:'*Othello* and Tim Blake Nelson's 'O': Shakespearean Violence in High School.'
Seminar:
3.4*Haider* [Vishal Bhardwaj, 2014] /
- Brian Walsh: 'Resisting *Hamlet*: Revenge and Nonviolent Struggle in Vishal Bhardwaj's *Haider*'
3.5*Kaliyattom* [Jayaraaj, 1997] /
- Sujata Iyengar: 'Beds, Handkerchiefs, and Moving Objects in *Othello*'

Module 4[Novel]:
4.1*Les Misérables* [Claude Lelouch. 1995] /
- Walter C. Metz: 'From Jean-Paul Belmondo to Stan Brakhage: Romanticism and Intertextuality in*Irma Vep* and *Les Misérables*'
4.2*Great Expectations* [Alfonso Cuarón, 1998] /
- Steve Vineberg: 'Alfonso Cuarón's *Great Expectations*'
4.3*The Colour Purple* [Steven Spielberg, 1985] /
- Maria Fas: 'The Walker-Spielberg Tandemand Lesbianism in *The Color Purple*:"[Spielberg] Don't Like It Dirty"'
Seminar:
4.4*Pather Panchali* [Satyajit Ray, 1955] /
-C. G. Shyamala:'A Deconstructive Reading of Satyajit Ray's *Pather Panchali*.'
4.5*Umrao Jaan* [Muzaffar Ali, 1981] /
- Ayesha Arfeen: 'The Institution of *Kotha*: A Case Study of Tawaif-Centered Films.'

Module 5[Malayali Resonances]:
5.1*Chemmeen*[Ramu Kariat, 1965] /
- Mini Chandran: 'Not Lost in Translation:*Chemmeen* on Alien Shores.'
5.2*Mathilukal* [Adoor, 1990] /
- Krishnakumari M. P.: 'Basheer/Adoor: The Voice Beyond the Wall.'
5.3*Mazha*[Lenin Rajendran, 2000] /
- C. S. Venkiteswaran: '*Mazha*: From Story to Film.'
Seminar:
5.4*Nirmalyam* [M. T., 1973] /
- Meena T. Pillai: 'From *Pallivallum Kalchilambum* to *Nirmalyam*: Resurrecting the 'Word' and the 'World'.
5.5*Kanchanaseetha* [Aravindan, 1977] /

- Vasanthi Sankaranarayanan: 'On Adaptation: With Special Reference to Aravindan's *Kanchanaseetha* and *Chidambaram*.'

Specific Additional Readings:

1. Veena Talwar Oldenberg: "Lifestyle as Resistance: The Case of the Courtesans of Lucknow," in *Contesting Power: Resistance and Everyday Social Relations in South Asia*, ed. Douglas Haynes and Gyan Prakash (Berkeley: U of California P, 1992): 23-61.
2. Fareed Kazmi: "Muslim Socials and the Female Protagonist: Seeing a Dominant Discourse at Work," in *Forging Identities: Gender, Communities, and the State*, ed. Zoya Hasan (New Delhi: Kali for Women, 1994): 226-243.
3. Vijay Mishra: *Bollywood Cinema: A Critical Genealogy*.
4. Gayatri Chatterjee: *Mother India* (London: BFI, 2002).
5. Parama Roy: "Figuring Mother India: The Case of Nargis," in *Indian Traffic: Identities in Question in Colonial and Postcolonial India* (Berkeley: U of California P, 1998): 152-173.
6.Sumita Chakravarty: selection from Chapter 8, "Woman and the Burden of Postcoloniality: The Courtesan Film Genre," in *National Identity in Indian Popular Cinema 1947-1987* (Austin: U of Texas P, 1993): 269-293
7. Robert Stam: 'Revisionist Adaptation: Transtextuality, Cross-Cultural Dialogism, and Performative Infidelities.'

Texts for Consultation:

1. Robert Stam and Alessandra Raengo: *Literature and Film: A Guide to the Theory and Practice of Film Adaptation*, Wiley, 2005
2. Neil Sinyard: *Filming Literature: The Art of Screen Adaptation*, Routledge, 2013
3. Julie Sanders: *Adaptation and Appropriation*, Routledge, 2015
4. Brian McFarlane: *Novel to Film: An Introduction to the Theory of Adaptation*; Clarendon Press, Oxford, 1996
5.George Bluestone:*Novels into Film*,University of California Press, 1968
6. Andre Bazin: "Adaptation, or the Cinema as Digest" (1948),in*Bazin at Work* by Bert Cardullo, Routledge, 1997
7.Douglas M. Lanier: 'Hamlet: Tragedy and Film Adaptation' in Michael Neill and David Schalkwyk (Eds), *The Oxford Handbook of Shakespearean Tragedy*
8. James Naremore: *Film Adaptation*
9. Jay Gould Boyum: *Double Exposure: Fiction into Film*
10. Catherine Belsey:'Shakespeare and Film: A Question of Perspective.'in*Shakespeare on Film; Macmillan New Case Book.* Ed. Robert Shaughnessy.
11. Slavoj Zizek(ed): *Everything You Always Wanted to Know About Lacan (But Were Afraid to Ask Hitchcock)*

ELECTIVES

CLUSTER 3

24. Modern European Fiction [EN820401]
25. Modern European Drama [EN820402]
26. Indian Poetics: Theories and Texts [EN820403]

Semester 4 – Elective Course:
[EN820401] -Modern European Fiction

Total Credits: 3
Total Hours: 25
Weightage:

Course Objectives:
To familiarize the students with the evolution of European fiction over the latter half of the Nineteenth and early twentieth century

Course Description:
To acquaint the students with some of the major movements that shaped the growth of the European novel and the makers of European Fiction and to familiarize them with the writings of major novelists belonging to France, Germany, Russia, Greece, Italy and Austria spanning movements as varied as Realism, Existentialism, Naturalism and Postmodernism.

Module One:
1.1 Walter Cohen: "Modernism". *A History of European Literature*. Pp.413-420. Oxford: Oxford University Press, 2017
1.2 Jerome de Groot: "Postmodernism and the Historical Novel" in *The Historical Novel* Pp. 109-133. London: Routledge, 2010.
1.3 Joseph Frank: "The Background of Crime and Punishment" in *Through the Russian Prism.* PP 122-136. Princeton: Princeton University Press, 1990

Module Two:
2.1 Gustave Flaubert: *Madame Bovary*
2.2 Fyodor Dostoevsky: *Crime and Punishment*
2.3 Emile Zola: *Nana*

Seminar:
2.4 Tolstoy: *Anna Karenina*

Module Three:
3.1 Nikos Kazantsakis: *Zorba the Greek*
3.2 Patrick Modiano: *The Missing Person*
3.3 Thomas Mann: *Death in Venice*

Seminar:
3.4 Boris Pasternak*: Doctor Zhivago*

Module Four:
4.1 Franz Kafka: *The Trial*
4.2 Albert Camus: *The Outsider*
4.3 J.M.G. Le Clezio: *Desert*

Seminar:
4.4 Herman Hesse: *The Glass Bead Game*

Module Five:
5.1 Italo Calvino: *The Invisible Cities*
5.2 Gunter Grass: *Cat and Mouse*
5.3 Primo Levi: *If Not Now, When?*

Seminar:
5.4 Elfriede Jelenik: *Lust*

Specific Additional Readings:
1. James McFarlane : "The Mind of Modernism" in *Modernism: A Guide to European Literature* (Eds) Malcolm Bradbury and James McFarlane, Penguin,1976,(71-94)
2. Umbereto Eco: "On Some Functions of Literature" in *Our Literature*.2002.(1-15)
3. Italo Calvino: "Literature as a Projection of Desire" in *The Uses of Literature*, Harcourt Brace, 1986(50-61)

Texts for Consultation:

1. Franco Moretti (Ed): *The Novel: Forms and Themes Vol. 2*
2. Mario Vargas Llosa: *The Perpetual Orgy: Flaubert and Madame Bovary*
3. Georg Lukacs: *The Theory of the Novel*
4. Joseph Frank: *Dostoevsky: A Writer in His Time* (third and fourth volumes)
5. Mikhail Bakhtin: *The Dialogic Imagination*
6. Julian Preece: *The Life and Work of Gunter Grass*
7. Umberto Eco: *Six Walks in the Fictional Woods*
8. Sigmund Freud: *Mourning and Melancholia*
9. Primo Levi: *The Survival in Auschwitz*
10. Beren Lang. (ed): *Writing and the Holocaust*
11. Dominick La Capra: *Writing History, Writing Trauma*
12. Jacques Derrida: *The Other Heading*
13. Georg Lukacs: *Studies in European Realism*
14. Bill Overton: *The Novel of Female Adultery; Love and Gender in Continental European Fiction, 1830-1900*
15. George Steiner: *Tolstoy or Dostoevsky*
16. Ulrich Beck: *The Metamorphosis of the World*
17. Ronald Heyman: *Doestoevsky*
18. Gilles Deleuze: *Kafka: Toward a Minor Literature*
19. Giorgio Agamben: *Remnants of Auschwitz : The Witness and Archive*

Semester 4 – Elective Course:
[EN820402] -Modern European Drama

Total Credits: 3
Total Hours: 25
Weightage:

Objectives:
To familiarize the student with modern European Drama in terms of topics, perspectives, and dramatic literature
.
Course Description:
This paper contains representative works to acquaint the student with the social and cultural contexts that inform modern European Drama. The conventions of play beginning from the turn of the century realistic plays to the postmodern experiments are chosen. The paper contains representative plays of the Realistic, Naturalistic, Modernist, epic theatre, Theatre of the Absurd and postmodernist theatre. The paper has five modules. The first module consists of introductory essays on both modernist and postmodernist theatre along with some key terms associated with it. The teacher and the learner are expected to address these terms while studying the representative plays. The second, third and fourth modules consist of representative plays of the various modernist dramatic modes. The fifth Module entirely consists of postmodern plays. While dealing with them the teacher and the learner are expected to keep in mind the characteristics of postmodern plays in general. The student is also encouraged to revisit the ideological foundations of modernism. The student is to be acquainted with how the diversified movements in post-modernist theatre are informed by the theatre's increasing propensity to self-consciousness besides discussing poststructuralist theories and feminist theatre, environmental theatre, multicultural theatre, performance theories, threat from the cinema and the future of theatre.

Module 1:
1.1 John Fletcher and James McFarlane: "Modernist Drama: Origins and Patterns" in Modernism: A Guide to European Literature. Eds. Malcolm Bradbury and James McFarlane. Penguin, 1991.
1.2 Philip Auslander: "Postmodernism and Performance". (Pages 97- 115) Published in *Cambridge Guide to Postmodernism.* Edited by Steven Connor. Cambridge: Cambridge University Press, 2004
1.3 Key Terms: Realist Theatre, Naturalist Theatre, Meta theatre, Epic Theatre, Poor Theatre, Theatre of the Absurd, Theatre of Cruelty and Feminist Theatre

Module 2:
2.1 Henrik Ibsen: A Doll's House
2.2 August Strindberg: Miss Julie
Seminar:
2.3 Anton Chekhov: The Cherry Orchard

Module 3:
3.1 Luigi Pirandello: Six Characters in Search of an Author

3.2 Bertolt Brecht: The Life of Galileo
Seminar:
3.3 Federico Garcia Lorca: Blood Wedding

Module 4:
4.1 Sartre: The Flies
4.2 Jean Genet: The Maids
Seminar:
4.3 Eugene Ionesco: Rhinoceros

Module 5:
5.1 Heiner Muller: Hamletmachine
5.2 Georg Büchner: *Woyzeck*
Seminar:
5.3 Samuel Beckett: Catastrophe

Specific Additional Readings:
1. *Catastrophe*, in *Collected Shorter plays of Samuel Beckett* (London: Faber, 1984) 295-301)
2. Beryl S. and John Fletcher, *Student's Guide to the Plays of Samuel Beckett* 2d ed.(London: Faber, 1985)
3. Jonathan Kalb, *The Theater of Heiner Müller* (Cambridge: Cambridge University Press, 1998)
4. David Barnett, *Literature versus Theatre. Textual Problems and Theatrical Realization in the Later Plays of Heiner Müller* (Berne: Lang, 1998)
5. *A Glossary of Literary Terms 10th* (*tenth*) *Edition* by Abrams, M.H., Harpham, Geoffrey published by Cengage Learning (2011)
6. *Cambridge Guide to Postmodernism* Edited by Steven Connor. Cambridge: Cambridge University Press, 2004
7. Modernism: *A Guide to European Literature*. Eds. Malcolm Bradbury and James McFarlane. Penguin,1991.
8. No Exit and Three Other Plays. By Jean Paul *Sartre*. NO EXIT (Huis Clos). THE *FLIES* (Les Mouches) translated from the French by Stuart Gilbert.

Texts for Consultation:
1. Patrick Campbell (ed): *Analysing Performance: Issues and Interpretations*. Manchester Univ. Press, 1996
2. Stephen Watt. *Postmodern/Drama: Reading the Contemporary Stage*. Ann Arbor: University of Michigan Press, 1998
3. Martin Esslin :*The Theatre of the Absurd*
4. Luigi Pirandello: "Preface to Six Characters in Search of an Author"
5. Bertolt Brecht: A Short Organum for the Theatre
6. Keir Elam: Semiotics of Theatre and Drama
7. Dario Fo: Accidental Death of an Anarchist

8. Max Frisch: The Fire Raisers
9. John Willet: Brecht on Theatre: The Development of an Aesthetic
10. Eric Bentley: The Playwright as Thinker: A Study of Modern Drama in Modern Times

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Semester 4 – Elective Course:
[EN820403] – Indian Poetics: Theories and Texts

Total Credits: 3
Total Hours: 25
Weightage:

Objectives:
The aim of the course is to familiarise the students with the major texts of the Indian tradition in the light of Indian poetic principles.

Course Description:
The eight major schools of Indian Aesthetics are to be introduced. The two cardinal schools viz. Rasa and dhwani are to be discussed in detail. The students must be familiar with the strong geopolitics behind Tamil poetics. Texts have to be discussed in the light of the theories. Questions pertaining to the dominant aesthetic sentiment, the suggestive potential of the language of the text, and so on need to be raised. Alternative readings have to be encouraged. Issues like the ideological ramifications of the erotic sentiment as a tool for the containment of women, the heroic sentiment as a mechanism for authenticating kingship and social stratification, the distinction of language into Sanskrit for noble men and Prakrit for menial characters and women, the division of space into domestic and exterior and its significance in the domestication of women, the significant absence of women (with the possible exception of Avvayyar) etc. are to be highlighted. Students may be encouraged to read Romila Thapar's analysis of Shakuntalam to see the drastic difference in the portrayal of women in the epic and the play. How Sanskrit became an Orientalist imperial weapon also may be analysed.

MODULE 1:

1.1S.S. Barlingay: "Various Senses of the Word Rasa" (A Modern Interpretation to Indian Aesthetic Theory. Ch.4 PP.84-102)

1.2K.K. Kunjunni Raja: The Theory of Dhvani (Indian Aesthetics. Ed. V.S. Sethuraman)

1.3 A K Ramanujan:"The Five Landscapes" (Ed. Poems of Love and War 236-43)

MODULE 2:

2.1"Drona Parva" from the Mahabharata

2.2 Bhana Bhatta: Kadambari

Seminar:
2.3"Sundara Kanda" from the Ramayana

MODULE 3:

3.1 Kalidasa: Abhijnana Shakuntala (Ed. Romila Thapar)

3.2 Sudraka: Mrichakatika (The Little Clay Cart)

Seminar:

3.3 Vishakhadatta: Mudrarakshasa

MODULE 4:

4.1 Bhasa: Urubhanga

4.2 Jayadeva: "Song to the Melody Gurjari" in Gitagovinda

Seminar:

4.3 Bhavabhuti: Uttararamacharita

MODULE 5:

5.1 Ilango Adikal: Chilappatikaram

Seminar:

5.2"Palai" from A. K. Ramanujan (Poems of Love and War)

Texts for Consultation:

1. S K Nandi. Studies in Modern Indian Aesthetics Simla: Indian Institute of Advanced Study, 1975

2. Sudhakar Pandey and V N Jha eds.: Glimpses of Ancient Indian Poetics: From Bharata to Jagannatha. Delhi: Indian Book Centre, 1993

3. A V Subrahmanian: The Aesthetics of Wonder: New Findings in Sanskrit Alankarasastra Delhi: Motilal Banarsidas, 1988

4. Kapil Kapoor: Literary Theory: Indian Conceptual Framework. New Delhi: Affiliate East-West Press, 1998.

5. Sushil Kumar De.: History of Sanskrit Poetics Calcutta: Firma, 1988.

ELECTIVES

CLUSTER 4

27. English Language Teaching (ELT) [EN830401]
28. Translation Studies [EN830402]
29. Dalit Studies [EN830403]

Semester 4 – Elective Course:
[EN830401] -English Language Teaching (ELT)

Total Credits: 3
Total Hours: 25
Weightage:

Objectives:

To provide the fundamental techniques of teaching English language

To expose the learner to various theories of ELT from the earliest to the modern

To help them understand the concepts related to second language acquisition and the related pedagogical issues

To equip them with the methods and means of assessment and evaluation

To create awareness about how the theory can be put to practice in the real classroom activity

Course Description:
The course is divided into five modules. These modules cover the significant areas in ELT and they provide information about the contemporary theories as relevant to ELT.

Module I [The Basics of ELT]:

Topics

1.1 Imparting the four skills: listening, speaking, reading and writing
1.2 The process of second language acquisition and second language learning: a. Acquisition and Learning, b. Differences between L1 and L2 acquisition
1.3 Macaulay's Minute on Education and its impact
1.4 The teaching and learning of English in pre-Independent India
1.5 Developments in the Teaching of English in India
1.6 English and Society in India - Issues in the pedagogy of English in India
1.7 World Englishes

Module 2 [A Historical Overview of the Theories of ELT and Learning Theories]:
Topics:

2.1 Basic theories of learning: Connectionist or behaviorist theories and cognitive theories, Gestalt field or field cognitive type of learning theory.
2.2 General references to theorists such as Edward L. Thorndike, John B. Watson, Evan Petrovich Pavlov, Burrhus Frederic Skinner, Wolfgang Kohler, Clark L. Hull, Kurt Lewin, and Robert Gagne
2.3 Differentiating Method, Approach and Technique in ELT
2.4 The Grammar - Translation method

2.5 The Direct method
2.6 The Audio Lingual Method: The audio-lingual method and the language lab
2.7 Total Physical Response
2.8 The Natural Approach
2.9 The Communicative Approach Psychological framework: the learner and the learning process Behavioural, Cognitive, structural and Socio cultural approaches toward teaching.
2.10 Communicative Language Teaching and the Bangalore Project
2.11 Task-Based Language Teaching

Seminar:

2.12 Importance of ELT theories in Practice

Module 3 [Techniques of Teaching]:

Topics:

3.1 Teaching Vocabulary: Active and Passive vocabularies; Techniques to introduce new words; Vocabulary expansion
3.2 Teaching spelling: Difficulties and remedies
3.3 Teaching Grammar: Theoretical grammar and pedagogical grammar substitution tables.
3.4 The deductive approach – rule-driven learning
3.5 The inductive approach – the rule-discovery path,
3.6 The functional- notional approach
3.7 Teaching grammar in situational contexts
3.8 Teaching grammar through texts.
3.9 Honing listening skills
3.10 Teaching the techniques of Writing and speaking
3.11 Error correction
3.12 Using a dictionary

Seminar: Incorporating activities from the following books:-

3.13 Scott Thornbury (2001) *Uncovering Grammar*
http://www.onestopenglish.com/methodology/methodology/methodology-articles/pdf-content/uncovering-grammar/153825.article

3.14 Ur, P. (2009). *Grammar practice activities*. Cambridge: Cambridge University Press

Module 4 [Teaching literature in an ELT classroom]:

Topics:

4.1 Theoretical Background: Teaching literature in an ELT classroom:
- **a.** Reasons for using literature in the language classroom
- **b.** The importance of response and literature teaching

4.2 Teaching Poetry: Literary Language; Literary competence; Deviant use of Language; Rhythm, intonation; Pronunciation with the help of phonetic script.

4.3 Teaching Prose: parts of speech, sentence structure, and punctuation. Strategies for creative writing: Shared writing through exchange of ideas; developing imagination, establishing context; developing dialogue; using appropriate vocabulary

4.4 Teaching Drama

a. Drama techniques for language learning

b. Using role play for language learning

4.5 Film in language teaching: Improving listening skills, pronunciation, and vocabulary (One helpful website: http://film-english.com)

4.6 The internet and ELT: impact of the internet on English learning

Seminar:

4.7 Teaching prose, poetry and drama in class (practice sessions)

Module 5 [The Process of Evaluation]:

Topics:

5.1 Selection, grading and sequencing of teaching items; Preparation of lesson plans for teaching English
5.2 Use of audio video aids
5.3 Classroom observation and research; Monitoring learners' progress and giving feedback
5.4 Evaluating classroom tests and other forms of assessment for different purposes; Bloom's Taxonomy
5.5 Error analysis and remedial teaching - their significance and rationale.
5.6 Tests and examination; Diagnostic tests and achievement tests

Seminar:

5.7 Preparing test materials and assessment charts

Texts for Consultation:

1. J. D. Brown: (1987). Principles of Language Learning and Teaching, Englewood Cliffs,New Jersey, Prentice-Hall.

2. J. D. Brown: (1995). The Elements of Language Curriculum. Boston, Heinle&Heinle

3. C. J. Brumfit: (1980). Problems and Principles in English Teaching. Oxford, Pergamon PressLtd.

4. M. Finocchiaroand C. Brumfit: (1983). The Functional-Notional Approach From Theory toPractice. Oxford, Oxford University Press

5. T. Hedge: (2000). Teaching and learning in the language classroom. Oxford, OxfordUniversity Press.

6. T. Hutchison and A. Waters: (1987). English for Specific Purposes. Cambridge UniversityPress.

7. R. L. Oxford: (1996). Language Learning Strategies Around the World: Cross-CulturalPerspectives. University of Hawaii, The USA.

8. Jack C. RichardsWilly A. Renandya: (2002) Methodology in language teaching: an anthology of current practice, Cambridge University Press, New York

9. B. Kumaravadivelu: (2006). Understanding Language Teaching from Method to Postmethod.New Jersey, Lawrence Erlbaum Associates.

10. J. C. Richards: (2001). Curriculum Development in Language Teaching. Cambridge,Cambridge University Press.

11. J. C. Richards and T. S. Rodgers: (1986). Approaches and Methods in Language Teaching.Cambridge, Cambridge University Press.

12. T. M. Silviyanti: (2014). Looking into EFL students' perceptions in listening by using English movie videos on YouTube. Studies in English Language and Education, 1(1), 42-58.

13. R. V. White: (1988). The ELT Curriculum. Oxford, Basil Blackwell Ltd.

14. H. G. Widdowson:(1990) Aspects of Language Teaching. Oxford, Oxford University Press.

15. D. A. Wilkins: (1976). Notional syllabuses. Oxford, Oxford University Press.

16. C. Brumfit: (1983). Language teaching projects for the ThirdWorld (ELT Documents 116). London: Pergamon Press &British Council

17. Peter James:(2001). Teachers in Action: Tasks for in-service Language Teacher Education And Development. United Kingdom: Cambridge University Press.

18. K -12 Classroom Digital Resources: https://padlet.com/dolajuwon1/gl5rhenz6h0r

Semester 4 - Elective Course:
[EN830402] -Studying Translations: Aspects and Contexts

Total Credits: 3
Total Hours: 25
Weightage:

Objectives: To familiarize the student to the contextual diversity of 'translations', and to introduce the theoretical/political positions related to Translation Studies.

Course Description: This paper conceives the terrain of Translation Studies both as a global phenomenon and as a culturally loaded region/subject-specific activity.
Module 1 seeks to familiarize students to certain Global Views on Translation Studies,through the readings selected fromWalter Benjamin, Susan Bassnet/ Harish Trivedi, and Antoinne Berman.
Module 2 takes a close look at certain Indian Views on Translation Studies through the works of A. K. Ramanujan, Sujit Mukherjee, Gayatri Chakravorty Spivak and Rita Kothari.
Module 3 pans the Fictional Terrain: Herein is included Albert Camus' French work *L'étranger* translated by Joseph Laredo as *The Outsider* and by Stuart Gilbert as *The Stranger*;C. Ayyappan's Malayalam story *Prethabhaashanam* translated by V. C. Harris as 'Spectral Speech' and by Udaya Kumar as 'Ghost Speech'; Miguel de Cervantes' Spanish work *Don Quixote* - A. The Windmill Episode as translated by Tobias Smollett and Edith Grossman, and B. The Profound Cave Episode as translated by John Ormsby and Edith Grossman.
Module 4 pans the Poetic Terrain. The selections include Songs of Solomon 1 and 2 in their King James Version and The New International Version; Pablo Neruda's 'Puedo Escribir Los Versos Mas Tristes Esta Noche' translated as 'Tonight I Can Write (The Saddest Lines)'by W. S. Merwin and as 'I Can Write the Saddest Verses Tonight' by Mark Eisner; Faiz Ahmad Faiz's *Mujh se pehli si mohabbat meri mehboob na maang*/ Don't ask me for that love again and *Tanhai*/Solitude as differently translated by Victor G Kiernan and Agha Shahid Ali; Edward Fitzgerald's and Hans van Rossum's translationsof *Rubáiyát* of Omar Khayyám and the Psalms of David: 22 and 23 in their King James Version and The New International Version.
Module 5 looks at 'inter-semiotic' translations/transcreations of 'Mythic Images'. Firstly, there is the 'switched heads trope' from the *Kathasarithasagara* as differently worked out by Thomas Mann and by Girish Karnad. Then there is Kalidasa's *Abhijnanasakuntalam* [Sanskrit] as differently translated by William Jones as *Sacontala or The Fatal Ring* and by Chandra Rajan as *Kalidasa: The Loom of Time* (*Abhijnanasakuntalam*).

Crucial Note: The primary logic of Modules 3, 4, and 5 is not a summation of the essential core of these texts. Beyond the content, the aim is to initiate discussions where multiple translations of the same text or transcreations of a 'core-motif' by subsequent writers can be seen in terms of nuanced divergences; this is tantamount to locating these texts as 'variants. The examination

questions will be customized to this very aspect – comparing multiple translations [TL] of a single text [SL].

Module 1 [Global Views on Translation Studies]:
1.1 Walter Benjamin: 'The Task of the Translator.' (*Translation Studies Reader* pp 15-25)
1.2 Susan Bassnet and Harish Trivedi: 'Introduction: Of Colonies, Cannibals and Vernaculars.' (pp 1 - 18 in *Postcolonial Translation: Theory and Practice*.
1.3 Antoinne Berman: 'Translation and the Trials of the Foreign.' in Lawrence Venuti (ed.), *The Translation Studies Reader*. London: Routledge. pp. 284 - 297.

Module 2 [Indian Views on Translation Studies]:
2.1 A. K. Ramanujan: 'Three Hundred Ramayanas: Five Examples and Three Thoughts on Translation.' (pp. 131 - 160 in *The Collected Essays of A K Ramanujan*)
2.2 Sujit Mukherjee: 'Translation as Discovery' (pp. 139-150 in *Translation as Discovery*)
2.3 Gayatri Chakravorty Spivak: 'The Politics of Translation.' in Lawrence Venuti (ed.), *The Translation Studies Reader*. London: Routledge. pp. 397- 416
Seminar:
2.4 Rita Kothari, "Cast(e) in a Caste-less language: English as a Language of 'Dalit' Expression". *EPW Vol*.48, Issue No. 39, 28 Sep, 2013

Module 3 [The Fictional Terrain]:
3.1 Albert Camus: L'étranger [French]
- *The Outsider* Trans. Joseph Laredo **&***The Stranger* Trans. Stuart Gilbert.
3.2 C. Ayyappan: *Prethabhaashanam* [Malayalam]
-'Spectral Speech' Trans. V. C. Harris **&** 'Ghost Speech' Trans. Udaya Kumar
Seminar:
3.3 Miguel de Cervantes: *Don Quixote* [Spanish]
A. **The Windmill Episode**
[Part 1: Chapter 8: Of the good fortune which the valiant Don Quixote had in the terrible and undreamt-of adventure of the windmills, with other occurrences worthy to be fitly recorded]
- Tobias Smollett's translation **&** Edith Grossman's translation
B. **The Profound Cave Episode**
[Part 2: Chapter 23: Of the wonderful things the incomparable Don Quixote said he saw in the profound cave of Montesinos, the impossibility and magnitude of which cause this adventure to be deemed apocryphal.]
- John Ormsby's translation **&** Edith Grossman's translation

Module 4 [The Poetic Terrain]:
4.1 Songs of Solomon: 1[The Song of Songs, which *is* Solomon's. Let him kiss me with the kisses of his mouth…] & 2 [I *am* the rose of Sharon, *and* the lily of the valleys.]
- King James Version **&** The New International Version
4.2 Pablo Neruda: [Spanish] Puedo Escribir Los Versos Mas Tristes Esta Noche…

- 'Tonight I Can Write (The Saddest Lines)' – Trans. W. S. Merwin **&** 'I Can Write the Saddest Verses Tonight' - Trans. Mark Eisner

4.3 Faiz Ahmad Faiz: [Urdu]

A. *Mujh se pehli si mohabbat meri mehboob na maang*/ Don't ask me for that love again

B. *Tanhai*/Solitude

- Victor G Kiernan's translation **&** Agha Shahid Ali's translation

Seminar:

4.4*Rubáiyát* of Omar Khayyám: [Persian]

- Edward Fitzgerald's translation **&** Hans van Rossum's translation

4.5 Psalms of David: 22[My God, my God, why have you rejected me?]& 23 [The Lord is my shepherd; I have everything I need]

- King James Version **&** The New International Version

Module 5 [Translating 'Mythic Images']:

5.1 Hermann Hesse: *The Transposed Heads* [German]

5.2 Girish Karnad: *Hayavadana* [Kannada/English]

Seminar:

5.3 Kalidasa: *Abhijnanasakuntalam* [Sanskrit]

[Act III: The Love-making (Scene –The Hermitage in a Grove)]

- Sir William Jones: *Sacontala or The Fatal Ring***&** Chandra Rajan's *Kalidasa: The Loom of Time* (*Abhijnanasakuntalam*). New Delhi: Penguin, 1989.

Specific Additional Readings:

1. Romila Thapar: *Sakuntala – Texts, Readings, Histories*

2. Harvansh Rai Bachan: *Madhusala: The House of Wine*

3. Erik Gray: Fitzgerald and the *Rubáiyát*, In and Out of Time

4. Pratibha Umashankar: 'Thomas Mann and Girish Karnad'

5. Anand Mahadevan: 'Switching Heads and Cultures: Transformation of an Indian Myth by Thomas Mann and Girish Karnad.', *Comparative Literature*, Vol. 54, No. 1 (Winter, 2002)

6. Mini Chandran: NPTEL Course: Introduction to Translation Studies – Lecture 18 [Postcolonial Translation]

7. Elena Di Giovanni: Translation as Craft, as Recovery, as the Life and Afterlife of a Text: Sujit Mukherjee on Translation in India

8. *Gleanings from Haritham*: edited and published by School of Letters, M.G. University/DC Books: 2001

Texts for Consultation:

1. Sujit Mukherjee: "Translation as New Writing" in *Translation as Recovery*, New Delhi: Pencraft, 2004.

2. Sujit Mukherjee: *Translation as Discovery*: Orient Longman: 2006

3. Brinda Bose: "The Most Intimate Act: The Politics of Gender, Culture and Translation". *Translating Desire: The Politics of Gender and Culture in India.* New Delhi: Katha, 2002.

4. Susan Basnett: "From Comparative Literature to Translation Studies", chapter 7 of *Comparative Literature: A Critical Introduction*, Blackwell, Oxford, 1993.
5. Susan Bassnett: *Translation Studies.* London and New York: Methuen, 1991.
6. Susan Bassnett: *Translation Studies*: Routledge: 2000
7. Susan Bassnett and Harish Trivedi (eds): *Post-Colonial Translation: Theory and Practice*: Routledge:2000
8. Jeremy Munday: *Introducing Translation Studies*: Routledge: 2003
9. Lawrence Venuti (ed): *The Translation Studies Reader*: Routledge: 2000
10. Susie Tharu and K. Satyanarayana (eds): *No Alphabet in Sight: New Dalit Writings From South India*: Penguin Books India: 2011
11. Vinay Dharwadkar (ed): *The Collected Essays of A K Ramanujan*: Oxford University Press: 2004
12. Edith Grossman: *Why Translation Matters*: Orient Blackswan: 2011

Semester 4 - Elective Course:
[EN830403] -Dalit Studies

Total Credits: 3
Total Hours: 25
Weightage:

Objectives:To familiarize the student with the development, intent and contents of Dalit Literature and aesthetics from different regions of India.

Course Description: Most of the selections are translations into English from regional languages. Hence, we have Dalitwritings from Marathi, Punjabi, Gujarati, Telugu, Kannada, Tamil, and Malayalam. An attempt has been made to expose readers to the richness of Dalit Literature. With these criteria in mind the selected texts span from the period of colonial modernity through nationalist movement, independence, liberaldemocracy, cultural nationalism and globalization. An interrogation of 'brahmanical culture', anassertion of equality and human rights, an impulse to transcend the centre-margin dichotomy, and anaspiration for dignity and political power run through these Dalit writings.

Module I [Conceptual]:

1.1B.R.Ambedkar: Speech at Mahad (*Poisoned Bread,* p.223-233)
1.2 SaratchandraMuktibodh: What is Dalit Literature? (*Poisoned Bread*, p. 267-270)
1.3T.M. Yesudasan: "Towards a Prologue to Dalit Studies" in *No Alphabet in Sight*.

Module 2 [Poetry]:

2.1 PoikayilAppachan: About my race (*Oxford India Anthology of Malayalam Dalit Writing,* p.5)
2.2 ArunKamble: Which Language should I Speak? (*Poisoned Bread*, p.54) (Marathi)
2.3 JayantParmar: Manu (*Indian Literature*, 159, Jan-Feb 1994) (Gujarati)
2.4 ManjitQuadar: A Song (*Indian Literature*, 185, May-June 1998) (Punjabi)
2.5 BabuMasilamani: My Literature(*Muse India Issue* 9)(Tamil)
2.6 Sukirtharani: Infant Language(*Wild Girls Wicked Words*) (Tamil)
2.7 ChallapalliSwaroopa Rani: Prohibited History (*Indian Literature*) (Telugu)
2.8 Mathiavannan: In the Beginning there was Hatred (*No Alphabet in Sight*, p.220-221) (Tamil)
2.9M. B. Manoj: The Children of the Forest Talk to Yesu, *(No Alphabet in Sight*, p.529-530)
2.10S Joseph: My Sister's Bible
2.11M.R.Renukumar: Unfinished Thirties (*No Alphabet in Sight*, P.577-578)

Seminar:

2.12 Sunny Kavikkad: Naked Truths(*No Alphabet in Sight*, p 487-488)

Module 3 [Short Fiction]:

3.1 ArjunDangle: Promotion(Poisoned Bread, p.191-196) (Marathi)
3.2T.K.C. Vaduthala: Sweet-offering at Chankranthy (*Oxford India Anthology of Malayalam DalitWriting*, p.53-61)
3.3 JoopakaSubhadra: Friends in School. *Different Tales*. DC Books.(Telugu)

3.4 BaburaoBagul: Mother(Poisoned Bread p 183-190)
3.5 DevanooraMahadeva: Tar Comes (91-98) (Kannada)
3.6 AzhagiyaPeriyavan: Stench (*No Alphabet in Sight*, p.232-237) (Tamil)
3.7 AnnabhauSathe, Gold from the Grave(*Homeless in My Land: Translations from Modern Marathi Dalit Short* Stories p 64-70)
Seminar:
3.8 Harish Mangalam:The Midwife.(*Indian Literature*,Volume 37,1994 pp. 65-68)

Module 4 [Plays and Movies]:
4.1A SanthaKumar: *Dream Hunt*(Oxford India Anthology of Malyalam Dalit Writing, pp 169-179)
4.2M.M Vinodini: *Thirst*
4.3 NagarajManjule's movie*Fandry* (2013)
Seminar:
4.4M. Sajitha: *Matsyagandhi*

Module 5 [Life Writings]:
5.1P. Sivakami: *The Grip of Change*
5.2 Bama: *Karukku*
5.3 Joseph Macwan: *The Step Child*
Seminar:
5.4 Gunasekaran K.A.:*The Scar*. (Trans. from Tamil by V. Kadambari)

Texts for Consultation:
1. Kalyanarao, G. *Untouchable Spring*. Chennai: OrientBlackswan, 2010.
2. Baby Kamble.*The Prisons We Broke*. Orient Longman,2008.
3. Ravikumar&Azhagarasan. *The Oxford India Anthology of Tamil Dalit Writing.* OUP,2012.
4. SharankumarLimbale.*Towards an Aesthetic of Dalit Literature.*Orient Longman,2004.
5. KanchaIllaiah. *Why I am not a Hindu: A Sudra Critique of Hindutva Philosophy, Culture and Political Economy.*Samya, 2009.
6. D. R. Nagaraj.*The Flaming Feet and Other Essays: The Dalit Movement in India.*Permanent Black, 2010.
7. SharmilaRege.*Writing Caste/Writing Gender: Narrating Dalit Women's Testimonios*.Zubaan, 2006.
8. Gail Omvedt.*Dalit Visions,* Tracts for the Times/8, Orient Longman.
9. LataMurugkar.*Dalit Panther Movement in Maharashtra: A Sociological Appraisal*, PopularPrakashan, 1991.
10. K.Satyanarayana and Susie Tharu, *The Exercise of Freedom: An Introduction to Dalit Studies.*Navayana,2013.

1. MODEL QUESTION PAPERS

Question Paper Pattern:
I. Short Answer Questions – [Weightage 2] – 1 page answer – 4 out of 7
II. Medium Answer Questions – [Weightage 3] – 3 page answer – 4 out of 7
III. Essay Questions – [Weightage 5] – 5 page answer – 2 out of 4

2. FORMAT OF AWARDS TO BE ISSUED TO STUDENTS
   10.1 GRADE CARDS/ MARK CUM GRADE CARDS FOR EACH SEMESTER
   10.2 CONSOLIDATED GRADE CARD
   10.3 PROVISIONAL CERTIFICATE
   10.4 DEGREE CERTIFICATE

MAHATMA GANDHI UNIVERSITY

SYLLUBUS FOR ENGLISH LANGUAGE AND LITERATURE (MODEL 1)

2017 ADMISSIONS ONWARDS

SCHEME

Semester	Title	Course Category/Code	Hours Per Week	Credits	Internal Assessment	External Exam
1	Fine-tune Your English	Common Course-1 EN1CC01	5	4	20	80
1	Pearls from the Deep	Common Course -2 EN1CC02	4	3	20	80
1	Second Language	Common Course	4	4	20	80
1	Methodology of Literary Studies	Core Course-1 EN1CR01	6	4	20	80
1	History/Political Science/ Sociology/ Psychology	Complementary Course	6	4	20	80
2	Issues that Matter	Common Course -3 EN2CC03	5	4	20	80
2	Savouring the Classics	Common Course -4 EN2CC04	4	3	20	80
2	Introducing Language and Literature	Core Course -2 EN2CR02	6	4	20	80
2	Second Language	Common Course	4	4	20	80
2	History /Political Science / Sociology/ Psychology	Complementary Course	6	4	20	80
3	Literature and/as Identity	Common Course -5 EN3CC05	5	4	20	80
3	Second Language	Common Course	5	4	20	80
3	Harmony of Prose	Core Course -3 EN3CR03	4	4	20	80
3	Symphony of Verse	Core Course -4 EN3CR04	5	4	20	80
3	Evolution of Literary Movements: the Shapers of Destiny	Complementary Course 3 - EN3CM03	6	4	20	80
4	Illuminations	Common Course -6 EN4CC06	5	4	20	80
4	Second Language	Common Course	5	4	20	80
4	Modes of Fiction	Core Course -5 EN4CR05	4	4	20	80
4	Language and Linguistics	Core Course -6 EN4CR06	5	4	20	80
4	Evolution of Literary	Complementary Course 4	6	4	20	80

	Movements: the Cross Currents of Change	- EN4CM04				
5	Open Course	EN5CROP01 Appreciating Films EN5CROP02 Theatre Studies EN5CROP03 English for Careers	4	3	20	80
5	Acts on the Stage	Core Course -7 EN5CR07	6	5	20	80
5	Literary Criticism and Theory	Core Course -8 EN5CR08	5	4	20	80
5	Indian Writing in English	Core Course -9 EN5CR09	5	4	20	80
5	Environmental Science and Human Rights	Core Course EN5CREN01	5	4	20	80
6	Choice Based Course	EN6CB01 Comparative Literature EN6CB02 Modern Malayalam Literature in Translation EN6CB03 Regional Literatures in Translation EN6CB04 Voices from the Margins	4	4	20	80
6	Postcolonial Literatures	Core Course -10 EN6CR10	5	4	20	80
6	Women Writing	Core Course -11 EN6CR11	5	4	20	80
6	American Literature	Core Course -12 EN6CR12	5	4	20	80
6	Modern World Literature	Core Course -13 EN6CR13	5	4	20	80
6	Project	EN6PR01	1	2	20	80

Common Courses

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR COMMON COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 1- Fine-tune Your English

Course Code	**EN1CC01**
Title of the course	**Fine-tune Your English**
Semester in which the course is to be taught	**1**
No. of credits	**4**
No. of contact hours	**90**

AIM OF THE COURSE

The course is intended to introduce the students to the basics of grammar, usage and effective communication.

OBJECTIVES OF THE COURSE

On completion of the course, the student should be able to:
1. confidently use English in both written and spoken forms.
2. Use English for formal communication effectively.

COURSE OUTLINE

Module 1 **(18 Hours)**

The Sentence and Its Structure - How to Write Effective Sentences – Phrases -What Are They? - The Noun Clauses - The Adverb Clause - "If All the Trees Were Bread and Cheese" - The Relative Clause - How the Clauses Are Conjoined -

Word-Classes and Related Topics - Understanding the Verb - Understanding the Auxiliary Verb - Understanding the Adverbs - Understanding the Pronoun - The Reflexive Pronoun - The Articles I - The Articles II - The Adjective - Phrasal Verbs - Mind Your Prepositions

Module 2 **(18 Hours)**

To Err Is Human - Concord - A Political Crisis - Errors, Common and Uncommon - False Witnesses - The Anatomy of Mistakes- A Fault-finder Speaks - A Lecture on AIDS - A Test for You, Reader - Ungrammatical Gossip - Round Circles and Equal Halves: A Look at Tautology - Comparisons are Odious - In Defence Of A Friend - An Invitation

Spelling and Pronunciation - Pronunciation: Some Tips - More Tips on Pronunciation – Spelling - An Awesome Mess? - Spelling Part II

Module 3 **(18 Hours)**

Singleness of Meaning - Shades of Meaning - Confusing Pairs - What Is the Difference? - Mismatching Mars the Meaning

The Tense and Related Topics - 'Presentness' and Present Tenses- The 'Presentness' of a Past Action - Futurity in English - Passivization

Idiomatic Language- 'Animal' Expressions - Idiomatic Phrases - 'Heady' Expressions - Body Language

Module 4 **(18 Hours)**

Interrogatives and Negatives - Negatives- How to Frame Questions -What's What? The Question Tag

Conversational English - Polite Expressions - Some Time Expressions - In Conversation - Is John There Please?

Miscellaneous and General Topics - On Geese and Mongooses - Pluralisation - On Gender and Sexisms

Reading – Kinds of Reading – Recreational Reading – Study-type Reading Survey Reading – The Process of Reading – Readability – The Importance of Reading – Previewing - Skimming

Module 5 **(18 Hours)**

The world of words- have a hearty meal- word formation-Use the specific word- word games-the irreplaceable word- Let's play games- body vocabulary

Very Good but Totally Incompetent - Long Live the Comma - The Possessive Case- Letter Writing- Academic Assignments

Get your doubts cleared

Core Text: ***Fine-tune Your English*** **by Dr Mathew Joseph.** Orient Blackswan and Mahatma Gandhi University

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SYLLABI FOR COMMON COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 2 - Pearls from the Deep

Course Code	**EN1CC02**
Title of the Course	**Pearls from the Deep**
Semester in which the Course is to be taught	**1**
No. of Credits	**3**
No. of Contact Hours	**72**

AIM OF THE COURSE

To introduce students to the different genres of literature and to the niceties of literary expression.

OBJECTIVES OF THE COURSE

On completion of the course, the student should be able to:
1. appreciate and enjoy works of literature.
2. appreciate the aesthetic and structural elements of literature.

COURSE OUTLINE

Module 1 [Fiction] **(18 hours)**

Ernest Hemingway: *The Old Man and the Sea*

Module 2 [One Act Plays] **(18 hours)**

Susan Glaspell: Trifles
Asif Currimbhoy: The Refugee
A. A. Milne: The Boy Comes Home

Module 3 [Short Stories] **(18 hours)**

Guy De Maupassant: Two Friends
O. Henry: The Gift of the Magi

K. A. Abbas: Sparrows
Flora Annie Steel: Valiant Vicky, the Brave Weaver

Module 4 [Poems] **(18 hours)**

Rumi: The Chance of Humming
Walter Scott: Lochinvar
John Keats: La Belle Dame sans Mercy
Robert Frost: After Apple Picking
Chinua Achebe: Refugee Mother and Child
Kamala Das: My Grandmother's House
Ted Hughes: Jaguar
Pablo Neruda: Tonight I can Write the Saddest Lines
P. P. Ramachandran: How Simple!

Core Text: *Pearls from the Deep.* Cambridge University Press and Mahatma Gandhi University

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SYLLABI FOR COMMON COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 3 - Issues that Matter

Course Code	**EN2CC03**
Title of the course	**Issues that Matter**
Semester in which the course is to be taught	**2**
No. of credits	**4**
No. of contact hours	**90**

AIM OF THE COURSE

To sensitize the learners to contemporary issues of concern.

OBJECTIVES

By the end of the course, the learner should be able to:

1. Identify the major issues of contemporary significance
2. Respond rationally and positively to the issues raised
3. Internalise the values imparted through the selections.

COURSE OUTLINE

Module 1 **(18 hours)**

Luigi Pirandello: War

Judith Wright: The Old Prison

Arundhati Roy: Public Power in the Age of Empire

Module 2 **(18 hours)**

Bertolt Brecht: The Burning of the Books

W. H. Auden: Refugee Blues

Romila Thapar: What Secularism is and Where it Needs to be Headed

Module 3 **(18 hours)**

Zitkala- Sa: A Westward Trip

Bandhumadhav: The Poisoned Bread

Temsula Ao: The Pot Maker

Module 4 **(18 hours)**

Khushwant Singh: A Hosanna to the Monsoons

Ayyappa Paniker: Where are the woods, children?

Sarah Joseph: *Gift in Green* [chapter 2] - Hagar: A Story of a Woman and Water

Module 5 **(18 hours)**

Ghassan Kanafani: Six Eagles and a Child

Sanchari Pal: The Inspiring Story of How Sikkim Became India's Cleanest State

Indrajit Singh Rathore: Hermaphrodite

Core Text: *Issues that Matter*

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR COMMON COURSES – UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 4 - Savouring the Classics

Course Code	**EN2CC04**
Title of the Course	**Savouring the Classics**
Semester in which the course is to be taught	**2**
No. of credits	**3**
No. of contact hours	**72**

AIM OF COURSE

To introduce the students to the taste of time tested world classics.

OBJECTIVES OF THE COURSE

On completion of the course, the student should:
1. become familiar with the classics from various lands.
2. understand the features that go into the making of a classic.

OUTLINE OF THE COURSE

Module 1 [Poems] **(18 hours)**

Homer: Odysseus tells Eurycleaia to conceal his identity (*Odyssey* - Book 19: 476 - 507)
Sappho: Jealousy
Kalidasa: Look to This Day
Omar Khayyam: Rubaiyat (last four quatrains: 72-75)
Dante - Dante meets Virgil (*Inferno* - Canto 1: 61-99)
Matsuo Basho: Haikus
Alexander Pushkin: The Song of the Kazak

Module 2 [Shakespeare Excerpts] **(18 hours)**

Romeo and Juliet: ACT II, Scene ii
The Merchant of Venice: ACT IV, Scene i

Module 3 [Novel Excerpts] **(18 hours)**

Victor Hugo: *Les Miserables* (Part 1- Fantine Book II)
Mark Twain: *The Adventures of Huckleberry Fin* (Raft Passage)

Module 4 [Short Fiction] **(18 hours)**

Dostoyevsky: A Christmas Tree and a Wedding
Arthur Conan Doyle: The Adventure of the Dancing Men

Core Text: *Savouring the Classics*

Recommended Reading

Italo Calvino: *Why Read the Classics?*

A. C. Bradley: *Shakespearean Tragedy*

Katherine Armstrong: *Studying Shakespeare: A Practical Introduction*

Gemma McKenzie: *Foundations of European Drama*

Harold Bloom: The Western *Canon*

Jeremy Hawthorn: *Studying the Novel*

C. Marydas: *Shakespearean Aesthetics for University Wits*

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SYLLABI FOR COMMON COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 5 - Literature and/as Identity

Course Code Title of the course	**EN3CC05** **Literature and/as Identity**
Semester in which the course is to be taught	**3**
No. of credits	**4**
No. of contact hours	**90**

AIM OF THE COURSE

The course is intended to sensitivise students to the various ways in which literature serves as a platform for forming, consolidating, critiquing and re-working the issue of 'identity' at various levels.

OBJECTIVES OF THE COURSE

On completion of the course, the student should be aware of the following:

1. The subtle negotiations of Indigenous and Diasporic identities with-in Literature.
2. The fissures, the tensions and the interstices present in South Asian regional identities.
3. The emergence of Life Writing and alternate/alternative/marginal identities.

COURSE OUTLINE

Module 1 (Diasporic Identities) **(18 hours)**

Agha Shahid Ali: I See Kashmir from New Delhi at Midnight
M.G. Vassanji: Leaving
Imtiaz Dharker: At the Lahore Karhai
Chitra Banerjee Divakaruni: Indian Movie, New Jersey

Module 2 (South Asian Identities) **(18 hours)**

C. V. Velupillai: No State, No Dog
Sadaat Hasan Manto: The Dog of Tetwal
Intizar Hussain: A Chronicle of the Peacocks
Selina Hossain: Double War

Module 3 (Life Writings) **(18 hours)**

Malcolm X: "Nightmare", excerpt from *The Autobiography of Malcolm X*.
Sashi Deshpande: Learning to be a Mother in *Janani – Mothers, Daughters, Motherhood*, (ed.) Rinki Bhattacharya.

Module 4 (Indigenous Identities) **(18 hours)**

Excerpts from *Binti*, the Santhal creation song of cosmology, the *Bhilli Mahabharat* and *Garhwali Songs* in *Painted Words - An Anthology of Tribal Literature* - Edited by G. N. Devy.
Amos Tutuola: *The Palm-Wine Drinkard*. [Excerpt]

Module 5 (Alter Identities) **(18 hours)**

Nathaniel Hawthorne: The Birth Mark
John Henrik Clarke: The Boy Who Painted Christ Black
Ruskin Bond: The Girl on the Train

Core Text: *Literature and/as Identity*

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR COMMON COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 6 – Illuminations

Course Code	**EN4CC06**
Title of the course	**Illuminations**
Semester in which the course is to be taught	**4**
No. of credits	**4**
No. of contact hours	**90**

AIM OF THE COURSE

To acquaint the learners with different forms of inspiring and motivating literature.

OUTLINE OF THE COURSE

At the end of the course, the student shall be able to:
1. maintain a positive attitude to life.
2. evaluate and overcome setbacks based on the insights that these texts provide.

COURSE OUTLINE

Module 1 [Life Sketches] **(18 hours)**

Helen Keller: Three Days to See
Jesse Owens: My Greatest Olympic Prize
Dominic Lapierre: Mother Teresa

Module 2 [Essays] **(18 hours)**

Lafcadio Hearn: On Reading
Stephen Leacock: Are the Rich Happy?
A.G. Gardiner: On Courage

Module 3 [Speeches] **(18 hours)**

J. K. Rowling: The fringe benefits of failure and the importance of imagination
Malala Yousafzai: Nobel Lecture

Module 4 [Short Stories] **(18 hours)**

Oscar Wilde: The Nightingale and the Rose
George Orwell: The Miser

John Galsworthy: Quality
Paolo Coelho: The Beggar and the Baker

Module 5 [Poems] **(18 hours)**

William Ernest Henley: Invictus
Robert Frost: The Road Not Taken
Kahlil Gibran: Of Good and Evil
Joyce Kilmer: Trees

Core Text: *Illuminations*

Core Courses

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR CORE COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 1 - Methodology of Literary Studies

Course Code Title of the course Semester in which the course is to be taught	**EN1CR01** **Methodology of Literary Studies** **1**
No. of credits No. of contact hours	**4** **108**

AIM OF THE COURSE

The course seeks to introduce the student to the major signposts in the historical evolution of literary studies from its inception to the current postcolonial realm.

OBJECTIVES OF THE COURSE

On completion of the course, the student should be able to discern the following:
1. The emergence of literature as a specific discipline within the humanities.
2. The tenets of what is now known as 'traditional' approaches and also that of 'formalism.'
3. The shift towards contextual-political critiques of literary studies.
4. The questions raised by Cultural Studies and Feminism(s)
5. The issues of sublaternity and regionality in the literary domain.

COURSE OUTLINE

Module 1 **(18 hours)**

Part A: W. H. Hudson: "Some Ways of Studying Literature" from *An Introduction to the Study of Literature.*
Part B: William Shakespeare: Sonnet 116 – "Let Me Not to the Marriage of True Minds"

Module 2 **(18 hours)**

Part A: Cleanth Brookes: "The Formalist Critics" from the *My Credo* series: *The Kenyon Review*
Part B: Emily Dickinson: "Because I could not stop for Death" (poem 479)

Module 3 **(18 hours)**

Part A: Terry Eagleton: "What is Literature?" from *Literary Theory: An Introduction*.
Part B: Mahasweta Devi: "Kunti and the Nishadin"

Module 4 **(18 hours)**

Part A: Lois Tyson: "Feminist Criticism"
Part B: Sara Joseph: "Inside Every Woman Writer"

Module 5 **(18 hours)**

Part A: Peter Barry: Postcolonial Criticism

Part B: 2 Poems in tandem: Mahmoud Darwish: "Identity Card" and S. Joseph: "Identity Card"

Module 6 **(18 hours)**

Part A: Pradeepan Pampirikunnu: "What did Literary Histories Say to You?"
Part B: Poikayil Appachan: "No Alphabet in Sight"

Approaching the Course:
Ideally this paper should have a consistent linearity from Module 1 to 6; such a step-by-step progression will help trace the following trajectory effectively: **Traditional** to **Formalist** to **Political-Contextual** to **Feminist** to **Postcolonial** to **Regional-Subaltern** methodologies.

Core Text: ***Nuances: Methodology of Literary Studies.*** Macmillan and Mahatma Gandhi University

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR CORE COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 2 – Introducing Language and Literature

Course Code Title of the course	**EN2CR02** **Introducing Language and Literature**
Semester in which the course is to be taught	**2**
No. of credits	**4**
No. of contact hours	**108**

AIM OF THE COURSE

The course seeks to introduce the student to the basics of English language and literature.

OBJECTIVES OF THE COURSE

On completion of the course, the student should be able to discern the following:
1. The evolution and the differential traits of the English language till the present time.
2. The evolution of literature from antiquity to postmodern times.
3. The diversity of genres and techniques of representation and narration
4. The links between literature and film as narrative expressions.
5. The emergence of British and American Literature through diverse periods

COURSE OUTLINE

Module 1 **(18 hours)**

Language families - Indo European family of languages: Branches of Indo European - Home of the Indo Europeans - Main characteristics of Indo European languages

Germanic family of Languages: Characteristics - Grimm's Law - Verner's Law. - The position of English in Indo European family

Periods in the history of English language:
Old English period - Old English Dialects - Old English vocabulary
Middle English period - Norman Conquest - Middle English Vocabulary - Middle English dialects - French influence

Modern English period: Early modern English - The Great Vowel Shift - Renaissance and Reformation - The invention of printing - Authors and Books: The Bible - Shakespeare - Milton - Dictionaries - Loan words: Celtic, Scandinavian, Latin, French

Module 2 **(18 hours)**

Language Varieties

Dialect - Sociolect - Idiolect - Register - Pidgin - Creole -

English Today: Evolution of Standard English - Standard British English - Received Pronunciation - English as Global language - American English - Australian English - General Indian English - African English - Caribbean English - Second language acquisition

Word Formation: Compounding - Derivation - Abbreviation - Onomatopoeic words - Clipping - Acronyms - Portmanteau words

Historical Semantics - Semantic change: Generalisation - Specialisation - Association of Ideas - Euphemism - Popular misunderstanding

Module 3 **(36 hours)**

Classical Genres: Epic - Drama - Poetry

Modern Genres: Novel - Short Story - Novella

Genre Types:

Poetry - Narrative poetry and lyrical poetry - Elegy - Ode - Sonnet - Ballad - Dramatic Monologue

Drama - Tragedy - Comedy - Closet Drama – Epic Theatre - Theatre of the Absurd

Ambience:

Plot - Character - Point of View - Setting

Module 4 **(18 hours)**

Film and Literature - Dimensions of Film: Visual, Auditory and Spatial - Film Language: Montage and Mise-en-scene - Cut and the Shot - Styles of acting – Auteur theory - Adaptation

Module 5 **(18 hours)**

Periods of Literature: British and American

Old English - Middle English - Renaissance - Restoration - Neo-classical - Romantic - Victorian - Modern - Postmodern - American Crossover - American Transcendentalism

Core text for Modules 1 and 2:

V. Shyamala: *A Short History of English Language*.

Core Texts for Modules 3, 4 and 5:

Mario Klarer: *An Introduction to Literary Studies* [excluding the 4th chapter on 'Theoretical approaches to literature.']

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SYLLABI FOR CORE COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 3 – Harmony of Prose

Course Code	**EN3CR03**
Title of the course	**Harmony of Prose**
Semester in which the course is to be taught	**3**
No. of credits	**4**
No. of contact hours	**90**

AIM OF THE COURSE

The student is given space to mature in the presence of glorious essays, both Western and Non-Western.

OBJECTIVES OF THE COURSE

On completion of the course, the student shall be:

1. familiar with varied prose styles of expression.
2. aware of eloquent expressions, brevity and aptness of voicing ideas in stylish language.

COURSE OUTLINE

Module 1 **(18 hours)**

Francis Bacon: Of Friendship

Jonathan Swift: The Spider and the Bee

Joseph Addison: Meditations in Westminster Abbey

Module 2 **(18 hours)**

Samuel Johnson: Death of Dryden

Charles Lamb: Dream Children; a reverie

William Hazlitt: The Fight

Module 3 **(18 hours)**

Robert Lynd: Forgetting

Virginia Woolf: A Room of One's Own (an extract)

Aldous Huxley: The Beauty Industry

Module 4 **(18 hours)**

Nirad C. Choudhari: Indian Crowds (extract from *The Autobiography of an Unknown Indian*)

Amartya Sen: Sharing the World

A. K. Ramanujan: A Flowery Tree: A Woman's Tale

Module 5 **(18 hours)**

Kamau Brathwaite: Nation Language

Pico Iyer: In Praise of the Humble Coma

William Dalrymple: The Dancer of Kannur (extract from *Nine Lives*)

Core Text: *Harmony of Prose*

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR CORE COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 4 – Symphony of Verse

Course Code	**EN3CR04**
Title of the course	**Symphony of Verse**
Semester in which the course is to be taught	**3**
No. of credits	**4**
No. of contact hours	**90**

AIM OF THE COURSE

To acquaint the student with the rich texture of poetry in English.

OBJECTIVES OF THE COURSE

On completion of the course the students shall have:
1. an understanding of the representation of poetry in various periods of the English tradition.
2. an awareness of the emerging cultural and aesthetic expressions that poetry makes possible.

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COURSE OUTLINE

Module 1 (Renaissance and Restoration) (18 hours)

Edmund Spenser: One Day I Wrote Her Name
William Shakespeare: Sonnet 130
John Donne: Canonization
John Milton: Lycidas
John Dryden: A Song for St. Cecilia's Day

Module 2 (Romantic Revival) (18 hours)

William Wordsworth: Lucy Gray
Samuel Taylor Coleridge: Christabel (Part I)
Percy Bysshe Shelley: Ode to the West Wind
John Keats: To Autumn

Module 3 (Victorian) **(18 hours)**

Alfred, Lord Tennyson: Ulysses
Robert Browning: Porphyria's Lover
Matthew Arnold: Dover Beach
Christina Rossetti: A Hope Carol

Module 4 (Twentieth Century) **(18 hours)**

W. B. Yeats: Easter 1916
T S Eliot: The Love Song of J Alfred Prufrock
Philip Larkin: The Whitsun Weddings
Sylvia Plath: Lady Lazarus

Module 5 (Contemporary) **(18 hours)**

A. D. Hope: Australia
Maya Angelou: Phenomenal Woman
Seamus Heaney: Digging
Carol Ann Duffy: Stealing

Core Text: ***Symphony of Verse***

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR CORE COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 5 – Modes of Fiction

Course Code	**EN4CR05**
Title of the course	**Modes of Fiction**
Semester in which the course is to be taught	**4**
No. of credits	**4**
No. of contact hours	**90**

AIM OF THE COURSE

To acquaint students with various modes of fiction.

OBJECTIVES OF THE COURSE

On completion of the course, the student will have comprehended the categories of British and non- British short fiction, and also the novel as a form of literary expression.

COURSE OUTLINE

Module 1 [Short Fiction: British] (36 hours)

Mary Shelley: The Mortal Immortal
Jerome K. Jerome: The Dancing Partner
H. G. Wells: The Stolen Body
Somerset Maugham: Rain
G. K. Chesterton: The Blue Cross
James Joyce: Araby
Muriel Spark: The Executor
A. S. Byatt: On the Day E. M. Forster Died

Module 2 [Short Fiction: Non British] (36 hours)

Henry Lawson: The Drover's Wife
Maxim Gorky: Mother of a Traitor
Stephen Crane: A Dark Brown Dog
Katherine Mansfield: A Cup of Tea
Pearl S Buck: Once upon a Christmas
Gabriel Garcia Marquez: A Very Old Man with Enormous Wings

Mary Lerner: Little Selves
Nadine Gordimer: Once Upon a Time

Module 3 [Fiction] **(18 hours)**

Charles Dickens: *Great Expectations*

Core Text for Modules 1 and 2: *Modes of Fiction*

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR CORE COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 6 – Language and Linguistics

Course Code	**EN4CR06**
Title of the course	**Language and Linguistics**
Semester in which the course is to be taught	**4**
No. of credits	**4**
No. of contact hours	**90**

AIM OF THE COURSE

This course is an introduction to the science of linguistics. It seeks to give an overview of the basic concepts of linguistics and linguistic analysis to the students.

OBJECTIVES OF THE COURSE

This course seeks to achieve the following:
1. To show the various organs and processes involved in the production of speech, the types and typology of speech sounds, segmental & suprasegmental features of the English language, and transcription using IPA.
2. To describe and explain morphological processes and phenomena.
3. To show the various processes involved in the generation of meaning.
4. To enhance students' awareness that natural language is structure dependent and generative and to develop their ability to observe, describe and explain grammatical processes and phenomena.

COURSE OUTLINE

Module 1 [Introduction to Language, Linguistics and Phonetics] (36 hours)

What is Language? - What is Linguistics? Arbitrariness - Duality -Displacement - Cultural transmission
Basic Notions - Phonetics and Phonology - Branches of Phonetics – Articulatory, Acoustic, Auditory
Organs of Speech - Air Stream Mechanism – Pulmonic, Glottal, Velaric
Respiratory System - Phonatory System –Voiced and Voiceless Sounds
Articulatory System - Oral, nasal & nasalised sounds

Classification of Speech Sounds: Consonants and Vowels -
Criteria for Classification of Consonants - The Consonants of English RP

Place of Articulation - Bilabial, Labio-Dental, Dental, Alveolar, Post-Alveolar, Palato-Alveolar, Palatal & Velar Sounds
Manner of Articulation – Plosives, Fricatives, Affricates, Nasals, Lateral, Frictionless Continuants, Semi-Vowels, Trills & Taps
Criteria for Classification of Vowels - The Vowels of English RP
Tongue height: Close Vowels, Open Vowels, Half-Close Vowels, Half-Open Vowels
Part of the Tongue Raised: Front Vowels, Back Vowels, and Central Vowels
Position of Lips: Rounded Vowels, Unrounded Vowels
Diphthongs: Monophthongs and Diphthongs, Falling and Rising Diphthongs, Centring and Closing Diphthongs, Fronting and Retracting Diphthongs
Cardinal Vowels
    Vowel Diagram – Diphthongs - Tense and lax Vowels
Phonemes and Allophones
    Phone, Phoneme, Minimal pairs - Allophone, Aspiration, Dark and Clear / l /
    Contrastive Distribution and Complementary Distribution
Syllable
    What is a syllable? - Syllabic Structure – Onset, Nucleus, Coda - Syllabic Consonants
    Consonant Clusters, Abutting Consonants
Suprasegmentals
    Segmentals and Suprasegmentals - Suprasegmental Phonemes
    Word Stress - Sentence Stress - Weak forms and Strong Forms
    Rhythm – Intonation - Tone, Tonic Syllable, Tonicity - Intonation patterns
    Intonation – Functions
Juncture
Liasion
Assimilation
Elision
Linking / r / and Intrusive / r /
Transcription
    The incongruity between spelling and pronunciation in English
IPA
Broad and narrow Transcription
Transcription Practice

Module 2 [Morphology] (36 hours)

Basic Notions
    What is morphology?
    Morph, Morpheme
Morpheme Types and Typology
    Free and bound morphemes
    Root, Base, Stem
    Different types of affixes: Prefix, Suffix, Infix
    Inflection
    Inflectional and derivational affixes
    Class-changing and class- maintaining affixes
Allomorphy
    Allomorph
    Zero Morph
    Conditioning of allomorphs: Phonological &Morphological

Word
- Why is a word a difficult concept to define in absolute terms?
- Lexeme
- Form class and Function Class words

Morphological Operations/Processes
- Affixation
- Reduplication
- Ablaut
- Suppletion

Structure of Words
- Simple Words
- Complex Words
- Compound Words

SEMANTICS

Basic Notions
- What is semantics?
- Lexical and grammatical meaning
- Sense, reference, referent

Sense Relations

Synonymy – Antonymy – Hyponymy – Homonymy – Homography – Polysemy – Metonymy – Ambiguity – Tautology - Collocation

Module 3 [Syntax & Branches of Linguistics] (18 hours)

Basic Notions
- What is syntax?
- Grammar
- Grammaticality and Acceptability
- Descriptive and Prescriptive Grammar
- Synchronic and Diachronic Grammar
- Syntagmatic and Paradigmatic Relationships
- Sign, Signified and Signifier
- Langue and Parole
- Competence and Performance

Introduction to theories on Grammar
- Traditional Grammar
- Problems with traditional Grammar
- Structural grammars
- Phrase Structure Grammars
- Transformational Generative Grammars
  - Kernel Sentences
  - Deep and Surface Structures

One question from the essay section will be compulsory and shall deal with transcribing a passage of five lines of conversation and a set of five words using IPA symbols.

READING LIST

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MAHATMA GANDHI UNIVERSITY

SYLLABI FOR CORE COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 7 – Acts on the Stage

Course Code	**EN5CR07**
Title of the course	**Acts on the Stage**
Semester in which the course is to be taught	**5**
No. of credits	**4**
No. of contact hours	**108**

AIM OF THE COURSE

The course seeks to introduce the student to select theatre texts that form the canon of English drama.

OBJECTIVES OF THE COURSE

On completion of the course, the student shall be:
1. familiar with the works of the playwrights included in the course.
2. informed about the broad genre-based nuances in the realm of drama.
3. able to appreciate and critique drama as an art form.

COURSE OUTLINE

Module 1 **(72 Hours)**

William Shakespeare: *King Lear*

Module 2 **(36 Hours)**

One Act Plays

George Bernard Shaw: The Dark Lady of the Sonnets
Anton Chekov: The Boor
Maurice Maeterlinck: The Intruder
John Galsworthy: Strife

Core Text: ***Acts on the Stage***

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR CORE COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 8 – Literary Criticism and Theory

Course Code	**EN5CR08**
Title of the course	**Literary Criticism and Theory**
Semester in which the course is to be taught	**5**
No. of credits	**4**
No. of contact hours	**90**

AIM OF THE COURSE

The course seeks to introduce students to the major signposts in Literary Criticism, Literary Theory and Indian Aesthetics.

OBJECTIVES OF THE COURSE

On completion of the course, the student:
1. will have awareness about the major developments in literary criticism from the ancient times to the twentieth century.
2. will be initiated to the realm of literary theory and major theoretical schools.
3. will have awareness about the chief strains of Indian literary criticism.
4. will be able to analyse short poetical pieces critically.

COURSE OUTLINE

Module 1 [Literary Criticism] **(36 hours)**

A. Classical Criticism
Plato - Aristotle
B. Neoclassical Criticism
Neoclassicism in England - Dryden, Pope, Aphra Behn, Samuel Johnson
C. Romantic criticism
German Idealism - British Romantic criticism: Wordsworth, Coleridge
D. Victorian Criticism
Matthew Arnold
E. From Liberal Humanism to Formalism
The poetics of Modernism: Yeats, Pound, Eliot
Formalism - Russian Formalism: Boris Eichenbaum, Mikhail Bakhtin, Roman Jakobson- New Criticism: John Crowe Ransom, Wimsatt and Beardsley

F. Early 20th Century Criticism

F. R. Leavis - Marxist and Left Wing critics - Early feminist critics: Virginia Woolf, Simone de Beauvoir

From M. A. R Habib: *Literary Criticism from Plato to the Present: An Introduction*. Oxford: Wiley Blackwell, 2011

Module 2 [Literary Theory] **(36 hours)**

A. Structuralism - Poststructuralism - Deconstruction - Psychoanalysis
B. Ideology and Discourse
C. Postmodernism

From Mary Klages: *Literary Theory: A Guide for the Perplexed*. London: Continuum, 2008.

Module 3 [Indian Aesthetics & Practical Criticism] **(18 hours)**

A. Indian Aesthetics

Rasa - Dhvani - Vakrokti

From G. Balamohan Thampi: *Essays on Eastern Aesthetics*

B. Practical Criticism

Critical analysis of poetry

Based on Neil McCaw: Close Reading (Chapter 3 of *How to Read Texts**:** A Student Guide to Critical Approaches and Skills*. London: Viva-Continuum, 2008.)

Note: A compulsory question on practical criticism to be included in Section B (5 Marks) of the Question Paper

Core Text: *Literary Criticism and Theory*

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR CORE COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 9 – Indian Writing in English

Course Code	**EN5CR09**
Title of the course	**Indian Writing in English**
Semester in which the course is to be taught	**5**
No. of credits	**4**
No. of contact hours	**90**

AIM OF THE COURSE

The course is intended to sensitivise students to the various ways in which literature written in English, in the Indian sub-continent serves as a platform for forming, consolidating, critiquing and re-working the issue of national 'identity' at various levels.

OBJECTIVES OF THE COURSE

On completion of the course, the student should be aware of the following:
1. The subtle flavours that distinguish the 'Indian' quotient in English writings from India.
2. The different concerns that Indian English writers share, cutting across sub-nationalities and regionalities.
3. The *locus standi* of diasporic 'Indian' writers.

COURSE OUTLINE

Module 1 (Poetry) **(18 Hours)**

Henry Derozio: The Harp of India
Nissim Ezekiel: The Patriot
Jayanta Mahapatra: Freedom
Kamala Das: Introduction
Dom Moraes: Absences

Module 2 (Fiction) **(18 Hours)**

Anita Nair: *Ladies Coupe*

Module 3 (Drama) **(18 Hours)**

Girish Karnad: *Tughlaq*

Module 4 (Short Fiction) **(18 Hours)**

R. K. Narayan: The Antidote
Salman Rushdie: The Free Radio
Jhumpa Lahiri: The Interpreter of Maladies
Chitra Banerjee Divakaruni: Mrs Dutta Writes a Letter

Module 5 (Prose) **(18 Hours)**

Rabindranath Tagore: Nationalism in India
B. R. Ambedkar: Back from the West and Unable to Find Lodging in Baroda
Satyajit Ray: Odds Against Us
Amitav Ghosh: The Imam and the Indian

Core Text: *Indian Writing in English*

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR CORE COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE – Environmental Science and Human Rights

Course Code	**EN5CREN01**
Title of the course	**Environmental Science and Human Rights**
Semester in which the course is to be taught	**5**
No. of credits	**4**
No. of contact hours	**90**

Core module syllabus for Environmental Studies & Human Rights for under-graduate courses of all branches of higher education

VISION

The importance of environmental science and environmental studies cannot be disputed. The need for sustainable development is a key to the future of mankind. Continuing problems of pollution, solid waste disposal, degradation of environment, issues like economic productivity and national security, Global warming, the depletion of ozone layer and loss of biodiversity have made everyone aware of environmental issues. The United Nations Conference on Environment and Development held in Rio de Janerio in 1992 and World Summit on Sustainable Development at Johannesburg in 2002 have drawn the attention of people around the globe to the deteriorating condition of our environment. It is clear that no citizen of the earth can afford to be ignorant of environment issues.

India is rich in biodiversity which provides various resources for people. Only about 1.7 million living organisms have been described and named globally. Still many more remain to be identified and described. Attempts are made to conserve them in ex-situ and in-situ situations. Intellectual property rights (IPRs) have become important in a biodiversity-rich country like India to protect microbes, plants and animals that have useful genetic properties. Destruction of habitats, over-use of energy resource and environmental pollution has been found to be responsible for the loss of a large number of life-forms. It is feared that a large proportion of life on earth may get wiped out in the near future.

In spite of the deteriorating status of the environment, study of environment has so far not received adequate attention in our academic programme. Recognizing this, the Hon'ble Supreme Court directed the UGC to introduce a basic course on environment at every level in college education. Accordingly, the matter was considered by UGC and it was decided that a

six months compulsory core module course in environmental studies may be prepared and compulsorily implemented in all the University/Colleges of India.

The syllabus of environmental studies includes five modules including human rights. The first two modules are purely environmental studies according to the UGC directions. The second two modules are strictly related with the core subject and fifth module is for human rights.

OBJECTIVES

Environmental Education encourages students to research, investigate how and why things happen, and make their own decisions about complex environmental issues by developing and enhancing critical and creative thinking skills. It helps to foster a new generation of informed consumers, workers, as well as policy or decision makers.

Environmental Education helps students to understand how their decisions and actions affect the environment, builds knowledge and skills necessary to address complex environmental issues, as well as ways we can take action to keep our environment healthy and sustainable for the future. It encourages character building, and develops positive attitudes and values.

To develop the sense of awareness among the students about the environment and its various problems and to help the students in realizing the inter-relationship between man and environment and helps to protect the nature and natural resources.

To help the students in acquiring the basic knowledge about environment and the social norms that provides unity with environmental characteristics and create positive attitude about the environment.

Module I **(18 hours)**

Unit 1: Multidisciplinary nature of environmental studies - Definition, scope and importance Need for public awareness.

Unit 2: Natural Resources: Renewable and non-renewable resources: Natural resources and associated problems.
a) Forest resources: Use and over-exploitation, deforestation: case studies - Timber extraction, mining, dams and their effects on forest and tribal people.
b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources: case studies.
d) Food resources: World food problems - changes caused by agriculture and overgrazing - effects of modern agriculture – fertilizer & pesticide problems – water logging – salinity: case studies.
e) Energy resources: Growing energy needs - renewable and non renewable energy sources - use of alternate energy sources: case studies.
f) Land resources: Land as a resource - land degradation - man induced landslides – soil

erosion and desertification.
Role of individual in conservation of natural resources - Equitable use of resources for sustainable life styles.

Unit 3: Ecosystems
Concept of an ecosystem - Structure and function of an ecosystem - Producers, consumers and decomposers - Energy flow in the ecosystem.
Ecological succession - Food chains, food webs and ecological pyramids.
Introduction, types, characteristic features, structure and function of the given ecosystem - Forest ecosystem

Module II **(26 hours)**

Unit 1: Biodiversity and its conservation
Introduction - Bio-geographical classification of India
Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.
India as a mega-diversity nation.
Hot-sports of biodiversity
Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts - Endangered and endemic species of India

Unit 2: Environmental Pollution
Definition - Causes, effects and control measures of: Air pollution - Water pollution - Soil pollution - Marine pollution - Noise pollution - Thermal pollution - Nuclear hazards
Solid Waste Management: Causes, effects and control measures of urban and industrial wastes
Role of an individual in prevention of pollution - Pollution case studies
Disaster management: floods, earthquake, cyclone and landslides

Unit 3: Social Issues and the Environment
Urban problems related to energy - Water conservation, rain water harvesting, watershed management
Resettlement and rehabilitation of people: its problems and concerns: case studies
Environmental ethics: Issues and possible solutions
Climate change, global warming, acid rain, ozone layer depletion , nuclear accidents and holocaust: case studies - Consumerism and waste products

Environment Protection Act - Air (Prevention and Control of Pollution) Act – Water (Prevention and control of Pollution) Act - Wildlife Protection Act - Forest Conservation Act
Issues involved in enforcement of environmental legislation - Public awareness

Module III **(10 hours)**

Jean Giono: *The Man Who Planted Trees*

K. Satchitanandan: Hiroshima Remembered

Module IV **(10 hours)**

Bessie Head: Heaven is not Closed

Safdar Hashmi: Machine

Module V **(26 hours)**

Unit 1: Human Rights
An Introduction to Human Rights: Meaning, concept and development - Three Generations of Human Rights (Civil and Political Rights, Economic, Social and Cultural Rights).

Unit 2: Human Rights and United Nations
Contributions, main human rights related organs - UNESCO, UNICEF, WHO, ILO, Declarations for women and children, Universal Declaration of Human Rights.

Human Rights in India – Fundamental rights and Indian Constitution, Rights for children and women, Scheduled Castes, Scheduled Tribes, Other Backward Castes and Minorities

Unit 3: Environment and Human Rights
Right to Clean Environment and Public Safety
Issues of Industrial Pollution - Prevention, Rehabilitation and Safety Aspect of New Technologies such as Chemical and Nuclear Technologies - Issues of Waste Disposal - Protection of Environment

Conservation of natural resources and human rights: Reports, Case studies and policy formulation.
Conservation issues of Western Ghats: Mention Gadgil committee report, Kasthuri Rangan report.
Over-exploitation of ground water resources, marine fisheries, sand mining, etc.

Internal: Field study

Visit to a local area to document environmental grassland/ hill /mountain
Visit a local polluted site: Urban/Rural/Industrial/Agricultural Study of common plants, insects, birds, etc
Study of simple ecosystem: pond, river, hill slopes, etc
(Field work Equal to 5 lecture hours)

REFERENCES

Bharucha, Erach. *Text Book of Environmental Studies for Undergraduate Courses*. University Press, 2nd Edition 2013 (TB)

Clark, R. S. *Marine Pollution*, Oxford: Clarendon (Ref)

Cunningham, W. P., Cooper, T. H., Gorhani, E & Hepworth, M. T. 2001 *Environmental Encyclopaedia*, Mumbai: Jaico. (Ref)

Dc A. K. *Environmental Chemistry*, Wiley Eastern. (Ref)

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Heywood, V. H & Watson, R. T. 1995. *Global Biodiversity Assessment*, Cambridge UP (Ref)

Jadhav, H & Bhosale,V. M. 1995. *Environmental Protection and Laws*. Delhi: Himalaya (Ref)

McKinney, M. L & Schock, R. M. 1996. *Environmental Science Systems & Solutions*. Web enhanced edition (Ref)

Miller T.G. Jr., *Environmental Science*, Wadsworth (TB)

Odum, E. P 1971. *Fundamentals of Ecology*. W. B. Saunders (Ref)

Rao, M. N. & Datta, A. K. 1987. *Waste Water Treatment* Oxford & IBII (Ref)

Rajagopalan, R. *Environmental Studies from Crisis and Cure*, Oxford UP, 2016 (TB)

Sharma B.K., 2001. *Environmental Chemistry*. Meerut: Geol. (Ref)

Townsend C. Harper J, and Michael Begon, *Essentials of Ecology*, Blackwell Science (Ref)

Trivedi R. K. *Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards*, Vol I and II, Enviro Media (Ref)

Trivedi, R. K. and P. K. Goel. *Introduction to Air Pollution*. Techno-Science (Ref)

Wanger, K. D. 1998. *Environmental Management*. Philadelphia: W.B. Saunders (Ref)

(M) Magazine (R) Reference (TB) Textbook

Human Rights

Amartya Sen. *The Idea Justice*. New Delhi: Penguin, 2009.

Chatrath, K. J. S. Ed. *Education for Human Rights and Democracy*. Shimla: Indian Institute of Advanced Studies, 1998.

Law Relating to Human Rights. Asia Law House, 2001.

Shireesh Pal Singh, *Human Rights Education in 21st Century*. New Delhi: Discovery

S. K. Khanna. *Children and the Human Rights*. Common Wealth, 2011.

Sudhir Kapoor. *Human Rights in 21st Century*. Jaipur: Mangal Deep, 2001.

United Nations Development Programme. *Human Development Report 2004: Cultural Liberty in Today's Diverse World*. New Delhi: Oxford UP, 2004.

Six months compulsory core module course in Environmental Studies & Human Rights for undergraduates

Teaching Methodologies

The core Module Syllabus for Environmental Studies includes class room teaching and Field Work. The syllabus is divided into five modules covering 72 lectures. The first two modules will cover 44 lectures which are class room based to enhance knowledge skills and attitude to environment. The third and forth is based on subject related environmental studies which will be covered in 20 lecture hours and would provide student a multidisciplinary knowledge on environmental issues in relation with the core subject. Human rights is also included in the fifth module and 8 lectures are set apart for that. Field study is one of the most effective learning tools for environmental concerns and is purely for internal evaluation. This moves out of the scope of the text book mode of teaching into the realm of real learning in the field, where the teacher merely acts as a catalyst to interpret what the student observes or discovers in his/her own environment. Field studies are as essential as class work and form an irreplaceable synergistic tool in the entire learning process.

Course material provided by UGC for class room teaching and field activities be utilized.

The universities/colleges can also draw upon expertise of outside resource persons for teaching purpose.

Environmental Core Module shall be integrated into the teaching programmes of all undergraduate courses.

Core Text for Module 3 & 4: *Greening Knowledge*

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR CORE COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 10 – Postcolonial Literatures

Course Code	**EN6CR10**
Title of the course	**Postcolonial Literatures**
Semester in which the course is to be taught	**6**
No. of credits	**4**
No. of contact hours	**90**

AIM OF THE COURSE

To familiarize the students the varied dimension s of postcolonial subjectivity through theory and literature.

OBJECTIVES OF THE COURSE

On completion of the course, the student will:
1. be aware of the social, political, cultural aspects of postcolonial societies.
2. realise the impact of colonialism and imperialism on native cultural identities.
3. get an insight into the links between language, history and culture.

COURSE OUTLINE

Module 1 [The Domain] **(36 hours)**

Bill Ashcroft, Gareth Griffiths and Helen Tiffin: Introduction of *The Empire Writes Back*
Edward Said: Orientalism [an excerpt]
Frantz Fanon: The Fact of Blackness

Module 2 [Poetry] **(18 hours)**

Faiz Ahmed Faiz: A Prison Evening
A. K. Ramanujan: Small Scale Reflections on a Great House
David Malouf: Revolving Days
Wole Soyinka: Civilian and Soldier
Margaret Atwood: Journey to the Interior

Module 3 [Fiction] **(18 hours)**

Peter Carey: *Jack Maggs*

Module 4 [Drama] **(18 hours)**

Ngugi wa Thiong'o: *The Trial of Dedan Kimathi*

Core Text: *Postcolonial Literatures*

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR CORE COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 11 – Women Writing

Course Code	**EN6CR11**
Title of the course	**Women Writing**
Semester in which the course is to be taught	**6**
No. of credits	**4**
No. of contact hours	**90**

AIM OF THE COURSE

To introduce the theoretical and literary responses by women and the concerns that govern feminist literature.

OBJECTIVES OF THE COURSE

On completion of the course, the students will be able to:
1. critically respond to literature from a feminist perspective.
2. realize how the patriarchal notions pervade in the social and cultural scenario and how feminism exposes these notions.
3. identify how stereotypical representations of women were constructed and how these are subverted by feminist writing

COURSE OUTLINE

Module 1 [Essays] **(36 hours)**

Betty Friedan: The Problem that has No Name (Chapter 1 of *The Feminine Mystique*)
Elaine Showalter: Towards a Feminist Poetics
Patricia Hill Collins: Mammies, Matriarchs and Other Controlling Images (Chapter 4 of *Black Feminist Thought* pp. 79-84

Module 2 [Poetry] **(18 hours)**

Anna Akhmatova: Lot's Wife

Mamta Kalia: After Eight Years of Marriage
Julia Alvarez: Women's Work
Meena Alexander: House of a Thousand Doors
Sutapa Bhattacharya: Draupadi
Kristine Batey: Lot's Wife
Vijayalakshmi: Bhagavatha

Module 3 [Short Fiction] **(18 hours)**

Charlotte Perkins Gilman: The Yellow Wallpaper
Willa Cather: A Wagner Matinee
Isabel Allende: And of the Clay We Created
Sara Joseph: The Passion of Mary

Module 4 [Fiction] **(18 hours)**

Alice Walker: *The Color Purple*

Core Text: *Women Writing*

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR CORE COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 12 – American Literature

Course Code	**EN6CR12**
Title of the course	**American Literature**
Semester in which the course is to be taught	**6**
No. of credits	**4**
No. of contact hours	**90**

AIM OF THE COURSE

To enable the students to have a holistic understanding of the heterogeneity of American culture and to study works of prose, poetry, drama, and fiction in relation to their historical and cultural contexts.

OBJECTIVES OF THE COURSE

At the end of the course, the student shall be:
1. familiar with the evolution of various literary movements in American literature.
2. acquainted with the major authors in American Literary History.

COURSE OUTLINE

Module 1 [Prose] **(18 hours)**

M. H Abrams: Periods of American Literature in *A Glossary of Literary Terms*
Robert E. Spiller: The Last Frontier in *The Cycle of American Literature*
Ralph Waldo Emerson: Gifts
James Baldwin: If Black English isn't Language, then Tell me, What is?

Module 2 [Poetry] **(18 hours)**

Walt Whitman: I Hear America Singing
Emily Dickinson: I dwell in Possibility
Robert Frost: Love and a Question
e. e. cummings: Let's Live Suddenly without Thinking
Langston Hughes: Let America be America Again
Allen Ginsberg: A Supermarket in California
Adrienne Rich: In a Classroom

Marianne Moore: Poetry

Module 3 [Short Story] **(18 hours)**

Nathaniel Hawthorne: My Kinsman, Major Molineux
Edgar Allan Poe: The Purloined Letter
Mark Twain: How I Edited an Agricultural Paper
Leslie Marmon Silko: Lullaby
Kate Chopin: A Respectable Woman

Module 4 [Drama] **(18 hours)**

Arthur Miller: *The Crucible*

Module 5 [Novel] **(18 hours)**

Harper Lee: *To Kill a Mocking Bird*

Core Text: *American Literature*

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR CORE COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 13 – Modern World Literature

Course Code	**EN6CR13**
Title of the course	**Modern World Literature**
Semester in which the course is to be taught	**6**
No. of credits	**4**
No. of contact hours	**90**

AIM OF THE COURSE

To make the students aware of the stupendous variety that resides in Literatures the world over.

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OBJECTIVES OF THE COURSE

On completion of the course, the students should be able to discern the following:
1. That literatures the world over engage in very deep ways with the vicissitudes of life.
2. World literatures often defy genres/regionalities and canonical assumptions to emerge as a platform where poetics and politics fuse.
3. The notion of Major and Minor, Central and Peripheral literatures is a myth.

COURSE OUTLINE

Module 1 [Poetry] **(18 hours)**

Marina Tsvetaeva: Meeting
Federico Garcia Lorca: New Heart
Pablo Neruda: Ars Poetica
Leopold Sedar Senghor: Black Woman
Wizlawa Szymborska: The Terrorist, He's Watching
Adonis: Nothing but madness remains
Bei Dao: The Answer
Ko Un: A Poet's Heart

Module 2 [Short Stories: European] **(18 hours)**

Leo Tolstoy: God Sees the Truth, but Waits
Bjornstjerne Bjornson: The Father
Franz Kafka: Before the Law

Bertolt Brecht: The Monster
Albert Camus: The Guest
Javier Marias: The Life and Death of Marcelino Iturriaga

Module 3 [Short Stories: Non-European] **(18 hours)**

Ryunosuke Akutagawa: In a Grove
Jorge Luis Borges: The Garden of Forking Paths
Naguib Mahfouz: Half of a Day
Julio Cortazar: Continuity of Parks
Danilo Kis: The Encyclopaedia of the Dead
Juan Gabriel Vasquez: The Dogs of War

Module 4 [Novel] **(18 hours)**

Italo Calvino: *The Cloven Viscount*

Module 5 [Drama] **(18 hours)**

Eugene Ionesco: *Chairs*

Core Text: *Modern World Literature*

Complementary Courses

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR COMPLEMENTARY COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS
SEMESTER 3 (BA English Model 1 & Model 2)

COURSE 3: The Evolution of Literary Movements: The Shapers of Destiny

Course Code	**EN3CM03**
Title of the course	**The Evolution of Literary Movements: The Shapers of Destiny**
Semester in which the course is to be taught	**3**
No. of credits	**4**
No. of contact hours	**108**

1. AIM OF THE COURSE

To make the learner aware of the way in which history shapes the life and literature of a people

2. OBJECTIVES OF THE COURSE

- To give the learner a comprehensive overview of the history of Britain and its impact upon the rest of the world
- To enable him to understand English literature in the light of historical events
- To analyse the manner in which a person is moulded by the historical events of his personal and communal life

3. COURSE OUTLINE

Module 1: Moulding and Being Moulded **18 hours**

Early settlers and invaders- the Iberians, the Celts and Romans, the Angles, Saxons, Jutes. The Anglo Saxon heptarchy- The coming of Christianity- Theodore of Tarsus and the organization of the church- Alfred the Great – St. Dunstan and Edgar – Canute the Danish king- Edward the Confessor, Harold Godwin- Society and literature of the time-the

Witangemot -the Anglo Saxon Chronicle, Beowulf, Caedmon, Cynewulf, Venerable Bede and others-

Module 2: The True Briton 36 hours

Normans: the last invaders –William the Conqueror –the reforms of Henry I- Feudalism- the Angevin kings - the struggle between the church and the state, St. Thomas Becket – the universities of Oxford and Cambridge–the Guilds - Richard the Lionheart and the Crusades- the Magna Carta- Henry III – Simon de Montfort, and the Parliament- Edward I, annexation of Wales, Scotland and Ireland – Edward II and Edward III – The Black Death, The Hundred Years War, The Peasants Revolt – the effects of these on society and literature- The Wars of the Roses – Chaucer and the growth of the East Midland dialect into standard English – Growth of drama and stage performances- Chaucer's contemporaries- John Wycliffe and the Lollards..

Module Three : Brittannia Rules the Waves 36 hours

The Tudor Dynasty- benevolent despots – Renaissance – maritime discoveries – the scientific temper and scientific inventions- flamboyant Henry VIII, Reformation- religious persecution- Thomas More, Erasmus, Thomas Cromwell-The Book of Common Prayer- Elizabeth I- Shakespeare – nest of singing birds- Francis Drake- peace and prosperity- The Stuarts and the Divine Right Theory- The Authorised Version- The Civil War- Oliver Cromwell and the Protectorate – John Milton- the Jacobean playwrights – Restoration- Caroline writers- The Whigs and Tories- Queen Anne and the expansion of colonialism – The Glorious Revolution

Module Four : A Precious Stone Set in the Silver Sea 18 hours

The United Kingdom today- Physical features of the British Isles, geography, demography – Customs and practices – myths and legends –the growth and development of the English language –the position held by the UK in today's world

Reading List

1. Trevelyan, G. M. Illustrated English Social History (Vol 1-6). England: Penguin, 1968.
2. Churchill, Winston. A History of the English Speaking Peoples (Vol 1-12). London: Cassel and Co., 1966.
3. Nehru, Jawaharlal. Glimpses of World History. New Delhi: Penguin, 2004.
4. Alexander, Michael (ed.) A History of English Literature. New York: Palgrave-Macmillan, 2007.
5. Sampson, George (ed.) A History of English Literature. Delhi: Foundation, 2004.
6. Thorndike, Lynn. Encyclopedia of World Civilization (Vol 2). Delhi: Shubi Publications, 1990.
7. Yeats, W. B. Writings on Irish Folklore Legend and Myth. London: Penguin, 1999.
8. Warner, Marina. From the Beast to the Blond. London: Vintage, 1995.

4. Core Text: Susan Varghese. *Evolution of Literary Movements: The Shapers of Destiny*. Current Books.

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR COMPLEMENTARY COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS
SEMESTER 4 (BA English Model 1 & Model 2)

COURSE 4: The Evolution of Literary Movements: The Cross Currents of Change

Course Code	**EN4CM04**
Title of the course	**The Evolution of Literary Movements: The Cross Currents of Change**
Semester in which the course is to be taught	**4**
No. of credits	**4**
No. of contact hours	**108**

AIM OF THE COURSE

To enable students to have a notion of the evolution of literature and to help them perceive the interplay of social processes and literature

OBJECTIVES OF THE COURSE

By the end of the course it is hoped that:
1. students will be competent to understand literature against the backdrop of history.
2. students will be inspired to contribute dynamically to historical and literary processes.

COURSE OUTLINE

Module 1 [Literature and Revolution] (36 hours)

a. The interaction between the French Revolution and the literature of the age
b. Literature in the context of the Russian Revolution

Module 2 [Literature and Renaissance] (18 hours)

a. The social context of the burgeoning of literature in Latin America
b. Kerala at the dawn of awakening

Module 3 [Literature and Liberation] (36 hours)

a. Literature and feminism
b. Dalit writing

Module 4 [Literature and the Third World] **(18 hours)**

a. Articulating the Postcolonial Experience
b. An overview of New Literatures

Core Text: Dr B Keralavarma. *Evolution of Literary Movements: The Cross-currents of Change*.

Open Courses

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR OPEN COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 1 – Appreciating Films

Course Code	**EN5CROP01**
Title of the course	**Appreciating Films**
Semester in which the course is to be taught	**5**
No. of credits	**4**
No. of contact hours	**72**

AIM OF THE COURSE

The course seeks to introduce the student to the major elements that constitute cinema. Also the attempt will be to equip the student to academically discuss cinema in terms of critiques and close analyses.

OBJECTIVES OF THE COURSE

On completion of the course, the student should be able to discern the following:
1. The broad contours of the history and aesthetics of films.
2. The overarching film genres and the basic terminology of film studies.
3. The distinction between mere appreciation of films and sustained ideological film analysis.
4. The questions raised by Cultural Studies and Feminism(s) in their encounter with films.
5. The issues raised by cinematic adaptations of literature.

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COURSE OUTLINE

Module 1 (Broad Film Genres) (18 hours)

Lumiere vs. Melies [*Arrival of a Train* vs. *An Impossible Voyage*]
Narrative Cinema vs. Documentary Cinema
Hollywood Style as Norm - Roland Emmerich's *Independence Day* (1996)
German Expressionism - F.W. Murnau's *Nosferatu* (1922)
Neo-realism - Vittorio De Sica's *Bicycle Thieves* (1948)

Module 2 (Film Languages) (18 hours)

Montage Theory: [Clippings from Eisenstein's *Battleship Potemkin* and Chaplin's *Modern*

Times]
Mise-en-scene: [The opening sequence from Werner Herzog's *Aguirre, Wrath of God* **(**1972) and the infamous 'horse head' scene from Francis Ford Coppola's *The Godfather* (1972)]
Deep Focus, the Long Take and psychological representation: [Select scenes from Orson Welles' *The Magnificent Ambersons* (1942)]
Jump Cut (anti-seamless-dissolve) [Examples from Godard's *Breathless* (1960)]

Module 3 (Reading Films) (18 hours)

Cinema and Ideology/Identity Politics
[Kamal Haasan's *Hey Ram* (2000) and Shaji Kailas's] *Aaraam Thampuran* (1997)]

Cinema and Feminism
[Rajkumar Hirani's *PK* (2014) and K. G. George's *Aadaminte Variyellu* (1983))

Module 4 (Film Adaptations) (18 hours)

Shakespeare/Hamlet: Vishal Bhardwaj's *Haider* (2014)
Basheer/Mathilukal: Adoor Gopalakrishnan's *Mathilukal* (1990)

Films Recommended for Background Viewing

George Melies: *An Impossible Voyage*
Lumiere brothers: *Arrival of a Train*
Sergei Eisenstein: *Battleship Potemkin*
Charlie Chaplin: *Modern Times*
Werner Herzog: *Aguirre, Wrath of God*
Francis Ford Coppola: *The Godfather*
Orson Welles: *The Magnificent Ambersons*
Jean Luc-Godard: *Breathless*
V. K. Prakash: *Karmayogi* [Malayalam]

Core Text: *Appreciating Films*

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR OPEN COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 2 – Theatre Studies

Course Code	**EN5CROP02**
Title of the course	**Theatre Studies**
Semester in which the course is to be taught	**5**
No. of credits	**4**
No. of contact hours	**72**

AIM OF THE COURSE

The students will be introduced to a selection of plays from the West and the East, ranging from the tragic and the comic, the folk and the street, so as to generate interest in theatre and make them aware of the new trends in modern theatre.

OBJECTIVES OF THE COURSE

On completion of the course, the student should be able to imbibe the following:

1. An understanding of a selection of well-discussed plays across the world.
2. The classical and modern theatre in the West and the East.
3. The form and content of various kinds of theatre.
4. Colonial and subversive postcolonial aspects in Indian theatre.
5. Issues of gender, identity, caste, tradition, morality, etc dealt with by modern theatre.

.

COURSE OUTLINE

Module 1 (Classics) **(18 hours)**

Kalidasa: *Abhijnanasakunthalam* – Act I

William Shakespeare: *Othello* – Act I, Scene III, 1-295

Module 2 (Tragic Vision) **(18 hours)**

Eugene O'Neil: Before Breakfast

Langston Hughes: Soul Gone Home

Module 3 (Comic Vision) **(18 hours)**

Bernard Shaw: How He Lied to Her Husband

Anton Chekov: The Proposal

Module 4 (Folk/Street) **(18 hours)**

Kavalam Narayana Panicker: Maraattom

Malini Bhattacharya: Giving Away the Girl

Core Text: *Theatre Studies*

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR OPEN COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 3 – English for Careers

Course Code	**EN5CROP03**
Title of the course	**English for Careers**
Semester in which the course is to be taught	**5**
No. of credits	**4**
No. of contact hours	**72**

AIM OF THE COURSE

To make the students competent in their job-seeking, job-getting, and job-holding needs. The course shall cater to equipping the students in Comprehensive Language Enhancement.

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OBJECTIVES OF THE COURSE

On completion of the course, the students should be able:

1. To develop communicative skills, which will enable them to prepare for a career and function effectively in it.
2. To equip themselves in oral and written communication to enhance their academic and professional use of language.
3. To train themselves in making effective presentations.

COURSE OUTLINE

Module 1[Oral and Written Skills for Jobs and Careers] (18 hours)

a. Applying for jobs—Preparing Resumes—Writing Cover letters.
b. Preparing for interviews—Taking Interviews—Post-Interview follow-up-Promotion
c. Interviews—Group Discussions

Module 2[Correctness of Language Usage] (18 hours)

a. Common errors in communication and how to avoid them.
b. Some Notions—Conventional and idiomatic expressions.
c. Today's Vocabulary
d. Grammar for Grown-ups

Module 3 [Facing People] **(18 hours)**

a. Structuring and delivering a presentation.
b. Communication in the Management context.
c. Importance of Words/Language.
d. Horizontal and Democratic Communication.

Module 4 [**Keeping the Job]** **(18 hours)**

a. Human relationships in academic and professional life.
b. Front Office Management and Keeping public relations (Telephone Skills)
c. Soft Skills for Team Building.
d. Keeping the Job—Professional Ethics
e. Managing Multiple Roles- Healthy Balancing of family and career.

Reading List

1. Samson et al. *English for Life - 4***.** New Delhi: Cambridge UP.

2. Vasudev, Murthy. *Effective Proposal Writing***.** New Delhi: Response, 2006.

3. *Towards Academic English: Developing Effective Writing Skills***.** New Delhi: Cambridge UP, 2007.

4. *Oxford Guide to Effective Writing and Speak*ing. OUP, 2007.

5. Bhatnagar, R. P. *English for Competitive Examinations***.** New Delhi: Macmillan, 2009.

6. *English for Careers***.** *Pearson*.

7. *ABC of Common Grammatical Errors*. Macmillan, 2009

8. Kaul, Asha. *The Effective Presentation*. New Delhi: Response

9. Shepherd, Kerry. *Presentations at Conferences, Seminars and Meetings***.** New Delhi: Response.

10. Vilanilam, J. V. *More Effective Communication: a Manuel for Professionals.* Response 2008

11. *English for Career Development***.** Orient Longman, 2006.

Core Text: *English for Careers*

Choice Based Courses

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR CHOICE BASED COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 1 – Comparative Literature

Course Code	**EN6CB01**
Title of the course	**Comparative Literature**
Semester in which the course is to be taught	**6**
No. of credits	**4**
No. of contact hours	**72**

AIM OF THE COURSE

To introduce the student to the various concepts relating to comparative study of literature and to promote an international approach to the study of literature.

OBJECTIVES OF THE COURSE

On completion of the course, the student should be able to:
1. Develop strategies and methodologies in the study of literatures in comparison.
2. Undertake a methodological investigation of problems involving more than one literature so that she/he may acquire a broader sense of literary history and tradition.
3. Critically analyze literary texts in a broader perspective of World Literature.

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COURSE OUTLINE

Module 1 [Themes and Contexts] (18 hours)

K. M. Krishnan: 'Introduction' in the anthology *Between the Lines*
Susan Bassnett: 'What is Comparative Literature Today' from *Comparative Literature: An Introduction*

Module 2 [Envisioning] (18 hours)

Part A: Writing

Ted Hughes: The Thought Fox
Seamus Heaney: Personal Helicon

Part B: Death Wish

Sylvia Plath: Tulips
Dorothy Parker: Resume

Part C: Hamlets

Anna Akhmatova: Reading Hamlet
C. P. Cavafy: King Claudius
Salman Rushdie: Yorick

Module 3 [Nuance] **(18 hours)**

Part A: Myth

Rabindranath Tagore: Karna Kunti Samvad
G. Sankarapilla: Wings Flapping, Somewhere

Part B: Sleuthing

Arthur Conan Doyle: The Adventure of the Blue Carbuncle
V. K. N.: Sherlock Holmes

Module 4 [Motif] **(18 Hours)**

Carlo Collodi: The Adventures of Pinocchio
Nikolai Gogol : The Nose
Vaikom Muhammad Basheer : The World Renowned Nose

Core Text: *Comparative Literature*

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR CHOICE BASED COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 2 – Modern Malayalam Literature in Translation

Course Code	**EN6CB02**
Title of the course	**Modern Malayalam Literature in Translation**
Semester in which the course is to be taught	**6**
No. of credits	**4**
No. of contact hours	**72**

AIM OF THE COURSE

The students will be introduced to a selection of literature translated from Malayalam into English. The student will be able to establish an endearing rapport with the cultural aspects of the living environs.

OBJECTIVES OF THE COURSE

On completion of the course, the student should be able to comprehend the following:
1. An understanding of a selection of much discussed writers/literary pieces in Malayalam.
2. The various genres in Malayalam.
3. The modern trends in Malayalam literature.
4. Experiments with form in Malayalam poems and prose.

.

COURSE OUTLINE

Module 1 (Poetry) **(18 hours)**

Balamani Amma: The Pen
Ayyappa Paniker: Theft
Kadamanitta: Feline Fancies
Satchidanandan: The Mad
Balachandran Chullikkad: Possessed
V. M. Girija: A Tree I Was Long Back
S. Joseph: Group Photo
Anitha Thampi: Sweeping the Front Yard
Bindu Krishnan: Certain Days, Like This

Module 2 (Short Fiction) **(18 hours)**

M. T. Vasudevan Nair: For You
Madhavikutti: Neypayasam
M. Mukundan: The Eyesight of the Mirror
Paul Zacharia: Last Show
N. S. Madhavan: Afterword
Santhosh Echikkanam: The Hunters in a Picture Story
Subhash Chandran: Bloody Mary
Anvar Abdulla: Sea-Roar

Module 3 (Novel) **(18 hours)**

O. V. Vijayan: *The Legends of Khasak*

Module 4 (Novella/Memoir/Prison Narrative) **(18 hours)**

Vaikom Muhammad Basheer: Walls

Background Reading

1. Sujit Mukherjee, 'Translation as Discovery' (139-150 in *Translation as Discovery*)
2. A K Ramanujan, 'Three Hundred Ramayanas: Five Examples and Three Thoughts on Translation.' (131 – 160 in *The Collected Essays of A K Ramanujan*)
3. Gayatri Chakravorty Spivak, 'The Politics of Translation.' (397- 416 in *The Translation Studies Reader*)
4. G N Devy, "'Translation and Literary History: An Indian View (pp 182 – 88 in *Postcolonial Translation: Theory and Practice*)
5. Walter Benjamin, 'The Task of the Translator.' (15 - 25 in *The Translation Studies Reader*)

Core Text: *Modern Malayalam Literature in Translation*

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR CHOICE BASED COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 3 – Regional Literatures in Translation

Course Code	**EN6CB03**
Title of the course	**Regional Literatures in Translation**
Semester in which the course is to be taught	**6**
No. of credits	**4**
No. of contact hours	**72**

AIM OF THE COURSE

The students will be introduced to a selection of regional literatures translated into English.

OBJECTIVES OF THE COURSE

On completion of the course, the student should be able to comprehend the following:
1. An understanding of much discussed writers/literary pieces in the vernaculars.
2. The modern trends in regional literatures.

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COURSE OUTLINE

Module 1 [Prose] (18 hours)

Susan Bassnett: Introduction to *Translation Studies*
Keya Majumdar: Appropriating the Other - Some Challenges of Translation and its Theories"
Romila Thapar: 'The Abhijnana-Sakuntalam of Kalidasa' from *Shakuntala: Texts, Readings and History*

Module 2 [Poetry] (18 hours)

Jibanananda Das: Banalata Sen
Kedarnath Agarwal: Freedom of the Writer
Amin Kamil: Naked Thoughts
P Lankesh: Mother (Avva)
P. P. Ramachandran: Iruppu
S Joseph: Fish Monger

Module 3 [Drama] (18 hours)

C. J. Thomas: *Crime 27 in 1128*

Vijay Tendulkar: *Kanyadaan*

Module 4 [Short Story] **(18 hours)**

Saadat Hasan Manto: Toba Tek Singh
Amrita Pritam: The Weed
Annabhau Sathe: Gold from the Grave
Sujatha: Washing Machine
Devanuru Mahadeva: Tar Arrives

Core Text: *Regional Literatures in Translation*

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR CHOICE BASED COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 4 – Voices from the Margin

Course Code	**EN6CB04**
Title of the course	**Voices from the Margins**
Semester in which the course is to be taught	**6**
No. of credits	**4**
No. of contact hours	**72**

AIM OF THE COURSE

To introduce "voices" from the margins to the students, as an attempt to understand suppressed histories and discourses.

OBJECTIVES OF THE COURSE

On completion of the course, the student will have critically encountered subaltern voices, Dalitness and indigeneity.

COURSE OUTLINE

Module 1 **(36 Hours)**

'Subaltern' - Entry in *Routledge Dictionary of Literary Terms* by Peter Childs and Roger Fowler

Poikayil Appachan. "Remembering the Travails." *Writing in the Dark: A Collection of Malayalam Dalit Poetry*. Eds. M. B. Manoj and George K. Alex. Mumbai: VAK. 2008. 21-25.

Sharankumar Limbale. "Dalit Literature: Form and Purpose." *Towards an Aesthetics of Dalit Literature.* Hyderabad: Orient Longman. 2004. 23-39.

Kallen Pokkudan. *My Life* (Excerpts). *The Oxford India Anthology of Malayalam Dalit Writing*. New Delhi: OUP. 2012. 185-195.

Hira Bansode. "Yashodhara." *Posioned Bread*. Ed. Arjun Dangle. Hyderabad: Orient Blackswan. 2009. 36-37.

M. B. Manoj. “Anonymous.” *No Alphabet in Sight: New Dalit Writing from South India: Dossier 1: Tamil and Malayalam*. Eds. K. Satyannarayana and Susie Tharu. New Delhi: Penguin. 532-533.

Bama. *Sangati*. New Delhi: OUP. 2005.

Module 2 **(36 Hours)**

Ramanika Gupta. “Adivasi Literature: An Emerging Consciousness.” *Indigeneity: Culture and Representation.* Hyderabad: Orient Blackswan. 2009. 191-202.

G. N. Devy. “Aphasia: The Fate of the Indigenous Languages” Introduction to *The Language Loss of the Indigenous*. Eds. G. N. Devy, Geoffrey V. Davis and K. K. Chakravarty. New Delhi: New York: Routledge. 2016. 1-6.

Dakxin Bajrange. “Budhan” in. *Painted Words: An Anthology of Tribal Literature.* Ed. G. N. Devy. Vadodara: Purva Prakash. 2012. 245-272.

Narayan/Catherine Thankamma. “We want to be understood . . . and allowed to live with dignity.” Interview. *Kocharethi: The Araya Woman.* New Delhi: OUP. 2011. 208-216.

Bhaskaran. *Mother Forest*: *The Unfinished Story of C.K. Janu*. New Delhi: Kali for Women. 2004.

Core Text: *Voices from the Margins*

Department of English 2021-22

2Tax SJ 1Eco SB 2PCZ NC 1MA ASK 2Eng RML 3M NS 2MA SS	2Eco MM 1Eng SS 2M SB 1PCZ RP 3M RML 1MA PCS 2MA NC	2Mkt SS 1Eng ASK 2Bot SJ 1Eco NC 3M PCS 1MA NS 2MA SB	2M MM 1Tax NS 3M RML 1Bot SB 2MA RP 1MA SJ	2M RML 1M NC 3M RP 1PCZ ASK 2MA PCS 1Mkt SS 1MA MM
2Mkt SS 1Eco ASK 2Bot RP 1PCZ SB 3M SJ 1Mkt PCS 2MA NC 1MA RML	2M ASK 1Eng PCS 3M NC 1Eco RP 2MA SJ 1Tax NS 1 MA SS	2M RP 1Bot SS 3M NS 1MA SB 2MA MM	2Eco SB 1Eng RML 2M ASK 1PCZ NC 3M MM 1 MA PCS 2MA AN	2Eng SJ 1MA MM 2PCZ RML 3M NS 2MA RP
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MM- Mrudula Menon V. NS- Neena Simon NC- Navya Chandran AN- Asmin N

SB- Soney Bhageeradhan SJ- Sabitha Joseph SS- Sarah Santhosh

PCS- C.S. Prabha RP- Reethi P ASK- Amrutha S. Kumar

RML- Remya M.L.

MAHATHMA GANDHI UNIVERSITY KOTTAYAM

BOARD OF STUDIES IN MATHEMATICS (UG)

CURRICULAM FOR

B.Sc MATHEMATICS MODELII

AND

MATHEMATICS COMPLEMENTARY COURSES

UNDER

CHOICE BASED CREDIT SYSTEM (UGCBCS2017)

(Effective from 2017 admission onwards)

ACKNOWLDGEMENT

There are many profound personalities whose relentless support and guidance made this syllabus restructuring 2017 a success. I take this opportunity to express my sincere appreciation to all those who were part of this endeavor for restructuring the syllabus UG course in Mathematics under Mahatma Gandhi University, Kottayam.

I express profound gratitude to the Honorable Vice –Chancellor, Pro- Vice Chancellor, Registrar, Members of the Syndicate and Academic Council, for their sincere Co-operation and guidance for completion of this work. I place on record my wholehearted gratitude to the members of Faculty of Science and Board of Studies for their untiring efforts. I also appreciate the efforts of members of University Academic Section and other staff.

I am also grateful to all teachers who participated in the workshops organized by the University for restructuring the syllabus. I also place on record my gratitude to allprofessionals, academicians and other stakeholders who gave valuable suggestion in this regard.

Dean- Faculty of Science

Mahatma Gandhi University

Kottayam

AIMS AND OBJECTIVES

The courses for the UG Programme are framed using time tested and internationally popular text books so that the courses are at par with the courses offered by any other reputed universityaround the world.

Only those concepts that can be introduced at the UG level are selected and instead of cramming the course with too many ideas the stress is given in doing the selected concepts rigorously. The idea is to make learning mathematics meaningful and an enjoyable activity rather than acquiring manipulative skills and reducing the whole thing an exercise in using thumb rules.

As learning Mathematics is doing Mathematics, to this end, some activities are prescribed to increase students' participation in learning.

Every student has to do a project during 6^{th} semester. The topics for the project can be selected as early as the beginning of the 4^{th} semester.

Course Structure:

The U.G. Programme in Mathematics must include (a) Common courses, (b) Core courses, (c) Complementary Courses, (d) Open courses (e) Choice based courses (f) Project

Courses:

The number of Courses for the restricted programme should contain 12 core courses, 1 open course, 1 choice based course and 8 complementary courses. There should be 10 common courses, or otherwise specified, which includes the first and second language of study.

Objectives :

The syllabi are framed in such a way that it bridges the gap between the plus two and post graduate levels of Mathematics by providing a more complete and logic frame work in almost all areas of basic Mathematics.

By the end of the second semester, the students should have attained a foundation in basic Mathematics and other relevant subjects to complement the core for their future courses.

By the end of the fourth semester, the students should have been introduced to powerful tools for tackling a wide range of topics in Calculus, Theory of Equations and Geometry. They should have been familiar with additional relevant mathematical techniques and other relevant subjects to complement the core.

By the end of sixth semester, the students should have covered a range of topics in almost all areas of Mathematics, and had experience of independent works such as project, seminar etc.

DEGREE MATHEMATICS PROGRAMME (UGCBCS 2017)
CURRICULUM FOR B.Sc MATHEMATICS Model II (Vocational)

Total Credits:120

Total hours :150

Semester I

No	Course Title	Hrs/ Week	Credit
1	Common Course English 1	5	4
2	Common Course Sec. Lang 1	5	4
3	Mathematics Core Course - 1	**4**	3
4	Complementary Course 1	3	3
5	Vocational Course-1	4	4
6	Vocational Course-2 Software Lab:I-	4	3

Semester II

No	Course Title	Hrs/ week	Credit
1	Common Course English 2	5	4
2	Common Course Sec. Lang 2	5	4
3	Mathematics Core Course- 2	**4**	3
4	Complementary Course 2	3	3
5	Vocational Course-3	4	4
6	Vocational Course-4 Software Lab:II	4	3

Semester III

No	Course Title	Hrs/ week	Credit
1	Common Course English 3	5	4
2	Mathematics Core Course – 3	**5**	4
3	Complementary Course 3	3	3
4	Vocational Course-5	6	4
5	Vocational Course-6 Software Lab:III	6	4

Semester IV

No	Course Title	Hrs/ week	Credit
1	Common Course English 4	5	4
2	Mathematics Core Course – 4	5	4
3	Complementary Course 4	3	3
4	Vocational Course- 7	6	4
5	Vocational Course -8 Software Lab IV Project	6	4

Semester V

No	Course Title	Hrs/ week	Credit
1	Mathematics Core Course – 5	6	4
2	Mathematics Core Course – 6	6	4
3	Mathematics Core Course – 7	5	4
4	Human Rights and Mathematics for Environmental studies	4	4
5	Open Course	4	3

Semester VI

No	Course Title	Hrs/ week	Credit
1	Mathematics Core Course – 9	5	4
2	Mathematics Core Course-10	6	4
3	Mathematics Core Course-11	5	4
4	Mathematics Core Course-12	5	4
5	Choice Based Course	4	3
6	Project	0	2

MATHEMATICS CORE COURSES

Semester	Title of the Course	Number Of hours	Total Credits	Total hours/ semester	University Exam Duration	Marks	
						Internal	External
I	MM1CRT01: Foundation of Mathematics	4	3	72	3 hrs	20	80
II	MM2CRT02: Analytic Geometry, Trigonometry and	4	3	72	3 hrs	20	80

	Differential Calculus						
III	**MM3CRT03: Calculus**	**5**	**4**	**90**	**3 hrs**	**20**	**80**
IV	**MM4CRT04: Vector Calculus, Theory of Numbers and Laplace transforms**	**5**	**4**	**90**	**3 hrs**	**20**	**80**
V	**MM5CRT05: Mathematical Analysis**	**6**	**4**	**108**	**3 hrs**	**20**	**80**
	MM5CRT06: Differential Equations	**6**	**4**	**108**	**3 hrs**	**20**	**80**
	MM5CRT07: Abstract Algebra	**5**	**4**	**90**	**3 hrs**	**20**	**80**
	Human rights and Mathematics for Environmental Studies.	**4**	**4**	**72**	**3 hrs**	**20**	**80**
	Open course	**4**	**3**	**72**	**3 hrs**	**20**	**80**
VI	**MM6CRT09 : Real Analysis**	**5**	**4**	**90**	**3 hrs**	**20**	**80**
	MM6CRT10: Graph Theory and metric spaces	**6**	**4**	**108**	**3 hrs**	**20**	**80**
	MM6CRT11 : Complex Analysis	**5**	**4**	**90**	**3 hrs**	**20**	**80**
	MM6CRT12 : Linear Algebra	**5**	**4**	**90**	**3 hrs**	**20**	**80**
	Choice Based Course	**4**	**4**	**72**	**3 hrs**	**20**	**80**
	MM6PRT01 : Project	**-**	**2**	**-**	**-**	**20**	**80**

OPEN COURSE DURING THE FIFTH SEMESTER

Title of the Course	No. of contact hrs/week	No. of Credit	Duration of Exam
MM5OPT02: Applicable Mathematics	**4**	**3**	**3 hrs**

CHOICE BASED COURSE DURING THE SIXTH SEMESTER

Title of the Course	No. of contact hrs/wee	No. of Credit	Duration of Exam
MM6CBT03: Numerical Analysis	**4**	**3**	**3 hrs**

Semester	Course	No. of hours per week		Durn. of Exam in hours	Maximum Mark			Credit
		Lecture	Lab.		Internal	External	Total	
1	CA1VOT01 : Computer Fundamentals	4	-	3	20	80	100	4
1	CA1VOP01Software Lab –I-Introduction to WEB Technologies		4	3	20	80	100	3
2	CA2VOT02 : Object Oriented	4	-	3	20	80	100	4
	Programming with C++							
2	CA2VOP02 : Software Lab-II using C++	-	4	3	20	80	100	3
3	CA3VOT03 :Database Management Systems	6	-	3	20	80	100	4
3	CA3VOP03 :Software Lab -II using SQL	-	6	3	20	80	100	3
4	CA4VOT04:Operating System	6	-	3	20	80	100	4
4	CA4VOP04 : Software Lab – IV Project	-	6	3	20	80	100	3

Internal for all practical papers

All the four components of the internal assessment are mandatory.

Components Internal evaluation of Practical	Marks
Attendance	5
Test paper	5
Record*	5
Lab involvement	5
Total	**20**

*Marks awarded for Record should be related to number of experiments recorded and duly signed by the concerned teacher in charge.

Internal for Software Lab – IV Project

Component	Mark
Initial report (up to coding)	2
Mid Phase Evaluation	3
Lab involvement	5
Final Evaluation(demonstration with explanation, modification, viva)	7
Report	3
Total	**20**

Semester - 1 **Computer Fundamentals**- hrs :4/week , Credits: 4 , Total Marks - 80 marks

Semester – 1 **Software Lab –I- Introduction to WEB Technologies**

hrs :4/week , Credits: 3 , Total Marks - 80mark

Semester- 2**Object Oriented Programming in C++** hrs :4/week , Credits: 4 , Total Marks - 80marks

Semester - 2 **Software Lab-II using C++** hrs :4/week , Credits: 3 , Total Marks - 80 marks

Semester -3 **Database Management System** hrs :6/week , Credits: 4 , Total Marks - 80 marks

Semester -3 **Software Lab -III using SQL** hrs :6/week , Credits: 3 , Total Marks – 80 marks

Semester- 4 **Operating Systems** hrs :6/week , Credits: 4 , Total Marks – 80 marks

Semester -4 **Software Lab – IV Project** hrs :6/week , Credits: 3 , Total Marks – 80 marks

B.Sc DEGREE PROGRAMME MATHEMATICS (UGCBCS2017)

First Semester MM1CRT01:

Foundation of Mathematics

4 hours/week (Total Hours: 72) **3 credits**

Brief Description of the Course

This course introduces the concepts of mathematical logic methods of proofs, sets, functions, relations and partial orderings. A brief introduction of theory of Equations is also included. These topics are foundations of most areas of modern mathematics and are applied frequentlyin the succeeding semesters.

Syllabus

Text Books:

1. K.H. Rosen: Discrete Mathematics and its Applications (Sixth edition), Tata McGraw Hill Publishing Company, New Delhi.
2. S. Bernard and J.M Child: Higher Algebra, AITBS Publishers, India,2009

Module 1: Basic Logic **(20 hours)**

Propositional logic, Propositional equivalences, Predicates and quantifiers, Rules of inference, Introduction to proofs.

Text 1: Chapter – 1excluding sections 1.4 & 1.7

Module 2: Set theory **(12 hours)**

Sets, set operations, functions

Text 1: Chapter – 2 excluding section 2.4

Module 3: Relations **(20hours)**

Relations and their properties, representing relations, equivalence relations, partial orderings.

(Text 1: Chapter 7 excluding Sections 7.2 & 7.4)

Module 4: Theory of Equations **(20 hours)**

Roots of Equations, Relation Connecting the roots and coefficients of an equation, Transformation of equations, Special Cases, The Cubic equation, The Biquadratic Equation, Character and Position of the Roots of an Equation, Some General Theorems, Descartes's Rule of Signs, Corollaries, Reciprocal Equations

Text 2: Chapter VI Sections 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, Chapter XI Section 1

References:

1. Lipschutz: Set Theory and related topics (Second Edition), Schaum Outline Series, TataMcGraw-Hill Publishing Company, New Delhi. (Reprint 2009).

2. P.R. Halmos : Naive Set Theory, Springer.
3. Ian Chiswell&Wifrid Hodges: Mathematical Logic, Oxford university press
4. Richard Johnsonbaugh; Discrete Mathematics; Pearson Education; Dorling Kindersley India Pvt. Ltd
5. Clifford Stien, Robert L Drysdale, KennethBogart ; Discrete Mathematics for Computer Scientists; Pearson Education; Dorling Kindersley India Pvt. Ltd
6. Kenneth A Ross; Charles R.B. Wright ; Discrete Mathematics; Pearson Education; Dorling Kindersley India Pvt. Ltd
7. Ralph P. Grimaldi, B.V.Ramana; Discrete And Combinatorial Mathematics ; Pearson Education; Dorling Kindersley India Pvt. Ltd
8. Winfried Karl Grassman, Jean-Paul Tremblay; Logic And Discrete Mathematics A Computer Science Perspective ; Pearson Education; Dorling Kindersley India Pvt. Ltd
9. Lipschutz:Set Theory And Related Topics (2nd Edition), SchaumOutlineSeries, Tata McGraw-Hill Publishing Company, New Delhi
10. H.S.Hall, S.R. Knight: Higher Algebra, Surjit Publications, Delhi.

Question Paper Pattern

Module	Part A (2 marks)	Part B (5 marks)	Part C (15 marks)	Total
I	3	2 or 3	1	7 or 6
II	3	2	0.5	5.5
III	3	2	1.5	6.5
IV	3	2 or 3	1	6 or 7
Total no. of questions	12	9	4	25
No. of questions to be answered	10	6	2	18
Total marks	20	30	30	80

B.Sc. DEGREE PROGRAMME MATHEMATICS (UGCBCS2017)SECOND SEMESTER

MM2CRT02: ANALYTIC GEOMETRY, TRIGONOMETRY AND DIFFERENTIAL CALCULUS

4 hours/week (Total Hours : 72) **3 credits**

Text books:

1. **Manicavachagom Pillay, Natarajan : Analytic Geometry (Part I Two Dimensions)**
2. **S.L.Loney : Plane Trigonometry Part II , S.Chand and Company Ltd**
3. **Shanti Narayan , P.K.Mittal : Differential Calculus , S.Chand and Company**

MODULE I: Conic Sections **(22 hrs)**

Tangent and Normals of a Conic (Cartesian and Parametric form), Orthoptic Locus, Chords in terms of given points, Pole and Polar and Conjugate diameters of Ellipse.

Relevant Sections of Text 1

MODULE II: Polar Co-ordinates **(15 hrs)**

Polar Co-ordinates, Polar Equation of a line , Polar Equation of Circle, Polar Equation of Conic , Polar Equations of tangents and Normals , Chords of Conic Sections.

Relevant Sections of Text 1

MODULE III: Trigonometry (**17 hrs**)

Circular and Hyperbolic functions of complex variables, Separation of functions of complex variables into real and imaginary parts, Factorization of $x^n - 1, x^n + 1$, $x^{2n} - 2x^n a^n \cos n\theta + a^{2n}$ and Summation of infinite Series by $C + iS$ method

Relevant Sections of Text 2 Cha ter – V, VI, VIII, IX.

Module IV: Differential Calculus **(18 hrs)**

Successive Differentiation and Indeterminate forms

Text 3: Chapter 5 and Chapter 10

References:

1. S. K. Stein : Calculus And Analytic Geometry, McGraw Hill

2. P. K. Jain , Khalil Ahmad : Analytic Geometry of Two Dimensions ,(2ndEdition) New AgeInternational (P) Limited Publishers

3. Thomas and Finney : Calculus and Analytic Geometry , Addison Wesley

QUESTON PAPER PATTERN

Module	Part A 2 Marks	Part B 5 Marks	Part C 15 Marks	Total
I	4	2	1	7
II	2	1	1	4
III	3	3	1	7
IV	3	3	1	7
Total No. of Questions	12	9	4	25
No. of Questions to be answered	10	6	2	18
Total Marks	20	30	30	80

B. Sc DEGREE PROGRAMME MATHEMATICS (UGCBCS 2017)THIRD SEMESTER

MM3CRT03: CALCULUS

5 hours/week (Total Hours: 90) **4 credits**

Syllabus

Text Books:

1. **Shanti Narayan, P.K.Mittal: Differential Calculus , SChand and Company**
2. **George B Thomas Jr: Thomas' Calculus (12th Edition), Pearson.**

Module I: Differential Calculus **(27 hrs)**

Expansion of functions using Maclaurin's theorem and Taylor's theorem, Concavity and points of inflexion. Curvature and Evolutes. Length of arc as a function derivatives of arc, radius of curvature - Cartesian equations only. (Parametric, Polar, Pedal equation and Newtonian Method are excluded) Centre of curvature, Evolutes and Involutes, properties of evolutes. Asymptotes and Envelopes.

Text 1: Chapter 6, Chapter 13, Chapter 14 , Chapter 15 (Section 15.1 to 15.4 only), Chapter 18 (Section 18.1 to 18.8 only).

Module II: Partial Differentiation **(18 hrs)**

Partial derivatives, The Chain rule, Extreme values and saddle points, Lagrange multipliers.

Text 2 Chapter 14 (Sections 14.3, 14.4, 14.7 and 14.8 only) All other sections are excluded

Module III: Integral Calculus **(20 hrs)**

Volumes using Cross-sections, Volumes using cylindrical shells, Arc lengths, Areas of surfaces of Revolution.

Text 2: Chapter 6 (Section 6.1 to 6.4 only (Pappus Theorem excluded)

Module IV: Multiple Integrals **(25 hrs)**

Double and iterated integrals over rectangles, Double integrals over general regions, Area by double integration, Triple integrals in rectangular coordinates, Triple integrals in cylindrical and spherical coordinates, Substitutions in multiple integrals.

Text 2: Chapter 15 (Sections 15.4 and 15.6 are excluded)

References

1. T.M Apostol- Calculus Volume I & II(Wiley India)
2. Widder-Advanced Calculus, 2nd edition
3. K.C. Maity& R.K Ghosh- Differential Calculus(New Central Books Agency)
4. K.C. Maity& R.K Ghosh- Integral Calculus(New Central Books Agency)

5. Shanti Narayan, P.K. Mittal- Integral Calculus- (S. Chand & Co.)
6. Howard Anton et. Al. Calculus, Seventh Edition, John Wiley

QUESTION PAPER PATTERN

Module	Part A 2 Marks	Part B 5 Marks	Part C 15 Marks	Total
I	4	2	1	7
II	3	2	1	6
III	3	2	1	6
IV	2	3	1	6
Total number of questions	12	9	4	25
No. of Questions to be answered	10	6	2	18
Total Marks	20	30	30	80

B. Sc DEGREE PROGRAMME MATHEMATICS (UG CBCS 2017)FOURTH SEMESTER

MM4CRT04 : VECTOR CALCULUS, THEORY OF NUMBERS AND LAPLACE TRANSFORM

5 hours/week(Total Hours : 90) **4 credits**

Syllabus

Text Books:

1. **Thomas Jr., Weir M.D, Hass J.R – Thomas' Calculus (12th Edition) Pearson, 2008.**
2. **David M Burton - Elementary Number Theory, 7th Edition ,McGraw Hill Education(India) Private Ltd.**
3. **Erwin Kreyszig : Advanced Engineering Mathematics, Ninth Edition, Wiley, India.**

Module I: Vector Differentiation **(25 hrs)**

(A quick review of vectors), A vector equation and Parametric equations for lines and equation for a plane in space only (the distance from a point to a line and a plane and angle between planes are excluded) Vector functions, Arc length and Unit tangent vector, Curvature and the Unit normal vector, Tangential and Normal Components of Acceleration, Directional derivatives and Gradient vectors, tangent planes and Normal lines only.

Relevant sections from 12.5, 13.1, 13.3, 13.4, 13.5, 14.5, 14.6 (tangent planes and normal lines only) of Text 1

Module II: Vector Integration **(30 hrs)**

Line integrals, Vector fields and line integrals: Work, Circulation and Flux, Path Independence, Conservative Fields and Potential Functions (Proofs of theorems excluded), Green's theorem in the plane (Statement and problems only), Surfaces and Area: Parameterisations of surfaces, Implicit surfaces, Surface integrals, Stokes' theorem (Statement and simple Problems only), Divergence theorem only (Statement and Problems only) Gauss' law onwards are excluded.

Sections 16.1 to 16.6 and relevant portions from 16.7 & 16.8 of Text 1

Module III: Theory of Numbers **(15 hrs)**

Basic properties of congruence, Fermat's theorem, Wilson's theorem, Euler's phi function.

Text 2 : Chapter 4: section 4.2, Chapter 5: sections 5.2, 5.3 and Chapter 7: section 7.2.

Module IV: Laplace transforms **(20 hrs)**

Laplace transform, Linearity of Laplace transform, First shifting theorem, Existence of Laplace transform, Transforms of derivatives, Solution of ordinary differential equation & initial value problem, Laplace transform of the integral of a function, Convolution and Integral equations.

Text 3 (Sections 6.1, 6.2 and 6.5)

References

1. Anton, Bivens and Davis, Calculus (10th Edition) International Student Version, John Wiley & sons 2015
2. David M. Burton, Elementary Number Theory (7^{th} Edition), Mc Graw Hill Education
3. H.F. Davis and A.D. Snider: Introduction to Vector Analysis, 6th ed., Universal Book Stall, New Delhi.
4. Shanti Narayan, P.K Mittal – Vector Calculus (S. Chand)
5. Merle C. Potter, J. L. Goldberg, E. F. Aboufadel – Advanced Engineering Mathematics (Oxford)
6. Ghosh, Maity – Vector Analysis (New Central books)

QUESTON PAPER PATTERN

Module	Part A 2 Marks	Part B 5 Marks	Part C 15 Marks	Total
I	3	2	1 or 2	6 or 7
II	3	3	1 or 2	7 or 8
III	3	2	1	6
IV	3	2	1	6
Total No. of Questions	12	9	4	25
No. of Questions to be answered	10	6	2	18
Total Marks	20	30	30	80

B. Sc DEGREE PROGRAMME MATHEMATICS (UGCBCS 2017)FIFTH

SEMESTER

MM5CRT05 : MATHEMATICAL ANALYSIS

6 Hrs/Week (Total Hours : 108) **4 Credits**

SYLLABUS

Text Book : Introduction to Real Analysis – Robert G Bartle and Donald RSherbert (3rd Edition) John Wiley & Sons, In. 2007

MODULE I: REAL NUMBERS **30 hours**

Finite and Infinite Sets, The Algebraic and Order Properties of R, Absolute Value and Real Line, The Completeness Property of R, Applications of the Supremum Property, Intervals.

Chapter 1: Section 1.3 and Chapter 2 : Sections 2.1, 2.2,2.3,2.4,2.5

MODULE II: SEQUENCES **30 hours**

Sequences and their Limits, Limit Theorems, Monotone Sequences, Subsequences and the Bolzano- Weierstrass Theorem, The Cauchy Criterion, Properly Divergent Sequences.

Chapter 3 : Sections 3.1,3.2,3.3,3.4, 3.5,3.6

MODULE III: SERIES **24 hours**

Introduction to Series, Absolute Convergence, Tests for Absolute convergence, Tests for nonabsoute Convergence

Chapter 3 : Section 3.7, Chapter 9 : Sections 9.1,9.2,9.3

MODULE IV: LIMITS **24 hours**

Limits of Functions, Limit Theorems, Some Extensions of the Limit Concept.

Chapter 4 : Sections 4.1,4.2,4.3

References:

1. Richard R Goldberg - Methods of real Analysis, 3rd edition , Oxford and IBM Publishing Company (1964)
2. Shanti Narayan - A Course of Mathematical Analysis, S Chand and Co. Ltd (2004)
3. Elias Zako - Mathematical Analysis Vol 1, Overseas Press, New Delhi (2006)
4. J.M Howie - Real Analysis, Springer 2007.
5. K.A Ross- Elementary - Real Analysis, Springer, Indian Reprints.
6. S.C Malik, Savitha Arora - Mathematical Analysis, Revised Second Edition

QUESTION PAPER PATTERN

Module	Part A 2 Marks	Part B 5 Marks	Part C 15 Marks	Total
1	3	2	1	6
2	3	3	1	7
3	3	2	1	6
4	3	2	1	6
Total number of questions	12	9	4	25
Total number of questions to be answered	10	6	2	18
Total	20	30	30	80

B. Sc DEGREE PROGRAMME MATHEMATICS (UGCBCS 2017)

FIFTH SEMESTER

MM5CRT06 : DIFFERENTIAL EQUATIONS

6 hours/week (Total: 108 hours) **4 credits**

Syllabus

Text Book:

1. **G.F. Simmons, S.G. Krantz - Differential Equations, (Tata McGraw Hill-New Delhi). (Walter Rudin Student Series)**
2. **Ian Sneddon – Elements of Partial Differential Equation (Tata Mc Graw Hill)**

Module I: What is a differential equation (26 hrs.)

The nature of solutions, Separable equations, First order linear equations, Exact equations, Orthogonal trajectories and families of curves, Homogeneous equations, Integrating factors, Reduction of order-dependent variable missing-independent variable missing

Text 1: Chapter 1 (Sections 1.2 to 1.9)

Module II: Second order linear equations (26 hrs.)

Second order linear equations with constant coefficients (which includes Euler's equi-dimensional equations given as exercise 5 in page 63 of Text 1), The method of undetermined coefficients, The method of variation of parameters, The use of a known solution to find another, Vibrations and oscillations (first two subsections), Higher order linear equations

Text 1: Chapter 2 (Sections 2.1, 2.2, 2.3, 2.4, 2.5 (2.5.3 and 2.5.4 are excluded) and 2.7 (example 2.17 is excluded).

Module III: Power Series solutions and special functions (26 hrs.)

Series solutions of first order differential equations, Second order linear equations: ordinary points (specially note Legendre's equations given as example 4.7), Regular singular points, More on regular singular points.

Text 1: Chapter 4 (Sections 4.2, 4.3, 4.4 and 4.5).

Method IV: Partial Differential equations (30 hrs.)

Methods of solution of $\frac{dx}{P}=\frac{dx}{Q}=\frac{dx}{R}$ Pfaffian differential forms and equations, proof of theorem

5 on condition for integrability is excluded). Solution of Pfaffian differential equations in three variables (By inspection, variables separable, one variable separable and homogeneous equations only). Origin of first order partial differential equations, Linear equations of the first order (proof of theorem 2 and theorem 3 are excluded)

Text 2: Chapter 1 (Section 3, 5 (no proof of theorem-5) & section 6 (a, b, c and d only)and Chapter 2 (Section 1, 2 and 4 (no proof of theorem 2 and theorem 3)

QUESTON PAPER PATTERN

Module	Part A (2 marks)	Part B (5 marks)	Part C (15 marks)	Total
I	3	4	1	8
II	4	2	1	7
III	2	2	1	5
IV	3	1	1	5
Total No. of Questions	12	9	4	25
No. of questions to be answered	10	6	2	18
Total Marks	20	30	30	80

B. Sc DEGREE PROGRAMME MATHEMATICS (UGCBCS 2017)

FIFTH SEMESTER

MM5CRT07 : ABSTRACT ALGEBRA

5 hours/week (Total Hrs: 90) **4 credits**

Syllabus

Text book :John B. Fraleigh : A First Course in Abstract Algebra (7th Edition) (Pearson)

Module I **(25 hrs)**

Groups and subgroups-Binary operations, Isomorphic binary structures, Groups-definition and examples, elementary properties of groups, finite groups and group tables, subgroups, cyclic subgroups, cyclic groups, elementary properties of cyclic groups.

Part I: Sections 2, 3, 4, 5 and 6

Module II: **(25 hrs)**

Permutations, cosets, and direct products-groups of permutations, Cayley's theorem, orbits, cycles and the alternating groups, cosets and the theorem of Lagrange, direct products.

Part II: Sections 8, 9, 10, 11.1 and 11.2

Module III **(20 hrs)**

Homomorphisms and Factor groups - Homomorphisms, properties of homomorphisms, factor groups, The Fundamental Homomorphism theorem, normal subgroups and inner automorphisms, simple groups.

Part III: Sections 13, 14, 15.14 to 15.18

Module IV **(20 hrs)**

Rings and fields-definitions and basic properties, homomorphisms and isomorphisms,Integral domains- divisors of zero and cancellation, integral domains, the characteristic of a ring. Ideals and factor rings. Homomorphisms and factor rings.

Part IV: Sections 18 and 19 and Part V: Section 26.

References :

4. I. N. Herstein - Topics in Algebra
5. Joseph A Gallian - Contemporary Abstract Algebra, Narosa Pub. House .
6. Artin – Algebra , PHI

QUESTON PAPER PATTERN

Module	Part A (2 marks)	Part B (5 marks)	Part C (15 marks)	Total
I	3	3	1	7
II	4	2	1	7
III	2	2	1	5
IV	3	2	1	6
Total No. of Questions	12	9	4	25
No. of questions to be answered	10	6	2	18
Total Marks	20	30	30	80

B. Sc DEGREE PROGRAMME MATHEMATICS (UGCBCS 2017)

FIFTH SEMESTER

CODE : HUMAN RIGHTS AND MATHEMATICS FOR ENVIORNMENTAL STUDIESCORE MODULE

SYLLABUS FOR ENVIRONMENTAL STUDIES& HUMAN RIGHTS

FOR UNDER GRADUATE COURSES OF ALL BRANCHES OF HIGHER EDUCATION

Vision

The importance of environmental science and environmental studies cannot be disputed. The need for sustainable development is a key to the future of mankind. Continuing problems of pollution, solid waste disposal, degradation of environment, issues like economic productivity and national security, Global warming, the depletion of ozone layer and loss of biodiversity have made everyone aware of environmental issues. The United Nations Coference on Environment and Development held in Rio de Janerio in 1992 and world Summit on Sustainable Developmentat Johannesburg in 2002 have drawn the attention of people around the globe to the deteriorating condition of our environment. It is clear that no citizen of the earth can afford to be ignorant of environment issues..

India is rich in biodiversity which provides various resources for people. Only about 1.7 million living organisms have been described and named globally. Still many more remain to be identified and described. Attempts are made to conserve them in ex-situ and in-situ situations. Intellectual property rights (IPRs) have become important in a biodiversity-rich country likeIndia to protect microbes, plants and animals that have useful genetic properties. Destruction of habitats, over-use of energy resource and environmental pollution have been found to be responsible for the loss of a large number of life-forms. It is feared that a large proportion of lifeon earth may get wiped out in the near future.

In spite of the deteriorating status of the environment, study of environment have so far not received adequate attention in our academic programme. Recognizing this, the Hon'ble Supreme Court directed the UGC to introduce a basic course on environment at every level in college education. Accordingly, the matter was considered by UGC and it was decided that a six months compulsory core module course in environmental studies may be prepared and compulsorily implemented in all the University/Colleges of India.

The syllabus of environmental studies includes five modules including human rights. The first two modules are purely environmental studies according to the UGC directions. The second two modules are strictly related with the core subject and fifth module is for human rights.

Objectives

- Environmental Education encourages students to research, investigate how and why things happen, and make their own decisions about complex environmental issues. By developing and enhancing critical and creative thinking skills, It helps to foster a new generation of informed consumers, workers, as well as policy or decision makers.
- Environmental Education helps students to understand how their decisions and actions affect

the environment, builds knowledge and skills necessary to address complex environmental issues, as well as ways we can take action to keep our environment healthy and sustainable for the future, encourage character building, and develop positive attitudes and values.

- To develop the sense of awareness among the students about the environment and its various problems and to help the students in realizing the inter-relationship between man and environment for protecting the nature and natural resources.
- To help the students in acquiring the basic knowledge about environment and to inform the students about the social norms that provide unity with environmental characteristics and create positive attitude about the environment.

4 hours/week (Total Hrs: 72) **4 credits**

SYLLABUS

Text Book :

1. **Thomas Koshy : Fibonacci and Lucas numbers with applications, John Wiley & Sons, Inc (2001).**

Unit 1 :Multidisciplinary nature of environmental studies

Definition, scope and importance (**2 hrs**)
Need for public awareness.

Unit 2 : Natural Resources :

Renewable and non-renewable resources : Natural resources and associated problems.

a) **Forest resources** : Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.

b) **Water resources** : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

c) **Mineral resources** : Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) **Food resources** : World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

e) **Energy resources**: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources, Case studies.

f) **Land resources**: Land as a resource, land degradation, man induced landslides, soil erosion and desertification

- Role of individual in conservation of natural resources.
- Equitable use of resources for sustainable lifestyles. (**10 hrs**)

Unit 3: Ecosystems

- Concept of an ecosystem
- Structure and function of an ecosystem
- Producers, consumers and decomposers
- Energy flow in the ecosystem
- Ecological succession

- Food chains, food webs and ecological pyramids.
- Introduction, types, characteristic features, structure and function of the given ecosystem:- Forest ecosystem

(6 hrs)

ModuleII

Unit 1: Biodiversity and its conservation

- Introduction
- Biogeograhical classification of India
- Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.
- India as a mega-diversity nation
- Hot-sports of biodiversity
- Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts
- Endangered and endemic species of India

(8 hrs)

Unit 2: Environmental Pollution

Definition

Causes, effects and control measures of: -

a. Air pollution
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

- Solid waste Management: Causes, effects and control measures of urban and industrial wastes.
- Role of an individual in prevention of pollution
- Pollution case studies
- Disaster management: floods, earthquake, cyclone and landslides. **(8hrs)**

Unit 3: Social Issues and the Environment

- Urban problems related to energy
- Water conservation, rain water harvesting, watershed management
- Resettlement and rehabilitation of people: its problems and concerns, Case studies
- Environmental ethics: Issues and possible solutions
- Climate change, global warming, acid rain, ozone layer depletion , nuclear accidents and

holocaust, Case studies

- Consumerism and waste products
- Environment Protection Act
- Air (Prevention and Control of Pollution) Act
- Water (Prevention and control of Pollution) Act
- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation
- Public awareness (**10 hrs**)

Module III : Fibonacci Numbers in nature

The rabbit problem, Fibonacci numbers, recursive definition, Lucas numbers, Different types of Fibonacci and Lucas numbers. Fibonacci numbers in nature : Fibonacci and the earth, Fibonacci and flowers, Fibonacci and sunflower, Fibonacci, pinecones, artichokes and pineapples,Fibonacci and bees, Fibonacci and subsets, Fibonacci and sewage treatment, Fibonacci and atoms, Fibonacci and reflections, Fibonacci, paraffins and cycloparaffins, Fibonacci and music, Fibonacci and compositions with 1's and 2's (excluding Fibonacci and poetry, Fibonacci and electrical networks)

Text 1 : Chapters 2 & 3 (excluding Fibonacci and poetry, Fibonacci and electrical networks)

Module IV : Golden Ratio (10 Hrs)

The golden ratio, mean proportional, a geometric interpretation, ruler and compass construction, Euler construction, generation by Newton's method. The golden ratio revisited, the golden ratio and human body, golden ratio by origami, Differential equations, Gattei's discovery of golden ratio, centroids of circles,

Text 1 : Chapters 20, 21

Module V : Human rights

Unit1-Human Rights– An Introduction to Human Rights, Meaning, concept and development, Three Generations of Human Rights (Civil and Political Rights; Economic, Social and Cultural Rights).

Unit-2 Human Rights and United Nations – contributions, main human rights related organs - UNESCO,UNICEF, WHO, ILO, Declarations for women and children,Universal Declaration of Human Rights.

Human Rights in India – Fundamental rights and Indian Constitution, Rights for children

and women, Scheduled Castes, Scheduled Tribes, Other Backward Castes and Minorities

Unit-3 EnvironmentandHuman Rights - Right to Clean Environment and Public Safety: Issues of Industrial Pollution, Prevention, Rehabilitation and Safety Aspect

of New Technologies such as Chemical and Nuclear Technologies, Issues of Waste Disposal, Protection of Environment

Conservation of natural resources and human rights: Reports, Case studies and policy formulation. Conservation issues of western ghats- mention Gadgil committee report, Kasthurirengan report. Over exploitation of ground water resources, marine fisheries, sand mining etc. **(8 Hrs)**

Internal: Field study

- Visit to a local area to document environmental grassland/ hill /mountain
- Visit a local polluted site – Urban/Rural/Industrial/Agricultural Study of common plants, insects, birds etc
- Study of simple ecosystem-pond, river, hill slopes, etc

(Field work Equal to 5 lecture hours)

References

1. .Bharucha Erach, Text Book of Environmental Studies for undergraduate Courses. University Press, IInd Edition 2013 (TB)
2. Clark.R.S., Marine Pollution, Clanderson Press Oxford (Ref)
3. Cunningham, W.P.Cooper, T.H.Gorhani, E & Hepworth, M.T.2001Environmental Encyclopedia, Jaico Publ. House. Mumbai. 1196p .(Ref)
4. Dc A.K.Enviornmental Chemistry, Wiley Eastern Ltd.(Ref)
5. Down to Earth, Centre for Science and Environment (Ref)
6. Heywood, V.H & Watson, R.T. 1995. Global Biodiversity Assessment, Cambridge University Press 1140pb (Ref)
7. Jadhav.H & Bhosale.V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284p (Ref)
8. Mekinney, M.L & Schock.R.M. 1996 Environmental Science Systems & Solutions. Web enhanced edition 639p (Ref)
9. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co. (TB)
10. Odum.E.P 1971. Fundamentals of Ecology. W.B. Saunders Co. USA 574p (Ref)
11. Rao.M.N & Datta.A.K. 1987 Waste Water treatment Oxford & IBII Publication Co.Pvt.Ltd.345p (Ref)

12. Rajagopalan. R, Environmental Studies from crisis and cure, Oxford University Press, Published: 2016 (TB)

13. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut (Ref)
14. Townsend C., Harper J, and Michael Begon, Essentials of Ecology, BlackwellScience (Ref)
15. Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Stadards, Vol I and II, Enviro Media (Ref)
16. Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication(Ref)
17. Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA499p (Ref)
18. (M) Magazine (R) Reference (TB) Textbook

QUESTON PAPER PATTERN

Module	Part A (2 marks)	Part B (5 marks)	Part C (15 marks)	Total
I	4	2	1	7
II	3	2	1	7
III	2	2	1	5
IV	3	3	1	7
Total No. of Questions	12	9	4	25
No. of questions to be answered	10	6	2	18
Total Marks	20	30	30	80

B. Sc DEGREE PROGRAMME MATHEMATICS (UGCBCS 2017)FIFTH

SEMESTER

MM5CRT05 : REAL ANALYSIS

5 Hrs/Week (Total Hours : 90) **4 Credits**

SYLLABUS

Text Book : Introduction to Real Analysis – Robert G Bartle and Donald RSherbert (3rd Edition) John Wiley & Sons, In

MODULE I: CONTINUOUS FUNCTIONS **30 hours**

Continuous Functions, Combinations of Continuous Functions, Continuous Functions on Intervals, Uniform continuity, Monotone and Inverse Functions.

Chapter 5: Sections 5.1,5.2,5.3,5.4,5.6

MODULE II: DIFFERENTIATION **30 hours**

The Derivative, The Mean Value Theorem, L' Hospital Rules, Taylor's Theorem

Chapter 6: Sections 6.1,6.2,6.3,6.4

MODULE III: THE REIMANN INTEGRAL **24 hours**

The Riemann Integral, Riemann Integrable Functions, The Fundamental Theorem

Chapter 7: Sections 7.1,7.2,7.3

MODULE IV: SEQUENCES AND SERIES OF FUNCTIONS **24 hours**

Point wise and Uniform Convergence, Interchange of Limits, Series of Functions.

Chapter 8: Sections 8.1,8.2, Chapter 9: Section 9.4

References:

1. Richard R Goldberg - Methods of real Analysis, 3rd edition , Oxford and IBMPublishing Company (1964)
2. Shanti Narayan - A Course of Mathematical Analysis, S Chand and Co. Ltd (2004)
3. Elias Zako - Mathematical Analysis Vol 1, Overseas Press, New Delhi (2006)
4. J.M Howie - Real Analysis, Springer 2007.
5. K.A Ross- Elementary - Real Analysis, Springer, Indian Reprints.

6. S.C Malik, Savitha Arora - Mathematical Analysis, Revised Second Edition

QUESTON PAPER PATTERN

Module	Part A (2 marks)	Part B (5 marks)	Part C (15 marks)	Total
I	3	2	1	6
II	3	3	1	7
III	3	2	1	6
IV	3	2	1	6
Total No. of Questions	12	9	4	25
No. of questions to be answered	10	6	2	18
Total Marks	20	30	30	80

B. Sc DEGREE PROGRAMME (UGCBCS 2017)SIXTH

SEMESTER

MM6CRT10 : GRAPH THEORY AND METRIC SPACES

6 hours/week (Total Hrs : 108) **4 credits**

Text books:

1. **John Clark Derek Allen Holton - A first look at graph theory, Allied Publishers**
2. **G. F. Simmons -- Introduction to Topology and Modern analysis(Tata McGraw Hill)**

Module I : Graph Theory **(36 Hrs)**

An introduction to graph. Definition of a Graph, More definitions, Vertex Degrees, Sub graphs, Paths and cycles, the matrix representation of graphs,

Text 1: Chapter 1 (Sections 1.1, 1.3 to 1.7)

Module II: Graph Theory **(30 Hrs)**

Trees. Definitions and Simple properties, Bridges, Spanning trees. Cut vertices and Connectivity. Euler's Tours, the Chinese postman problem. Hamiltonian graphs & the travelling salesman problem.

Text 1: Chapter 2 (Sections 2.1, 2.2 & 2.3, 2.6); Chapter 3 (Sections 3.1 (algorithm deleted), 3.2 (algorithm deleted), 3.3, and 3.4 (algorithm deleted)).

Module III: Metric Spaces **(18 Hrs)**

Metric Spaces – Definition and Examples, Open sets, Closed Sets, Cantor set.

Text 2: Chapter 2 (sections 9, 10 and 11).

Module IV: Metric spaces **(24 Hrs)**

Convergence, Completeness, Continuous Mapping (Baire's Theorem included).

Text 2: Chapter 2 (Sections 12 and 13).

Reference:

a. Douglas B West Peter Grossman - Introduction to Graph Theory

b. R. Balakrishnan, K. Ranganathan - A textbook of Graph Theory, Springer International Edition

c. S. Arumugham, S. Ramachandran - Invitation to Graph Theory, Scitech. Peter Grossman,

d. S. Bernard and J.M Child - Higher Algebra, AITBS Publishers, India,2009

QUESTON PAPER PATTERN

Module	Part A (2 marks)	Part B (5 marks)	Part C (15 marks)	Total
I	4	2	1	7
II	4	3	1	8
III	2	2	1	5
IV	2	2	1	5
Total No. of Questions	12	9	4	25
No. of questions to be answered	10	6	2	18
Total Marks	20	30	30	80

B. Sc DEGREE PROGRAMME MATHEMATICS (UGCBCS 2017)

SIXTH SEMESTER

MM6CRT11 : COMPLEX ANALYSIS

5 hours/week (Total Hrs: 90) **4 credits**

Syllabus

Text book:

James Ward Brown & Ruel V. Churchill - Complex variables and applications (8th edition)

Pre-requisites **(4 hours.)**

A quick review on Complex numbers and its properties, vectors and moduli, complex conjugates, exponential forms, arguments and its properties, roots of complex numbers, and regions in complex plane.
(No question shall be asked from this section.)

Module I: Analytic functions **(28 hours)**

Functions of a complex variable, limits, theorems on limits, continuity, derivatives, differentiation formulas, Cauchy-Riemann equation, sufficient condition for differentiability, analytic functions, examples, harmonic functions. Elementary functions, the Exponential function, logarithmic function, complex exponents, trigonometric functions, hyperbolic functions, inverse trigonometric and hyperbolic functions.

Chapter 2 (Sections 12, 15, 16, 18 to 22, 24 to 26); Chapter 3 (Sections 29, 30, 33 to 36).

Module II: Integrals **(25 hours)**

Derivatives of functions, definite integrals of functions, contours, contour integrals, some examples, upper bounds for moduli of contour integrals, antiderivates , Cauchy-Goursat theorem (without proof), simply and multiply connected domains, Cauchy's integral formula, an extension of Cauchy's integral formula, Liouville's theorem and fundamental theorem of algebra, maximum modulus principle.

Chapter 4 (Sections 37 to 41, 43, 44, 46, 48 to 54);
Chapter 5 (Sections 55 to 60 and 62).

Module III: Series **(15 hours)**

Convergence of sequences and series, Taylor's series, proof of Taylor's theorem, examples, Laurent's series (without proof), examples.

Chapter 5 (Sections 55 to 60 and 62)

Module IV: Residues and poles **(18 hours)**

Isolated singular points, residues, Cauchy's residue theorem, three types of isolated singular points, residues at poles, examples. Applications of residues, evaluation of improper integrals, example.

Chapter 6 (Sections 68 to 70 and 72 to 74);
Chapter 7 (Section 78)

Reference:

1. Lars V. Ahlfors - Complex Analysis – An Introduction to the Theory of Analytic Functions of one Complex Variables (4th edition), (McGRAW-HILL)
2. J M Howie: Complex Analysis, Springer
3. Shanti Narayan - Theory of functions of a complex variable
4. Steven G Krantz - Complex Variables – A Physical approach with applications and MATLAB, Chapman & Hall/CRC (2007).
5. Kasana - Complex Variables: Theory and Applications , 2nd edition
6. B. Choudhary - The Elements of Complex Variables.
7. A. David Wunsch – Complex Analysis with Applications (Pearson)

QUESTON PAPER PATTERN

Module	Part A (2 marks)	Part B (5 marks)	Part C (15 marks)	Total
I	5	3	1	9
II	3	3	1	7
III	2	1	1	4
IV	2	2	1	5
Total No. of Questions	12	9	4	25
No. of questions to be answered	10	6	2	18
Total Marks	20	30	30	80

B. Sc DEGREE PROGRAMME MATHEMATICS (UGCBCS 2017)

SIXTH SEMESTER

MM6CRT12 : LINEAR ALGEBRA

5 hours/week (Total Hrs: 90) **4 credits**

SYLLABUS

Text Book :

1. **S. Blyth and E. F. Robertson : Basic Linear Algebra, Springer, Second Ed.(2002)**

Module 1

A review of algebra of matrices is followed by some applications of matrices, analytic geometry, systems of linear equations and difference equations. Systems of linear equations: elementary matrices, the process of Gaussian elimination, Hermite or reduced row-echelon matrices. Linear combinations of rows (columns), linear independence of columns, row equivalent matrices, rankof a matrix, column rank, normal form, consistent systems of equations.

Text 1: Chapter 1 ; Chapter 2 (Sections 1, 2 and 4) and Chapter 3.

Module 2

Invertible matrices, left and right inverse of a matrix, orthogonal matrix, vector spaces, subspaces, linear combination of vectors, spanning set, linear independence and basis.

Text 1: Chapter 4 and Chapter 5.

Module 3

Linear mappings: Linear transformations, Kernel and range, Rank and Nullity, Linear isomorphism. Matrix connection: Ordered basis, Matrix of f relative to a fixed ordered basis, Transition matrix from a basis to another, Nilpotent and index of nilpotency.

Text 1: Chapter 6 and Chapter 7.

Module 4

Eigenvalues and eigenvectors: Characteristic equation, Algebraic multiplicities, Eigen space, Geometric multiplicities, Eigenvector, diagonalisation, Tri-diagonal matrix.

Text 1: Chapter 9**.**

Reference:

1 Richard Bronson, Gabriel B. Costa - Linear Algebra An Introduction (Second Edition), Academic Press 2009, an imprint of Elsevier.

2 David C Lay: Linear Algebra, Pearson

3 Sheldon Axler - Linear Algebra Done Right (Third Edition, Undergraduate text in Mathematics), Springer 2015.

4 S. H. Friedberg, Arnold J. Insel and Lawrence E. Spence, - Linear Algebra, 2nd Edition, PH Inc.

5 S. Kumaresan - Linear Algebra: A Geometric Approach, Prentice Hall India Learning Private Limited; New title edition (2000)

6 Gilbert Strang – Linear Algebra and its applications, Thomson Learning,

QUESTON PAPER PATTERN

Module	Part A (2 marks)	Part B (5 marks)	Part C (15 marks)	Total
I	2	2	1	5
II	3	2	1	6
III	4	3	2	
IV	3	2		
Total No. of Questions	12	9	4	25
No. of questions to be answered	10	6	2	18
Total Marks	20	30	30	80

MAHATHMA GANDHI UNIVERSITY

B.Sc. DEGREE PROGRAMME (UGCBCS 2017)

MATHEMATICS (OPEN COURSES)

(DURING THE FIFTH SEMESTER)

SYLLABUS

(Effective from 2017 admission onwards)

UNDERGRADUATE PROGRAMME MATHEMATICS (UGCBCS 2017)FIFTH

SEMESTER (OPEN COURSE)

MM5GET02 : APPLICABLE MATHEMATICS

4 hours/week **4 credits**

The objective is to prepare students of all streams, particularly those with arts and commerce back ground for their higher studies and to approach competitive examinations. Detailed explanation and short cut method for solving problems are to be introduced to students, so that they can acquire better understanding of concepts and problem solving skill.. All questions asked to be of arts students' standard.

Module – I **(18 hours)**

Types of numbers, HCF & LCM of integers, Fractions, Simplifications (VBODMASrule), squares and square roots, ratio and proportion, percentage, profit & loss.

Module – II **(18 hours)**

Quadratic equations (Solution of quadratic equations with real roots only), Permutations and combinations – simple applications, Trigonometry- introduction, values of trigonometric ratios of 0^0, 30^0, 45^0, 60^0 & 90^0, Heights and distances.

Module – III **(18 hours)**

Simple interest, Compound interest, Time and work, Work and wages, Time and distance, exponential series and logarithmic series.

Module – IV **(18 hours)**

Elementary mensuration – Area and perimeter of polygons, Elementary Algebra, monomial , binomial, polynomial (linear, quadratic & cubic), simple factorization of quadratic and cubic polynomials.

Differential Calculus - Differentiation – Standard results (derivatives), Product rule, Quotient rule and function of function rule (with out proof) and simple probles),

References –

1 M. Tyra, & K. Kundan- CONCEPTS OF ARITHMETIC, BSC PUBLISHING COMPANY PVT.LTD, C – 37, GANESH NAGAR, PANDAV NAGAR COMPLEX

2 GRE Math review (pdf)
3 Joseph Edward : Differential Calculus for beginners. Nabu Press (2011)
4 Calculus Volume I, S. Narayanan & T.K. Manikavachagam Pillai – S. Viswanathan (Printers & Publications) Pvt.Ltd
5 S Narayaynan, TK Manikavachagam Pillai : Calculus Volume I, S Viswanathan Printers and publications Pvt. Ltd.

QUESTON PAPER PATTERN

Module	Part A (2 marks)	Part B (5 marks)	Part C (15 marks)	Total
I	3	2	1	6
II	3	2	1	6
III	3	2	1	6
IV	3	3	1	7
Total No. of Questions	12	9	4	25
No. of questions to be answered	10	6	2	18
Total Marks	20	30	30	80

MAHATHMA GANDHI UNIVERSITY

B.Sc. DEGREE PROGRAMME (UGCBCS 2017)

MATHEMATICS (CHOICE BASED COURSE)

(DURING THE SIXTH SEMESTER)

SYLLABUS

(Effective from 2017 admission onwards)

B. Sc DEGREE PROGRAMME MATHEMATICS (UGCBCS 2017)SIXTH SEMESTER

MM6CBT03 : NUMERICAL ANALYSIS

4 hours/week (Total Hrs : 72) **3 Credits**

Syllabus

Use of Non Programmable Scientific Calculator is Permitted

Text Books :

3 **S. S. Sastry - Introductory Methods of Numerical Analysis , PHI Learning Private Limited Fifth Edition**

4 **Erwin Kreyszig, Advanced Engineering Mathematics, Tenth Edition Wiley New Delhi, 2015.**

Module I: Solution of Equations **(20 hrs)**

(A quick review mathematical preliminaries, errors, algebraic and transcendental equations) Bisection Method, Method of False Position, Iteration Method, Aitken's Δ^2 process, Newton–Raphson Method, Generalised Newton's Method and Ramanujan's Method

Text 1: Chapter 2 (Sections 2.1, 2.2, 2.3, 2.4, 2.5 and 2.6)

Module II: Interpolation **(18 hrs)**

Errors in Polynomial Interpolation , Forward Differences, Backward Differences, Central Differences Symbolic Relations, Difference of a Polynomial and Newton's Formulae for Interpolation .

Text 1: Chapter 3 (Sections 3.1, 3.2, 3.3, 3.5 and 3.6)

Module III: Fourier Approximations **(14 hrs)**

Fourier series, Fourier transform, Discrete Fourier transform (DFT) and inverse Discrete Fourier transform (IDFT).

Text 1: Chapter 4 (Section 4.6 : 4.6.1 and 4.6.2).

Module IV : Numerical Differentiation and Integration **(20 Hrs)**

Introduction, numerical differentiation and errors in numerical differentiation. NumericalIntegration, Trapezoidal Rule, Simpson's 1/3 Rule, Simpson's 3/8 Rule, Boole's and Weddle's Rules.

Text 1 : Chapter 6 (Sections 6.1, 6.2 : 6.2.1. Sections 6.4 : 6.4.1, 6.4.2, 6.4.3 and 6.4.4)

References

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1. Erwin Kreyszig : Advanced Engineering Mathematics, Eighth Edition, Wiley, India.
2. Scarborough : Numerical Mathematical Analysis
3. Francis Shield (Schaum's Series) : Numerical Analysis
4. Hilderbrand : Introduction to Numerical Analysis

QUESTON PAPER PATTERN

Module	Part A (2 marks)	Part B (5 marks)	Part C (15 marks)	Total
I	4	2	1	7
II	3	2	1	7
III	2	2	1	5
IV	3	3	1	7
Total No. of Questions	12	9	4	25
No. of questions to be answered	10	6	2	18
Total Marks	20	30	30	80

B.Sc MATHEMATICS VOCATIONAL MODEL-II-COMPUTER APPLICATIONS

SEMESTER – I

CA1VOT01 :: Computer Fundamentals

Theory: 4 hrs. per week Credits: 4

Total Marks - 80 marks

Module I (15hours)

Fundamentals of Computers:

Definition of computer and Characteristics, Generations of computers, Types of Computer- Desktop, Laptop, Mainframe, Super Computer, work stations.

Number systems- Binary, Octal and Hexadecimal, Converting from one number system to another,decimal to a new base, converting to decimal from another bases, converting from base other than ten to base other than ten, short cut method for converting from binary to octal, octal to binary, binary to hexadecimal and hexadecimal to binary, Computer Codes (BCD, EBCDIC, ASCII)

Book of Study 1 chapters 1&3

Module II (15hours)
Hardware Components:

Logical Organization of a Digital Computer, Bit/Byte/Word, input unit ,Output unit ,Storage unit

,Arithmetic logic unit,Control unit ,CPU. Input devices – keyboard,point and draw devices, data scanning devices ,output devices-monitors ,printers,plotters.

(Book of study 1-Chapters 4 & 9)

Module III (15hours)
Software Components:

Definition of software ,Types of software-system software -Application software,Logical system architecture,Software development steps. Machine language

,Assemblylanguage,Highlevellanguage.DefineProgram,purpose of program,algorithms,flowcharts,flowchartsymbols,flowchartingrules,advantagesang limitations of flowcharts.

Book of Study 1- chapters - 10,11,12

Module IV (15hours)

Boolean Algebra and Gates Networks

fundamental concepts of Boolean Algebra,Postulates of Boolean algebra, Theorems of Boolean algebra, Logic Gates- AND, OR, NOT, NAND, NOR, XOR and XNOR, logic circuits, converting expression to logic

circuit, The universal NAND gate, universal NOR gate. Exclusive OR and equivalence functions, Simplification of Expressions.

Book of Study 1- chapter 5 Book of Study 2- chapters 2.1-2.8, 3.1

Module V (12hours)

Introduction to Computer Networks:

Uses – Physical Communication Media – Network Types – Network Topologies – Communication Protocols. Basic internet services- email,FTP,TELNET ,WWW

(Book of study 1- Chapter 17 &18)

Book of Study

1. Computer Fundamentals by P.K Sinha M. Morris Ma
2. Introduction to Computer Science 2nd Edition, Rohit Khorana, Pearson Publishers
3. An introduction to Digital Computer design by V. Rajaraman and T. Radhakrishnan
4. Computer fundamentals by B. Ram
5. A First Course in Computers 2003, Saxena, VIKAS

Question Pattern	Marks	Module 1	Module 2	Module 3	Module 4	Module 5	Total
Short Answer	2	2	3	3	2	2	12
Paragraph answer	4	2	2	2	2	1	9
Problem/ Short Essay	6	1	1	1	1	1	5
Long Essay	10	1		1	1	1	4

SEMESTER – I

CA01VOP01 : Software Lab –I- Introduction to WEB Technologies

Practical: 4 hrs. per week Credits: 3

Total Marks - 80 marks

Getting Started With HTML:-

1. Basics of HTML- Document Body Text, Hyperlink, Adding more formatting, LISTS, Tables,, Frames, forms- MARQUEE. Cascading style sheets, Attributes specified to the style tag, CLASS, <SPAN> tag, <DIV> tag, LAYERS.
   Create HTML document with following formatting – Bold, Italics, Underline, Colors, Headings, Title, Font and Font Width, Background, Paragraph, Line Brakes, Horizontal Line, Blinking Text as well as marquee Text.

2. Create HTML document with Ordered and Unordered lists, Inserting Images, Internal and External linking
3. Create HTML document with Table: Some image here
4. Create Form with Input Type, Select and Text Area in HTML.
5. Create an HTML containing Roll No., student's name and Grades in a tabular form.
6. Create an HTML document (having two frames) which will appear as follows:

   About
   Department 1

   Department 2

   Department 3

   This frame would show the contents according to the linkclicked by the user on the leftframe.

7. Create an HTML document containing horizontal frames as follows:

   Department Names (could be along with Logos)
   Contents according to the Link clicked

8. Create a website of 6 – 7 pages with different effects as mentioned in above problems.
9. Create HTML documents (having multiple frames) in the following three formats:

   Frame1
   Frame2
   Frame1

   Frame2 Frame3

10. Create a form using HTML which has the following types of controls:
    I. Text Box
    II. Option/radio buttons
    III. Check boxes
    IV. Reset and Submit buttons

How PHP scripts work:-

The building blocks of PHP: variables, data types, arrays-basic array, associative array

, multidimensional array; array functions, program control, type casting, regular expression. User-defined functions, built-in functions, Using files. Forms in PHP:Creating a simple input form, combining HTML & PHP code on a single page.

References:

1. Luke welling & Laura Thomson,"PHP and MySQL web Development", fourth edition, Pearson.
2. Chris Bates, Web Programming, 3 rd Edition; Pub: John Wiley & Sons
3. HTML Black Book, Steven Holzner, Dreamtech Publishers
4. PHP and MySQL for Dynamic Web Sites, Fourth Edition: Visual QuickPro Guide Kindle Edition by Larry Ullman.
5. PHP & MySQL in easy steps, Kindle Edition by Mike McGrath.

Minimum 25 Experiments using HTML and PHP .

Scheme of Evaluation for Software Lab Iexternal is as follows:

Division of Marks (Practical - 3 hours External)

First program based on HTML	**- 30 marks**
Second program based on PHP	**-30 marks**
Viva Voce	**- 05 marks**
Lab Record (minimum of 12 Programs from each section)	**- 15 marks**
Total Marks	**- 80 marks**

SEMESTER – II

CA2VOT02 : Object Oriented Programming with C++

Theory: 4 hrs. per week Credits: 4

Total Marks - 80 marks

Module I (10 hours)

Algorithms, Flow Charts - Symbols, Rules for making Flow chart, the object oriented technology, Key concept of object oriented programming, Advantages of OOP, structure of C++ program, Tokens, variables, data types, operators in C++, memory management operators, comments ,simple C++ programme, header files and libraries, unformatted console I/O operations, setw() manipulator.

Chapters 1,2,3&4

Module II (18 hours)

Decision statements, control loop structure, arrays

Functions : introduction, parts of a function, passing arguments, return by reference, returning more values, default arguments, const arguments, inline functions, function overloading, recursion

Chapter 7&8

Module III (18 hours)

Classes and Objects

Constructers and Destructors , Constructors- parameterized constructors-multiple constructors-constructors with default argument- copy constructor-dynamic constructorDestructors- calling Constructers and Destructors, Constructers and Destructors with static members.

Chapter 9

Module IV (14 hours)

Operator and overloading:

introduction, the keyword operator, overloading unary operator, operator return type, overloading binaryoperator, overloading with friend function, overloading assignment operator

Chapters 10

Module V (12 hours)

Inheritance, Pointers-Virtual Functions a and Polymorphism
Files and Exception handling

Chapters 11,15,16&19

Book of Study:

1. Object Oriented Programming with C++ - E. Balagurusamy

Reference :

1. Programming with C++, Second edition by D Ravichandran, Tata McGraw- Hill.
2. Object Oriented Programming with C++- Mahesh Bhave and Sunil Pateker, Second edition, Pearson
3. Ashok N Kamthane and Amit Ashok Kamthane, Programming in C++, Second Edition, Pearson.

Question Pattern	**Marks**	**Module 1**	**Module 2**	**Module 3**	**Module 4**	**Module 5**	**Total**
Short Answer	2	2	3	2	2	3	12
Paragraph answer	4	2	2	2	2	1	9
Problem/ Short Essay	6	1	1	1	1	1	5
Long Essay	10	1	1	1	1		4

SEMESTER – II

CA2VOP02 :Software Lab-II using C++

Practical : 4 hrs. per week Credits: 3

Total Marks - 80 marks

1. Programs based on class, objects and manipulation of objects using member functions
2. Programs based on friend functions, passing objects as arguments to function.
3. Programs based on array of objects.
4. Programs based on function overloading, Default arguments.
5. Programs based on operator overloading (binary, unary) using member functions and friend functions.
6. Programs based on constructors, different types of constructors.
7. Programs based on Inheritance, different types of inheritance.

Scheme of Evaluation for Software Lab IIexternal is as follows:

Division of Marks (Practical - 3 hours External)

First program based	1 to 5	**- 30 marks**
Second program based	6 & 7	**-30 marks**
Viva Voce		**- 05 marks**
Lab Record (minimum of 25 Program)		**- 15 marks**
	Total Marks	**- 80 marks**

SEMESTER – III

CA3VOT03 : Database Management Systems

Theory: 6 hrs. per week Credits: 4

Total Marks - 80 marks

Module I (15 hours)

Basic concepts :

Database, need for DBMS, users, architecture of DBMS, data models, views of data, data Independence, , attributes, relationship attributes, relationship set, generalization, aggregation, structure of relations

Chapter 1

Module II (15 hours)

Data model :

conventional data models & systems, ER model, structure of relational Database and different types of keys;Data base languages.

Chapter 6

Module III(20 hours)

The relational algebra modification of database – Views. SQL – Basic structures , Data definition in SQL, Views and Queries in SQL, – Programming using SQL

(Chapter 2 & 3 of the text)

Module IV (25 hours)

Object – Oriented data base, Object – Oriented data model, Object – oriented languages.

File structures – File organization – Organization of records in files – Data dictionary storage –Storage structure for object – Oriented database – Indexing & Hashing – Basic concepts – B+ - Tree Index file – Hashing functions

(Chapter 9 & 11 & 12 of the text)

Module V (15 hours)

Query processing – Overview – Section of operation – Sorting
Database architecture – Different type of systems – Network types.

(Chapter 13 & 20 of the text)

Text Books:

Abraham Silberschatz, Henry K. Korth, S, Sudarshan - Data Base System Concepts , McGrawHill.

Reference:

1. R. Elmarsi, S. B. Navathe : Fundamentals of database system , Addison Wesley

2. Ullman : Principles of database systems

Question Pattern	Marks	Module 1	Module 2	Module 3	Module 4	Module 5	Total
Short Answer	2	2	3	2	2	3	12
Paragraph answer	4	2	2	2	2	1	9
Problem/ Short Essay	6	1	1	1	1	1	5
Long Essay	10	1	1	1	1		4

SEMESTER –III

CA3VPOP03 : Software Lab -III using SQL

Practical : 6 hrs. per week Credits: 3

Total Marks - 80 marks

1. Data definition commands - CREATE, ALTER, DROP, Adding Constraints Primary key, foreign key, unique key, check, not null.
2. Basic SQL queries INSERT, SELECT, DELETE, UPDATE, Using multiple tables, ordering of rows using ORDER BY option, Set operations using UNION, EXCEPT, INTERSECT, Substring Comparison using LIKE operator, BETWEEN operator.
3. Complex Queries Nested Queries, EXISTS and UNIQUE/DISTINCT functions, NULL values, Renaming of attributes and Joining of tables, Aggregate functions and grouping.

Scheme of Evaluation for Software Lab III external is as follows:

Division of Marks (Practical - 3 hours External)

First program based on 1&2		**- 30 marks**
Second program based on 3		**-30 marks**
Viva Voce		**- 05 marks**
Lab Record (minimum of 30 Programs)		**- 15 marks**
	Total Marks	**- 80 marks**

SEMESTER – IV

CA4VOT04 : Operating System

Theory: 6 hrs. per week Credits: 4

Total Marks - 80 marks

Module I: (15 hrs.)

INTRODUCTIONTO OPERATING SYSTEM:

Operating System: Objectives and functions; Different views of an operating system; Types of operating systems-batch os, mainframe os, server os, multiprocessor os, personal computer os, handheld computer os, embedded os, sensor node os, real-time os, smart card os; Operating system services .

(Book of study 1 -Chapter 1)

Module II (25 hours)

PROCESSES MANAGEMENT & CPU SCHEDULING:

Process Management: Process concept- The process, Process states, Process Control Block; Process Scheduling- Scheduling Queues, Schedulers;

CPU scheduling: Schedulingconcepts- Process behaviour, When to schedule, Dispatcher; Scheduling Criteria; Scheduling algorithms-FCFS, SJFS, Priority scheduling, Round-robin scheduling, Multilevel Queue Scheduling, Multilevel feedback queue scheduling.

Dealing with deadlocks: introduction; deadlock characterization-deadlock conditions, resource allocation graph; deadlock prevention.

(Book of study 1 – Chapter2, 4, 6)

Module III (15 hours)

MEMORY MANAGEMENT BASICS:

Introduction- Address binding, Logical and physical address space, Program relocation; Storage allocation and management techniques-Contiguous storage allocation-fixed partition, variable partition; Non-contiguous storage allocation-paging, segmentation.

(Book of study 2 –Chapter 8)

Module IV(15 hours)
FILE SYSTEMS:

Files: Basic concept- file attributes, file operations, file types, file structures, file access; directories- single-level directory system, two-level directory system, hierarchical directorysystem, directory operations.

(Book of study 1 -Chapter 11)

Module V (20 hours) PROTECTION AND SECURITY:

Why protection; goals of protection; security and its goals; authentication- passwords, artifact-based authentication, biometrics techniques; encryption; virus, worms and Trojans- dealing with viruses, dealing with worms; threat monitoring.

(Book of study 2 –Chapter12)

Book of study:

1. RohitKhurana, Operating System, 2nd edition,Vikas Publishing house pvt ltd.
2. EktaWalia, Operating Systems Concepts, Khanna Book Publishing

References:

1. Silberschatz, galvin, gagne, Operating System Concepts, 6th edition.
2. Gary Nutt, NabenduChaki, SarmishthaNeogy,Operating Systems, 3rd edition, Pearson.

Question Pattern	Marks	Module 1	Module 2	Module 3	Module 4	Module 5	Total
Short Answer	2	3	3	2	2	2	12
Paragraph answer	4	2	2	2	2	1	9
Problem/ Short Essay	6	1	1	1	1	1	5
Long Essay	10		1	1	1	1	4

Semester -IV

CA4VOP04 : Software Lab – IV Project Practical

6 hrs. per week Credits: 3
Total Marks - 80 marks

Scheme of Evaluation for Software Lab – IV Project Practical external is as follows:

Division of Marks (external)

Project demonstration and Presentation	**- 40 marks**
Viva related to project	**-20 marks**
Project report with proper content and binding	**- 20 marks**

Total Marks- 80marks

B.Sc. MATHEMATICS MODEL II

COMPLEMENTARY COURSE –OPERATIONSRESEARCH

SYLLABUS

[2017 Admission onwards]

B.Sc.DEGREEPROGRAMME COMPLEMENTARYCOURSE-OPERATIONSRESEARCH

(For B.ScMathematicsModelI)

FIRSTSEMESTER

LINEARPROGRAMMING

Syllabus

3hrs/week(TotalHrs:54)3Credits

TextBook

K.V. Mital and C.Mohan, Optimization methods inOperationsResearch and systemAnalysis (Ne wAgeInternationalpublishers)

ModuleI:MathematicalPreliminaries (15hrs)

Vectorsandvectorspaces(Definition1,2andexamplesonly),LinearDependence(Definition2,4andexamplesonly.Theorem1excluded),Dimensionofavectorspace),basis(Definition5andstatementofTheorem2only;EuclideanSpace(Definition6,7,8andExampleOnly),NormofaVector(Definition9,10anddTheorem3withoutproof).LinearAlgebraicEquatons(Generalformonly).OpenandclosedsetsinE$_n$,convexsets(Definition12,13,14,15,16,17andstatementofTheorem7).Convexlinearcombination(Definition18,19,20,21andexamples.Theorem8excluded);Intersectionofconvexsets,ConvexHullofaset(Definition22,statementsofTheorem9and10andexampleonly.Theorem11excluded),Verticesorextremepointsofaconvexset(Definition23andStatementofTheorem13Only);Convexpolyhedron(Definition24andStatementofTheorem14Only.Theorem15excluded),Hyperplanes,halfspacesandpolytopes(Definition25,26,27andstatementsofTheorem17andstatementofCorollaryonly.Theorem16Excluded),SeperatingandSupportingHyperplanes(Definition29,StatementofTheorems18and20Only.Theorem17Excluded);Verticesofaclosedboundedconvexset(StatementsofTheorem21andTheorem22Only**).**

Text1Chapter1(Sections1.1to1.19)
Problems3,4,6,8,and11.AllotherproblemsinProblemsIofChapter1areexcluded.
ProofsofallTheoremsexcluded.

ModuleII: GeneralProblemofMathematicalProgramming (12hours)

QuadraticForms(Definition30,Examples,StatementsofTheorem24,25,26and27only).LocalandGlobalExtrema(Definitions6and7only),Saddlepoint(Definition8only).ConvexFunctions(Definition10,StatementsofTheorem3and4only.Theorems5and6areexcluded),GeneralProblemofMathematical Programming.

Text1Chapter1(Section1.20only)andChapter2(Sections2.5,2.11and2.12only)
AllotherproblemsinProblemsIofChapter1andProblemsIIofChapter2areexcluded.
ProofsofallTheoremsexcluded.

ModuleIII-Linearprogramming (10hours)

Introduction,L.Pintwodimension.GeneralLPproblem,Feasiblesolutions(Definition1andstatement ofTheorem1),Basicsolutions,Basicfeasiblesolutions(Definition2andStatementsofTheorems2and3 only),Optimalsolutions(StatementsofTheorems4and5only),Summary,LPPusingGraphicalMethod .

Text1Chapter3(Sections3.1to3.8)
Problems1and2ofChapter3.AllotherproblemsinProblemsIIIofChapter3areexcluded.
ProofsofallTheoremsexcluded.

ModuleIV-Linearprogramming(Cont.) (17hours)

Linearprogramming:Simplexmethod,Simplexmethod(NumericalExample),Simplextablefindingt hefirstbasicfeasiblesolution,Artificialvariables,Degeneracy.

Text1Chapter3(Sections3.9to3.12)Text1Chapter2(Section2.12)andChapter3(Sections3.8to3.14), Problems3,4and5ofChapter3.AllotherproblemsinProblemsIIIofChapter3areexcluded

ReferenceTexts

1. FrankAyresJr,Matrices(Schaum'sOutlineSeries,TMHEdition);
2.LinearAlgebra,SeymourLipschutzandMarkLipson(Schaum'sOutlineSeries,TMHEdition)
3.OperationsResearchTheoryandApplications,.J.K.Sharma(MacmillanIndiaLtd.)

QUESTION PAPER PATTERN

Module	Part A 2 Marks	Part B 5 Marks	Part C 15 Marks	Total
I	7	2	-	9
II	2	3	1	6
III	2	2	1	5
IV	1	2	2	5
Total No. of Questions	12	9	4	25
No. of Questions to be answered	10	6	2	18
Total Marks	20	30	30	80

B.Sc.DEGREEPROGRAMME COMPLEMENTARYCOURSE-OPERATIONSRESEARCH –
(For B.ScMathematicsModelI)

SECONDSEMESTER

DUALITY,TRANSPORTATIONANDASSIGNMENTPROBLEM

3hrs/week(TotalHrs:54) **3Credits**

Syllabus

TextBook

K.V.Mital&C.Mohan:OptimizationMethodsinOperationsResearchandSystemAnalysis(NewAgeInternationalPublishers)
Chapter3(Sections17to20and22)Chapter4(Sections1to4,6to11,14to16)

ModuleI: LinearProgramming **(15hours)**

DualityinL.P.Problems,DualityTheorems(statementsonly-ProofsofallTheorems are excluded),Applicationofduality,DualSimplexMethod,ApplicationsofL.P.

ModuleII: TransportationProblems **(10hours)**

Introduction,TransportationProblems,TransportationArrays,Transportationmatrix,Findingabasisfeasiblesolution.TestingforOptimality.

ModuleIII: LoopingTransportation **(15hours)**

Theorem2insec8 (statementonly),Arraychangingthebasis,Degeneracy,UnbalancedProblem

ModuleIV:AssignmentProblems **(14hours)**

AssignmentProblems, Theorem 3 in sec 14(statement only),GeneralizedtransportationproblemSummaryofTransportationAlgorithms.

Reference: J.K.Sharma:OperationsResearchTheoryandApplications(MacmillanIndianLtd)

QUESTION PAPER PATTERN

Module	Part A 2 Marks	Part B 5 Marks	Part C 15 Marks	Total
I	4	2	1	7
II	4	1	0	5
III	2	3	2	7
IV	2	3	1	6
Total No. of Questions	12	9	4	25
No. of Questions to be answered	10	6	2	18
Total Marks	20	30	30	80

B.Sc.DEGREEPROGRAMME COMPLEMENTARYCOURSE-OPERATIONSRESEARCH –

(For B.ScMathematicsModelII)

THIRDSEMESTER QUEUEINGTHEORY

3hrs/week(TotalHrs:54)

3Credits

Syllabus

TextBook:

1. **K.V.Mital&C.Mohan:OptimizationMethodsinOperationsResearchandSystemAnalysis(NewAgeInternationalPrivateLimited)**
   Chapter12
2. **J.K.Sharma:OperationsResearchTheoryandApplications(ThirdEdition)(Macmillan) Chapter13(Section1to6)Chapter16(Sections1to6)**

ModuleI: TheoryofGames (16hours)

Introduction,Matrixgames,problemofgametheory,Minimaxtheorem(Theorem1,Theorem2,Corollary1andCorollary2withoutproof),SaddlePoint,StrategiesandPayoff.TheoremsofMatrixGames(Theorem3,Theorem4,Theorem5andTheorem6withoutProof),graphicalsolutions,NotionofDominance,RectangulargameasanLPproblem.

Text1:Chapter12, AllTheoremswithoutProof.

ModuleII:ProjectManagementPERT&CPM (10hours)

Introduction,BasicDifferencebetweenPERT&CPM,SignificanceofusingPERT/CPMphasesofProjectManagement,ProjectPlanningPhase,SchedulingPhase,ProjectcontrolPhasePERT/CPM,NetworkComponentsandPrecedenceRelationships,RulesofAOANetworkConstruction,ErrorsandDummiesinNetwork

Text2Chapter13-Sections13.1to13.4

ModuleIII:ProjectManagementPERT&CPM(Cont.) (14hours)

Criticalpathanalysis,ForwardPassMethod,Backwardpassmethod,Float(slack)ofanactivityandEventCriticalPath,ProjectSchedulingwithUncertainActivityTimes,EstimationofProjectCompletionTime.

Text2Chapter13-Sections13.5to13.6
AllQuestionsrelatedtoProbabilityDistributionsareexcluded

ModuleIV:QueuingTheory (14hours)

Introduction,EssentialfeaturesofaQueueingsystem,CallingPopulationsCharacteristics(pdfofPoissonDistributionandExponentialDistributionOnly),QueueingProcess,QueueDiscipline,ServiceProcess,PerformanceMeasuresofaQueueingsystem,Transient – stateandsteady – state,RelationshipsamongperformanceMeasures(FormulaeOnly),ProbabilitydistributionsQueueingsystems,DistributionsofArrivals(ExponentialProcess),DistributionofDeparture(pureDeathProcess),DistributionofServiceTimesClassificationofQueueingModels,SolutionofQueueingModels,Sin

gleservesQueueingModels(DerivationsforDifferentialDifferenceEquations,SystemofSteady-StateEquations,SysytemofDifferenceEquations,ProbabilityDensityFunctionsofWaitingTimeandBusyPeriodDistributionsareexcluded),PerformanceMeasuresforModelI(FormulaeOnly)
ModelI;{(M/M/1):(∞/FCFS)}
ModelII;{(M/M/1): (∞/SIRO)}

Text2Chapter16-Sections16.1to16.5ExceptModelIII

AllQuestionsrelatedtoProbabilityDistributionsexceptpdfofPoissonDistributionandExponentialDistributionareexcluded

Reference:

OperationsResearch – KantiSwarup – P.K.GuptaandManMohan(SultanChand&Sons)

QUESTION PAPER PATTERN

Module	Part A 2 Marks	Part B 5 Marks	Part C 15 Marks	Total
I	4	2	1	7
II	1	1	-	2
III	3	3	2	8
IV	4	3	1	8
Total No. of Questions	12	9	4	25
No. of Questions to be answered	10	6	2	18
Total Marks	20	30	30	80

B.Sc.DEGREEPROGRAMME COMPLEMENTARYCOURSE-
OPERATIONSRESEARCH –
(For B.ScMathematicsModelII)
FOURTHSEMESTER NONLINEARPROGRAMMING

3hrs/week(TotalHrs:54) **3Credits**

Syllabus

TextBook:

K.V.Mital&C.Mohan:OptimizationMethodsinOperationsResearchandSystemAnalysis,3rdEdition,NewAgeInternationalPrivateLimited

ModuleI -IntegerProgramming (13hours)

Introduction,ILPintwo-dimensionalspace,GeneralILPandMILPproblems,(StatementsofTheorems1,2and3only),Examplesofsection2continued,Cuttingplanes,Examples,RemarksonCuttingplanemethods
Text1Chapter6-Section1to7andallTheoremswithoutProof

ModuleII (14hours)
BranchandBoundMethod – Examples,Branchandboundmethod – GeneralDescription(TwovariablesProblemsOnly)
Text1Chapter6-Section8to 9 Problems8,11,12 ,13, 14,15,16,171nd 18inProblemsVIareexcluded**.**

ModuleIII -Kuhn-TuckerTheoryandNonLinearProgramming (15hours)
Introduction,LagrangianFunction,SaddlePoint,RelationBetweensaddlepointofF(X,Y)andMinimal pointofF(X)(Theorm1,2,3and4StatementOnly),Kuhn-Tuckerconditions(ConditionsOnly-Derivationsexcluded),GraphicalMethodProblems.

Text1Chapter8-Section1to4andallTheoremswithoutProof.

ModuleIV-Kuhn-TuckerTheoryandNonLinearProgramming(Cont.) (12hours)
QuadraticProgramming,Separableprogramming(Definition1and2.Derivationofthismethodisexcluded),ProblemsofQuadraticProgrammingandSeparableprogramming

Text1Chapter8-Section6and7

Reference:
OperationsResearchTheoryandApplications – J.K.Sharma(Macmillan)

QUESTION PAPER PATTERN

Module	Part A 2 Marks	Part B 5 Marks	Part C 15 Marks	Total
I	2	-	-	2
II	2	4	1	7
III	5	3	2	10
IV	3	2	1	6
Total No. of Questions	12	9	4	25
No. of Questions to be answered	10	6	2	18
Total Marks	20	30	30	80

MAHATHMA GANDHI UNIVERSITY B.Sc. DEGREE PROGRAMME (UGCBCS 2017)

MATHEMATICS (COMPLEMENTARY COURSES)SYLLABUS

(Effective from 2017 admissions onwards)

Syllabi of Complementary Courses in MATHEMATICS of BCA

B.Sc. DEGREE PROGRAMME (UGCBCS 2017)MATHEMATICS

(COMPLEMENTARY COURSE TO BCA)

FIRST SEMESTER

DISCRETE MATHEMATICS (I)

4 hrs/week (Total Hrs:72) **4Credits**

Syllabus

Text Books

Kenneth H Rosen ; Discrete Mathematics And Its Applications ; 6th Edition ;Tata

Mc Graw-Hill Publishing Company Limited

Module 1: Logic **(18 hrs)**

Propositional Logic, Propositional Equivalence, Predicates and Quantifiers and Rules of Inference

Chapter 1 (Sections 1.1, 1.2, 1.3 and 1.5only)

Module II: Basic Structures **(15 hrs)**

Sets, Set Operations, Functions, Sequences and Summations

Chapter 2 (Sections 2.1, 2.2, 2.3 and 2.4)

Module III: Number Theory and Cryptosystem **(20 hrs)**

The Integers and Division, Primes and Greatest Common Divisors, Applications of Number Theory.

Chapter 3 (Sections 3.4, 3.5 and 3.7 Only)

Module IV: Relations **(19 hrs)**

Relations and Their Properties, Representing Relations, Equivalence Relations, Partial Orderings.

Chapter 7 (Sections 7.1, 7.3, 7.5 and 7.6)

References

1. Clifford Stien, Robert L Drysdale, KennethBogart ; Discrete Mathematics for Computer Scientists; Pearson Education; Dorling Kindersley India Pvt. Ltd
2. Kenneth A Ross; Charles R.B. Wright ; Discrete Mathematics; Pearson Education; Dorling Kindersley India Pvt.Ltd
3. Ralph P. Grimaldi, B.V.Ramana; Discrete And Combinatorial Mathematics ; Pearson Education; Dorling Kindersley India Pvt. Ltd
4. Richard Johnsonbaugh; Discrete Mathematics; Pearson Education; Dorling Kindersley India Pvt.Ltd
5. Winfried Karl Grassman, Jean-Paul Tremblay; Logic And Discrete Mathematics A Computer Science Perspective ; Pearson Education; Dorling Kindersley India Pvt. Ltd

QUESTON PAPER PATTERN

Module	Part A 2 Mark	Part B 5 Marks	Part C 15Marks	Total
I	3	3	1	7
II	3	2	1	6
III	3	2	1	6
IV	3	2	1	6
Total No. of Questions	12	9	4	25
No. Questions to be answered	10	6	2	18
Total Marks	20	30	30	80

B.Sc. DEGREE PROGRAMME (UGCBCS 2017)MATHEMATICS

(COMPLEMENTARY COURSE TO B.Sc COMPUTER SCIENCE/ BCA)SECOND SEMESTER

DISCRETE MATHEMATICS (II)

4 hrs/week (Total Hrs:72) **4credits**

Syllabus

Text Books

1. **Kenneth H Rosen ; Discrete Mathematics And Its Applications ; 6th Edition ; Tata Mc Graw-Hill Publishing Company Limited**
2. **Frank Ayres Jr : Matrices , Schaum's Outline Series , TMH Edition.**

Module I: Graphs **(18 hrs)**

Graphs and Graph Models, Graph Terminology and Special types of Graphs,Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths.

Text 1 Chapter 8 (Sections 8.1, 8.2, 8.3, 8.4 and 8.5 only)

Module II: Trees **(17 hrs)**

Introduction to Trees, Application of Trees, Tree Traversal, and Spanning Trees.

Text 1 Chapter 9 (Sections 9.1, 9.2, 9.3 and 9.4 only)

Module III: Boolean Algebra **(17 hrs)**

Boolean Function, Representing Boolean Functions and Logic Gates

Text 1 Chapter 10 (Sections 10.1, 10.2 and 10.3 only)

Module IV: Matrices **(20 hrs)**

Definitions and examples of Symmetric, Skew-symmetric, Conjugate, Hermitian, Skew- hermitian matrices. Rank of Matrix , Determination of rank by Row Canonical form and Normal form , Linear

Equations, Solution of non homogenous equations using Augmented matrix and by Cramers Rule , Homogenous Equations, Characteristic Equation, Characteristic roots and Characteristic vectors of matix , Cayley Hamilton theorem and applications.

Text 2. Relevant Sections of Chapters 2, 5 , 10 , 19 and 23 (Proofs of all Theorems in Module IV are Excluded)

References

1. Clifford Stien, Robert L Drysdale, KennethBogart ; Discrete Mathematics for Computer Scientists; Pearson Education; Dorling Kindersley India Pvt. Ltd

2. Kenneth A Ross; Charles R.B. Wright ; Discrete Mathematics; Pearson Education; Dorling Kindersley India Pvt.Ltd

3. Ralph P. Grimaldi, B.V.Ramana; Discrete And Combinatorial Mathematics ; Pearson Education; Dorling Kindersley India Pvt. Ltd

4. Richard Johnsonbaugh; Discrete Mathematics; Pearson Education; Dorling Kindersley India Pvt.Ltd

5. Winfried Karl Grassman, Jean-Paul Tremblay; Logic And Discrete Mathematics A Computer Science Perspective ; Pearson Education; Dorling Kindersley India Pvt. Ltd

QUESTON PAPER PATTERN

Module	Part A 2 Mark	Part B 5 Marks	Part C 15Marks	Total
I	3	3	1	7
II	3	2	1	6
III	3	2	1	6
IV	3	2	1	6
Total No. of Questions	12	9	4	25
No. Questions to be answered	10	6	2	18
Total Marks	20	30	30	80

B.Sc. DEGREE PROGRAMME (UGCBCS 2017)MATHEMATICS

(COMPLEMENTARY COURSE TO BCA) FOURTHSEMESTER

OPERATIONS RESEARCH

4hrs/week **4credits**

Syllabus

Text Book:

Belly E Gillet – Introduction to Operations Research (A Computer Oriented ArithmeticApproach) (Tata Mc. GrawHill)

MODULE I: Basics of O.R. **(10hrs)**

The nature and uses of O.R- math concepts and approaches of O.R- models in O.R.

MODULE II: Linear programming problems **(25 hrs)**

Mathematical formulation of a L.P.P., General linear programming problems, solution of a L.P.P, graphical method for solving a L.P.P.

Simplex Method: Stack and surplus variables- reduction of any feasible solution to a basic feasible solution. Unbounded solution. Optimality conditions- artificial variable techniques- Big M method.

MODULE III: Transportation & assignment Problems **(20 hrs)**

Transportation model- solution by simplex method- north west corner rule, lowest cost entry method, vogel method, MODI method, degeneracy, assignment problems.

MODULE IV: Game Theory **(17 hrs)**

Two persons zero sum games, pure and mixed strategy with saddle point, solution of pure strategy games, solution of mixed strategy problems by arithmetic method. Principle of dominance.

Reference Books:

1. V.K Kapoor – OperationsResearch
2. Kanti Swarup , P.K Gupta and Man Mohan – Operations Research, Sultan Chand &Sons
3. K.V Mital and C. Mohan – Optimization Methods in Operations Research and SystemAnalysis
4. J. K Sharma – Operations Research Theory and Applications , Macmillan
5. B. N. Mishra, B. K. Mishra – OptimizationLinear Programming Ane Books

QUESTON PAPER PATTERN

Module	Part A 2 Mark	Part B 5 Marks	Part C 15Marks	Total
I	3	3	1	7
II	3	2	1	6
III	3	2	1	6
IV	3	2	1	6
Total No. of Questions	12	9	4	25
No. Questions to be answered	10	6	2	18
Total Marks	20	30	30	80

Syllabi of Complementary Courses in Statistics of BCA

Semester	Course Type	Course Code with Title	Credits	Lecture Hours	
				Per Week	Total
1	Complementary	ST1CMT01 - Basic Statistics and Introductory Probability Theory	3	4	72
3	Complementary	ST3CMT02 - Advanced Statistical Methods	4	4	72

Complementary Course to BCA Programme

Semester I - Course I

ST1CMT01 - BASIC STATISTICS AND INTRODUCTORYPROBABILITY THEORY

Hours per week -4

Number of credits -3

BRIDGE COURSE(This topics is for internal evaluation only. **Quick review** and give internal assessment from this topics. **Not included in the external examination**) ..... (**5 Hours)**

Introduction to Statistics, Population and Sample, Collection of Data, Censusand Sampling, Methods of Sampling Simple Random Sampling (with and without replacement) stratified sampling systematic sampling (Method only),Types of data quantitative, qualitative, Classification and Tabulation,

Diagrammatic representation - Bar diagram, Pie diagram; .....(**12 Hours**)

Module I

Graphical representation histogram; frequency polygon; frequency curve; ogives and stem and leaf chart. Measures of Central Tendency -Mean, Median, Mode, Quantile points-quartiles, Percentiles, Deciles. Measures of Dispersion -Range, Quartile Deviation, Mean Deviation, Standard Deviation, Coefficient of

Variation. Box Plot .....**(12 Hours)**

Module II

Introduction to bivariate data , Scatter Diagram ,Curve Fitting by the Method of Least Squares (without proof) Fitting of Straight Lines, Exponential Curve, Power Curve, Linear Correlation CovarianceMethod(formula only) and simpleproblems, Linear Regression-Regression Equations identification of regression lines and properties .....**(13 Hours)**

Module III

Probability Concepts Random Experiment, Sample Space, Events, Probability Measure, Approaches to Probability- Classical, Statistical and Axiomatic, Addition Theorem (upto 3 events) Conditional Probability, Independence of events, Multiplication theorem (upto 3 events), Total Probability Law, Bayes Theorem and its applications ..... **(15 Hours)**

Module IV

Random variables and distribution functions Random variables, probability density (mass) function, distribution function- properties, expectation of a discrete and continuous random variables-properties (without proof) mean and standard deviation of different probability density function, moment generating function, important properties (without proof) ..... **(15 Hours)**

Core Reference

1. S.P. Gupta: Statistical Methods (Sultan Chand & Sons Delhi).
2. S.C. Gupta and V.K. Kapoor: Fundamentals of Mathematical Statistics,Sultan Chand and Sons.
3. B.L. Agarwal: Basic Statistics, New Age International (p) Ltd.

Additional References

1. ParimalMukhopadhya: Mathematical Statistics, New Central BookAgency (p) Ltd, Calcutta
2. Murthy M.N.: Sampling theory and Methods, Statistical PublishingSociety, Calc

SCHEME OF QUESTION PAPER

(The number of questions from the 4 modules to be included in the 3 parts ofthe question paper)

Use of non-programmable calculator and statistical tables allowed.

Part	Marks of each Question	No. of Questions					Total Marks	To be answered	
		Module				Total		No. of Questions	Total Marks
		1	2	3	4				
A	2	3	3	3	3	12	24	10	20
B	5	3	2	2	2	9	45	6	30
C	15	0	1	1	2	4	60	2	30
Total Questions		7	6	6	6	25	129	18	80
Total Mark		36	31	31	31	129			

Complementary Course to BCA Programme

Semester III–Course II

ST3CMT02 - ADVANCED STATISTICAL METHODS

Hours per week -4

Number of credits -4

Module I

Theoretical distributions. Discrete distribution(Uniform, Bernoulli, binomial andPoisson), mean, variance, moment generating functions and fitting of data.

Continuous distribution- Uniform and normal distribution-important properties (without proof) of the distribution (mean, variance, moments, mgf, M.D. and Q.D Area under the normal curve-related problems ..... **(16Hours)**

Module II

Sampling Distributions. definition, Statistic, Parameter, Standard Error,

Sampling Distributions of Mean of the sample from Normal population and distribution of Variance(form alone), statement of the form of the distributions 32,t and F (without derivation), properties, Inter relationships ..... **(16 Hours)**

Module III

Estimation of parameters- Point Estimation and Interval estimation, properties of Point Estimation-Unbiasedness, Efficiency; Consistency; Sufficiency, Methods of estimation-method of moments and method of maximum likelihood.Interval Estimation for Mean, Variance of normal population and Proportion of binomial population ..... **(20Hours)**

Module IV

Testing of hypotheses- Statistical hypotheses, Simple and composite hypotheses.Null and Alternate hypothesis, Two types of errors, Critical Region, Size of the

test, Significance level P value, Power, Large Sample test Z test-,t test Chi-Squaretest-goodness of fit, test of independence ..... **(20 Hours)**

References:

1. S.C. Gupta and V.K. Kapoor: *Fundamentals of Mathematical Statistics*,Sultan Chand and Sons
2. S.C Gupta*: Fundamentals of Mathematical Statistics*, Sultan Chand andSons.
3. V.K. Rohatgi: *An Introduction to Probability Theory and MathematicalStatistics*, Wiley Eastern

SCHEME OF QUESTION PAPER

(The number of questions from the 4 modules to be included in the 3 parts ofthe question paper)

Use of non-programmable calculator and statistical tables allowed.

Part	Marks of each Question	No. of Questions					Total Marks	To be answered	
		Module				Total		No. of Questions	Total Marks
		1	2	3	4				
A	**2**	**3**	**3**	**3**	**3**	**12**	**24**	**10**	**20**
B	**5**	**3**	**2**	**2**	**2**	**9**	**45**	**6**	**30**
C	**15**	**0**	**1**	**1**	**2**	**4**	**60**	**2**	**30**
Total Questions		**7**	**6**	**6**	**6**	**25**	**129**	**18**	**80**
Total Mark		**36**	**31**	**31**	**31**	**129**			

Syllabi of Complementary Courses in Mathematics of BBA

BA1CMT03 FUNDAMENTALS OF BUSINESS MATHEMATICS

NPC and logarithm tables permitted

Complementary Course
No. of credit 4
No. of contact hour: 4

Aim of the course

To develop analytical and critical thinking skills in students to prepare them to logically analyse and critically evaluate problem situation through basic mathematics.

Objectives of the course

- Develop scientific ability
- Critically evaluate mathematical problems
- To have fundamental touch with industrial and commercial problems
- To know about modern trends in mathematics
- To prepare them for management studies.

Course outline

MODULE-I: Set theory

Modern theory in mathematics, Definition, elements and types of sets, operations on sets and Cartesian product of two sets.

MODULE-II: Algebra-1

Number system-Natural numbers, prime numbers, integers, rational and irrationalnumbers, Ratio, proportion and variation Sequences

MODULE-III: Algebra-2

Permutations and combinations, Logarithm, Compound interest and depreciation.

MODULE-IV: Matrices

Matrices, matrix operations, Determinant of a square matrix (expansions only) andRank of a matrix.

MODULE-V: System of linear equations

Inverse of square matrix (problems only). Solution of system of linear equationsusing matrices.

Note on course work.

This subject being pure science subject, this is taught directly in classrooms as lecture. Students are requested to give suggestion and ask doubt for critical evaluation. Proof of theorems and derivations are excluded, as it is beyond the scope of a B.B.A student. Basicmathematics is required for all subjects under commerce.

Ref.Texts: 1) Business Mathematics - S.Saha

2) Business mathematics -D.C. Sanchet& V.K Kapoor (Sultan Chand & Sons)

BA2CMT08 MATHEMATICS FOR MANAGEMENT

Complementary Course
No. of credit 4
No. of contact hour: 4

Aim of the course

To develop analytical and critical thinking skills and to analyse managerial problems in the light of mathematics and solving in such situations.

Objectives of the course

- To develop scientific ability
- To know about modern trends in mathematics
- To know about problems in industry and management and to learn how to solve the problem
- To have research in Managerial Sciences.

Course outline

MODULE I: Plane Analytic Geometry -1

This module consists of Cartesian coordinate system, Length of line segment,Section formulae, area of a triangle and collinearity of three points.

MODULE II: Plane Analytic Geometry -2

Gradient of a straight line, different equations of straight lines, parallelism and perpendicularity and concurrency of three lines.
(All derivations in analytic geometry excluded)

MODULE III:

Arithmetic Progression, sum of the series in AP

MODULE IV:

Geometric Progression, Sum of series in GP

MODULEV:

Calculation of interests and discounts, Present value and annuities, Computingpresent value of money, Computing present value of annuities.

Note on course work.

This is basically a pure science subject and taught directly in classrooms. Students'participation in various fields of applicability is needed for this course. Proof of theorems and derivations are excluded, as it is beyond the scope of a B.B.A student. But applications in business are to be highlighted.

Ref.Texts:

1. Business Mathematics -S.Saha

2. Business Mathematics -D.C. Sanchet& V.K Kapoor (Sultan Chand & Sons)

3. Business Mathematics –Lloyd D Brooks, AITBS Publishers and distributers,New Delhi

Syllabi of Complementary Courses in Statistics of BBA

BA1CMT04 FUNDAMENTALS OF BUSINESS STATISTICS

(Use of scientific calculators is permitted)

Complementary Course

No. of credit : 4

No. of contact hour: 4

Aim of the course

To provide a reasonable idea of basic statistical methods needed for astatistical investigation and forecasting.

Objective of the course

On completion of the course, student should be able

- To present a broad overview of statistics as a subject.
- To organize a statistical survey.
- To understand the importance of summary measures to describe thecharacteristics of data set.
- To analyse the relationship between two variables.
- To use various

forecasting techniques.Course

Outline

MODULE I: Introduction

Origin, Meaning, Scope and limitations of statistics. Relationship with businessand industry.

MODULE II: Collection of data

Collection, classification and tabulation of statistical data. Pie diagrams. Graphicrepresentation.

MODULE III: Measures of central tendency and dispersion

Mean, Median and Mode. Measures of dispersion-standard deviation.Coefficient of variation.

MODULE IV: Simple correlation and Regression.

Meaning, Karl Pearson's Correlation, Rank correlation, Computations. Uses,Regression equations - Forecasting.

MODULE V: Time series analysis:

Components of time series - Definition, Computation of Trend. Computation ofseasonal variation (Simple average method only)

Note on course work:-

This course should not be taught is the conventional lecture method alone. Itshould be supported by a statistical study based on real life situations.

Texts:-

2. Statistical methods: - S.P. Gupta 158
3. Fundamental of Mathematical statistics - S.C. Gupta & V.K. Kapoor
4. Basic Statistics: B.L. Agarwal.
5. An introduction to statistical methods: - C.B. Gupta.
6. Gupta, S.C., Fundamentals of Statistics, *Himalaya Publishing House.*

BA2CMT09 STATISTICS FOR MANAGEMENT

(Use of Statistical Tables & Scientific calculators are permitted)

Complementary Course
No. of credit : 4

No. of contact hour: 4

Aim of the course

To provide a general outlook of certain statistical test which are useful to researchers invarious fields.

Objective of the course

On completion of the course, a student should be able

- To have some idea about probability and probability distributions
- To develop the concept of a sampling distributions.
- To formulate hypothesis about various population parameters.
- To conduct

various statistical tests.

Course Outline

MODULE I: Probability Theory

Basic concepts in probability, Addition theorem and Multiplication theorem (Two events), conditional probability, Baye's Theorem (without proof)

MODULE II: Random variables and Theoretical distributions

Random variables, Discrete and continuous random variables (Definition), Binomial, Poisson and Normal Distributions- Definition-Mean and variance (without derivation), Properties.

MODULE III: Sampling

Introduction, Methods of sampling, Statistics and Parameters. Sampling distribution, standard error, central limit theorem (statement only)

MODULEIV: Large sample tests

Introduction, procedure of testing Hypothesis, Test of significance for attributes. Test ofsignificance for mean. (Single sample only)

MODULE V: Chi - square Test & Goodness of fit.

Introduction, Definition, chi-square test of goodness of fit (Fitting of distributions isexcluded), chi-square test of independence. Uses, limitations.

Note on course work:-

On completion of this course, student should be able to apply various statistical tests inresearch work.

References:

1. Statistical methods: - S.P. Gupta- Sultan Chand & sons, Revised edition 1995
2. Basic Statistics:- B.L Agarwal
3. Fundamentals of mathematical Statistics: - S.P. Gupta and V.K. Kapoor, SultanChand & sons, Revised edition 1989
4. Statistics for Management, Sharma Ananad, *Himalaya Publishing House, Mumbai*
5. Statistics for management: - Richard Levin and David S Rubin

6.

M Sc MATHEMATICS

PROGRAM STRUCTURE AND SYLLABUS
2019-20 ADMISSIONS ONWARDS

(UNDER MAHATMA GANDHI UNIVERSITY PGCSS REGULATIONS 2019)



BOARD OF STUDIES IN MATHEMATICS (PG)
MAHATMA GANDHI UNIVERSITY

2019

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   Department of Mathematics, University College Trivandrum

9. **Dr. SRINIVASAN**, Associate Professor,

   Department of Mathematics, Government College, Chitoor.

ACKNOWLEDGEMENT

The P.G. Board of studies expresses our sincere thanks to the honorable Vice Chancellor of Mahatma Gandhi University, Dr. Sabu Thomas, for the guidance and help extended to us during the restructuring of M.Sc Mathematics syllabus to suit the Credit and Semester System.

We thank Prof. Tomichan Joseph(Syndicate Member, Co-ordinator), for the wholehearted support and for the constant monitoring of the process. His willingness to hear and acknowledge is worth mentioning.

We are highly indebted to Prof..Praveen Kumar V.S.(Syndicate Member, Convener, Syllabus Revision), for his guidance, support as well as for providing necessary information.

The Board of studies thanks the members of M.G. University syndicate for all the help extended to us at various stages of restructuring of this P G Syllabus.

We thank the Registrar of the university, the Academic Section and the Finance Section for extending their service for the smooth completion of the syllabus restructuring. Special thanks are due to the representatives from all the colleges affiliated to M.G. University, who have actively participated in the three day work shop.

The Board of studies acknowledges the contributions from the participants of the workshop. The suggestions and recommendations of the sub groups formed in the workshop have helped us to make the syllabus in the present form.

Table of Contents

1. Preface

1.1 Aim of the Program

1.2. Eligibility for Admissions

1.3. Medium of Instruction and Assessment

1.4. Faculty under which the Degree is awarded

2. Te Program Structure

2.1. First Semester

2.2 Second Semester

2.3. Third Semester

2.4 Fourth Semester with Electives

3. Sample Model Question Papers

M Sc MATHEMATICS Degree Program

(Mahatma Gandhi University Regulations PGCSS2019 from 2019-20 Academic Year)

1. **Aim of the Program**

   Aims and objective:

- To improve the perspective of students on mathematics as per modern requirement.
- To enhance the logical, reasoning, analytical and problem solving skills of students.
- To orient students towards relating Mathematics to applications.
- To help the student build interest and confidence in learning the subject.
- To cultivate a research culture in young minds.
- To encourage students for pursuing higher studies in mathematics.
- To ultimately see that the learning of mathematics becomes more alive, vibrant, relevant and meaningful; a program that paves the way to seek and understand the world around them.
- To motivate students to uphold scientific integrity and objectivity in professional endeavours.

2. **Eligibility for Admissions**
   As per the rules and regulation of PG admission of M G University, 2019

3. **Medium of Instruction and Assessment**
   English

4. **Faculty under which the Degree is Awarded**
   Science

5. **Note on compliance with the UGC Minimum Standards for the conduct and award of Post Graduate Degrees**
   The programme is offered in accordance with the UGC minimum standards for the conduct an award of Post Graduate Degrees. The students have to secure 80 credits to complete the programme successfully.

THE PROGRAM STRUCTURE

Course Code	Title of the Course	Type of the Course	Hours per week	Credits
FIRST SEMESTER				
ME010101	Abstract Algebra	Theory	5	4
ME010102	Linear Algebra	Theory	5	4
ME010103	Basic Topology	Theory	5	4
ME010104	Real Analysis	Theory	5	4
ME010105	Graph Theory	Theory	5	4
SECOND SEMESTER				
ME010201	Advanced Abstract Algebra	Theory	5	4
ME010202	Advanced Topology	Theory	5	4
ME010203	Numerical Analysis with Python	Theory	5	4
ME010204	Complex Analysis	Theory	5	4
ME010205	Measure and Integration	Theory	5	4
THIRD SEMESTER				
ME010301	Advanced Complex Analysis	Theory	5	4
ME010302	Partial Differential Equations	Theory	5	4
ME010303	Multivariate Calculus and Integral Transforms	Theory	5	4
ME010304	Functional Analysis	Theory	5	4
ME010305	Optimization Technique	Theory	5	4
FOURTH SEMESTER				
ME010401	Spectral Theory	Theory	5	4
ME010402	Analytic Number Theory	Theory	5	4
	Elective 1	Theory	5	3
	Elective 2	Theory	5	3
	Elective 3	Theory	5	3
Dissertation				1
Comprehensive Viva				2
Total Credits				80
ME800401	Differential Geometry	Group A	5	3
ME800402	Algorithmic Graph Theory		5	3
ME800403	Combinatorics		5	3
ME810401	Probability Theory	Group B	5	3
ME810402	Operations Research		5	3
ME810403	Coding Theory		5	3
ME820401	Commutative Algebra	Group C	5	3
ME820402	Ordinary Differential Equations		5	3
ME820403	Classical Mechanics		5	3

FIRST SEMESTER COURSES

ME010101	**Abstract Algebra**
ME010102	**Linear Algebra**
ME010103	**Basic Topology**
ME010104	**Real Analysis**
ME010105	**Graph Theory**

ME010101 - ABSTRACT ALGEBRA

5 Hours/Week (Total Hours : 90) **4 Credits**

Text Book: **John B. Fraleigh, A First Course in Abstract Algebra, 7th edition, Pearson Education.**

Module 1: Direct products and finitely generated Abelian groups, fundamental theorem, Applications
Factor groups, Fundamental homomorphism theorem, normal subgroups and inner automorphisms.
Group action on a set, Isotropy subgroups, Applications of G- sets to counting.
(Part II – Sections 11, 14, 16 & 17) **(25 hours)**

Module 2: Isomorphism theorems, Sylow theorems , Applications of the Sylow theory.
(Part VII Sections34, 36 & 37) **(25 hours)**

Module 3: Fermat's and Euler Theorems, The field of quotients of an integral domain, Rings of polynomials, Factorisation of polynomials over a field.
(Part IV – Sections 20, 21, 22 & 23) **(20 hours)**

Module 4: Non commutative examples, Homeomorphisms and factor rings, Prime and Maximal Ideals
(Part V – Sections 24, 26 & 27) **(20 hours)**

Question Paper Pattern

	Section A	Section B	Section C
Module I	**3**	**2**	**1**
Module II	**3**	**2**	**1**
Module III	**2**	**2**	**1**
Module IV	**2**	**2**	**1**
Total	**10**	**8**	**4**

References:-

1. I.N. Herstein, Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975.
2. Thomas W. Hungerfor, Algebra (Graduate texts in Mathematics), Springer
3. M. Artin, Algebra, Prentice -Hall of India, 1991
4. N. Jacobson, Basic Algebra Vol. I, Hindustan Publishing Corporation
5. P.B. Bhattacharya, S.K. Jain, S.R. Nagapaul, Basic Abstract Algebra, 2nd edition, Cambridge University Press, Indian Edition, 1997.
6. David S Dummit, Richard M Foote, Abstract Algebra, Third Edition, Wiley.

ME010102 - LINEAR ALGEBRA

5 Hours/Week (Total Hours : 90) **4 Credits**

Text Book: **Kenneth Hoffman / Ray Kunze (Second Edition), *Linear Algebra*, Prentice-Hall of India Pvt. Ltd., New Delhi, 1992.**

Review : Chapter 1 of text

Module 1: Vector spaces, subspaces, basis and dimension
Co-ordinates, summary of row-equivalence, Computations concerning subspaces
(Chapter 2- 2.1, 2.2, 2.3,2.4 2.5& 2.6 of the text) **(20 hours)**

Module 2: Linear transformations, the algebra of linear transformations, isomorphism, representation of transformations by matrices, linear functional, double dual, transpose of a linear transformation.
(Chapter 3 - 3.1, 3.2, 3.3, 3.4, 3.5, 3.6 & 3.7 of the text) **(25 hours)**

Module 3: Determinants: Commutative Rings, Determinant functions, Permutation and uniqueness of determinants, Additional properties of determinants.
(Chapter 5 - 5.1, 5.2, 5.3 & 5.4 of the text) **(20 hours)**

Module 4: Introduction to elementary canonical forms, characteristic values, annihilatory Polynomials, invariant subspaces, Direct sum Decompositions
(Chapter 6 - 6.1, 6.2, 6.3, 6.4,6.6of the text)
(25 hours)

Question Paper Pattern

	Section A	Section B	Section C
Module I	**2**	**2**	**1**
Module II	**3**	**3**	**1**
Module III	**3**	**1**	**1**
Module IV	**2**	**2**	**1**
Total	**10**	**8**	**4**

References:

1. Klaus Jonich. Linear Algebra, Springer Verlag.
2. Paul R. Halmos, Linear Algebra Problem Book, The Mathematical Association of America.
3. S. Lang, Algebra, 3rd edition, Addison-Wesley, 1993.
4. K.B. Datta, Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd., New Delhi, 2000.
5. S. Kumaresan, Linear Algebra A Geometrical Approach, Prentice Hall ofIndia, 2000.

ME010103 - BASIC TOPOLOGY

5 Hours/Week (Total Hours : 90) **4 Credits**

Text Book : K.D Joshi , Introduction to General Topology , Wiley Eastern Ltd, 1984

Module I : Topological Spaces: Definition of a topological space – Examples of topological spaces-Bases and subbases – subspaces.

(Chapter 4: Sections 1, 2, 3, and 4 of the text) (25 hours)

Module II : Basic concepts: Closed sets and Closures – Neighbourhoods, Interior and Accumulation points – Continuity and Related Concepts – Making functions continuous , Quotient spaces

(Chapter 5: Section 1;1. To 1.7 , Section 2; 2.1 to 2.10 and 2.13, Section3; 3.1 to 3.11, Theorem 3.2 condition 4 (25 hours)

Module III : Spaces with special properties :- Smallness conditions on a space, Connectedness

(Chapter 6 : Section 1; 1.1 to 1.16, Section 2; 2.1 to 2.15 (20 hours)

Module IV : Spaces with special properties :- Local connectedness and Paths

Separation axioms:- Hierarchy of separation axioms

(Chapter 6 : Sections 3.1 to 3.8, Chapter 7 : Sections 1.1 to 1.17(20 hours)

Question Paper Pattern

	Section A	Section B	Section C
Module I	**3**	**2**	**1**
Module II	**3**	**2**	**1**
Module III	**2**	**2**	**1**
Module IV	**2**	**2**	**1**
Total	**10**	**8**	**4**

Reference:

1) George F. Simmons, Introduction to Topology and Modern Analysis, McGraw-Hill Book Company,1963
2) I.M. Singer &J.A. Thorpe ,Lecture Notes on Elementary Topology &Geometry, Springer Verlag 2004

ME010104 - REAL ANALYSIS

5 Hours/Week (Total Hours : 90) **4 Credits**

Text 1: **Tom Apostol, Mathematical Analysis (Second edition), Narosa Publishing House.**

Text 2: **Walter Rudin, Principles of Mathematical Analysis (Third edition), McGraw Hill Book Company, International Editions.**

Module 1: **Functions of bounded variation and rectifiable curves**

Introduction, properties of monotonic functions, functions of bounded variation, total variation, additive property of total variation, total variation on(a, x) as a functions of x, functions of bounded variation expressed as the difference of increasing functions, continuous functions of bounded variation, curves and paths, rectifiable path and arc length, additive and continuity properties of arc length, equivalence of paths, change of parameter.

(Chapter 6, Section: 6.1 - 6.12. of Text 1) **(20 hours.)**

Module 2: **The Riemann-Stieltjes Integral**

Definition and existence of the integral, properties of the integral, integration and differentiation, integration of vector valued functions.

(**Chapter 6 - Section 6.1 to 6.25 of Text 2)** **(20 hours.)**

Module 3: **Sequence and Series of Functions**

Discussion of main problem, Uniform convergence, Uniform convergence and Continuity, Uniform convergence and Integration, Uniform convergence and Differentiation.

(Chapter 7 Section. 7.1 to 7.18 of Text 2) **(25 hours.)**

Module 4: **Weierstrass Approximation &Some Special Functions**

Equicontinuous families of functions, the Stone - Weierstrass theorem, Power series, the exponential and logarithmic functions, the trigonometric functions, the algebraic completeness of complex field.

(Chapter 7 – Sections 7.19 to 7.27, Chapter 8 - Section 8.1 to 8.8 of Text 2)
(25 hours.)

Sections 3.1 to 3.8, Chapter 7 : Sections 1.1 to 1.17(20 hours)

Question Paper Pattern

	Section A	Section B	Section C
Module I	**2**	**2**	**1**
Module II	**3**	**2**	**1**
Module III	**3**	**2**	**1**
Module IV	**2**	**2**	**1**
Total	**10**	**8**	**4**

References:-

1. Robert G. Bartle Donald R. Sherbert, Introduction to Real Analysis, 4th Edition, John Wiley and Sons, New York.
2. Gerald B. Folland, Real Analysis: Modern Techniques and Their Applications, 2nd Edition, WeilyInterscience Publication, John Wiley and Sons, New York.
3. Royden H.L, Real Analysis, 2nd edition, Macmillan, New York.
4. Kenneth A. Ross, Elementary Analysis - The Theory of Calculus Second Edition, Springer International
5. ShantiNarayan & M.D. Raisinghania, Elements of Real Analysis, 7th Edition, S. Chand Publishing, New Delhi

ME010105 – GRAPH THEORY

5 Hours/Week (Total Hours : 90) **4 Credits**

Text : **R. Balakrishnan and K. Ranganathan , A Text book of Graph Theory, Second edition Springer.**

Module I: Introduction, Basic concepts. Sub graphs. Degrees of vertices. Paths and Connectedness, Automorphism of a simple graph, line graphs, Operations on graphs, Graph Products.

Directed Graphs : Introduction, basic concepts and tournaments.

(Chapter 1 Sections 1.1 – 1.7(Upto 1.7.3 including) 1.8, 1.9)

(Chapter 1 Sections 2.1, 2.2, 2.3) **(20Hours)**

Module II: Connectivity : Introduction, Vertex cuts and edge cuts, connectivity and edge connectivity, blocks, Cyclical edge Connectivity of a graph.

Trees; Introduction, Definition, characterization and simple properties, centres and cancroids, counting the number of spanning trees, Cayley's formula. Applications

(Chapter 3 Sections 3.1, 3.2 , 3.3, 3.4 and 3.5)

(Chapter 4 Sections4.1, 4.2, 4.3, 4.4 (Up to 4.4.3 including) and 4.5, 4.7)

(25Hours)

Module III: Eulerian and Hamiltonian Graphs: Introduction, Eulereian graphs, Hamiltonian Graphs, Hamiltonian around' the world' game

Graph Colorings: Introduction, Vertex Colorings, Applications of Graph Coloring, Critical Graphs, Brooks' Theorem

(Chapter 6 Sections 6.1, 6.2 and 6.3)

(Chapter 7 Sections 7.1, 7.2 and7.3(Up to 7.3.1 including) (20Hours)

Module IV: Planarity: Introduction, Planar and Nonplanar Graphs, Euler Formula and Its Consequences, K_5 and $K_{3,3}$ are Nonplanar Graphs, Dual of a Plane Graph, The Four-Color Theorem and the Heawood Five-Color Theorem .

Spectral Properties of Graphs: Introduction, The Spectrum of a Graph, Spectrum of the Complete Graph Kn, Spectrum of the Cycle Cn,

(Chapter 8 Sections 8.1, 8.2 , 8.3, 8.4, 8.5 and 8.6)

(Chapter 11 Sections 11.1, 11.2 , 11.3 and 11.4) **(25Hours)**

Question Paper Pattern

	Section A	Section B	Section C
Module I	**2**	**2**	**1**
Module II	**3**	**2**	**1**
Module III	**3**	**2**	**1**
Module IV	**2**	**2**	**1**
Total	**10**	**8**	**4**

References:

1. John Clark and Derek Allan Holton, A First Look at Graph Theory, Allied Publishers.

2. Douglas B West, Introduction to Graph Theory, Prentice Hall of India.

3. Sheldon Axler, Linear algebra done right, Second edition ,Springer.

SECOND SEMESTER COURSES

ME010201	**Advanced Abstract Algebra**
ME010202	**Advanced Topology**
ME010203	**Numerical Analysis with Python**
ME010204	**Complex Analysis**
ME010205	**Measure and Integration**

ME010201 - ADVANCED ABSTRACT ALGEBRA

5 Hours/Week (Total Hours : 90) **4 Credits**

Text Book : John B. Fraleigh, A First Course in Abstract Algebra, 7th edition, Pearson Education.

Module 1: Introduction to extension fields, algebraic extensions, Geometric Constructions Finite fields.
(Part VI – Section 29, 31 – 31.1 to 31.18, 32, 33 of the text) (20 hours)

Module 2: Unique factorization domains, Euclidean domains. Gaussian integers and multiplicative norms
(Part IX – Sections 45,46 & 47 of the text) (20 hours)

Module 3: Automorphism of fields, the isomorphism extension theorem , Splitting fields.
(Part X – Sections 48 & 49, 50 of the text) (25 hours)

Module 4: Separable extensions, Galois Theory, Illustrations of Galois Theory, Cyclotomic Extensions. (mention the insolvability of the quintic)
(Sections 51, 53, 54, 55 - 55.1 to 55.6 of the text) (25 hours)

Question Paper Pattern

	Section A	Section B	Section C
Module I	**2**	**2**	**1**
Module II	**3**	**2**	**1**
Module III	**3**	**2**	**1**
Module IV	**2**	**2**	**1**
Total	**10**	**8**	**4**

References:-

1. David S Dummit, Richard M Foote, Abstract Algebra, Third Edition, Wiley.
2. I.N. Herstein, Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975.
3. M. Artin, Algebra, Prentice -Hall of India, 1991.
4. Charles Lanski, Concepts in Abstract Algebra, American Mathematical Society, 2004.
5. Klaus Jonich. Linear Algebra, Springer Verlag.
6. Paul R. Halmos, Linear Algebra Problem Book, The Mathematical Association of America.
7. S. Lang, Algebra, 3rd edition, Addison-Wesley, 1993.
8. K.B. Datta, Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd., New Delhi, 2000.
9. Roger A. Horn, Charles R. Johnson, Matrix Analysis, Second Edition, Cambridge University press.

ME010202 - ADVANCED TOPOLOGY

5 Hours/Week (Total Hours : 90) **4 Credits**

Text 1 : **K.D Joshi , Introduction to General Topology , Wiley Eastern Ltd, 1984**

Text 2 : **James R. Munkres , Topology(second edition) , Pearson**

Module I : Separation axioms:- Compactness and Separation axioms , The Urysohn Characterisation of normality –Tietze Characterisation of normality .
(Chapter 7: Sections 2; 2.1 to 2.10 Section 3; 3.1 to 3.6 – Proof of Lemma 3.4 excluded Section 4; 4.1 to 4.7 of text 1) (20hours)

Module II : Products and Co-products:- Cartesian products of families of sets – The product topology -Productive properties.
(Chapter 8 : Section 1; 1.1 to 1.9 Section 2; 2.1 to 2.8 , Section 3 – 3.1 to 3.6 of text 1) (25hours)

Module III : Embedding and Metrisation;- Evaluation functions into products – Embedding lemma and Tychonoff Embedding – The Urysohn Metrisation Theorem
(Chapter 9: Section 1; 1.1 1.5, Section 2; 2.1 to 2.5 Section, 3; 3.1 to 3.4 Variation of compactness **(Chapter 11:Sections 1.1 to 1.11 of text 1)**
(25 hours)

Module IV : Definition and convergence of nets, Homotopy of paths.
(Chapter 10: Section 1 of text 1; Chapter 9 : Section 1 of text 2) (20hours)

Question Paper Pattern

	Section A	Section B	Section C
Module I	**2**	**2**	**1**
Module II	**3**	**2**	**1**
Module III	**3**	**2**	**1**
Module IV	**2**	**2**	**1**
Total	**10**	**8**	**4**

References:

3) George F. Simmons, Introduction to Topology and Modern Analysis, McGraw-Hill Book Company,1963
4) I.M. Singer &J.A. Thorpe ,Lecture Notes on Elementary Topology &Geometry, Springer Verlag 2004

ME010203 Numerical Analysis with Python3

5 Hours/Week (Total Hours : 90) **4 Credits**

Text 1 **Jason R Brigs , Python for kids – a playful introduction to programming, No Starch Press**

Text 2 **Amit Saha, Doing Math with Python, No Starch Press, 2015.**

Text 3 **Jaan Kiusalaas, Numerical Methods in Engineering with Python3, Cambridge University Press.**

Though any distribution of Python 3 software can be used for practical sessions, to avoid difficulty in getting and installing required modules like numpy, scipy etc, and for uniformity, the Python3 package *Anaconda 2018.x* (https://www.anaconda.com/distribution/#download-section) may be installed and used for the practical sessions. However, a brief introduction on how to use Python IDLE 3 also should be given.

BASICS OF PYTHON

Before going into mathematics programming part, an introduction to Python should be given.No questions should be included in the end semester examination from this unit. Internal examinations may test the knowledge of concepts from this section.

From Text 1, Chapter 2 full – calculations and variables,

Chapter 3 – creating strings, lists are more powerful than strings, tuples,

Chapter 5- If statements, if-then-else statements, if and elif statements, combining conditions, the difference between strings and numbers,

Chapter 6 – using for loops, while we are talking about looping,

Chapter 7 – using functions, parts of a function, using modules

Chapter 9 – The functions abs, float, int, len, max, min, range, sum

From Text 2 Chapter 1 - section complex numbers

Unit I -

Module I : Defining Symbols and Symbolic Operations, Working with Expressions, Solving Equations and Plotting Using SymPy, problems on factor finder, summing a series and solving single variable inequalities

Chapter 4 - From text 2

Unit II

Module II : Finding the limit of functions, finding the derivative of functions, higher-order derivatives and finding the maxima and minima and finding the integrals of functions are to be done. in the section programming challenges, the following problems - verify the continuity of a function at a point, area between two curves and finding the length of a curve

Chapter 7 from text 2

Unit III

Module III : Interpolation and Curve Fitting - Polynomial Interpolation - Lagrange's Method, Newton's Method and Limitations of Polynomial Interpolation,

Roots of Equations - Method of Bisection and Newton-Raphson Method.

Chapter 3, sections 3.1, 3.2 Chapter 4, sections 4.1, 4.3, 4.5 From Text 3, -

Unit IV-

Module III : Gauss Elimination Method (excluding Multiple Sets of Equations), Doolittle's Decomposition Method only from LU Decomposition Methods

Numerical Integration, Newton-Cotes Formulas, Trapezoidal rule, Simpson's rule and Simpson's 3/8 rule.

Chapter 2, sections 2.2, 2.3 , Chapter 6, sections 6.1, 6.2 From Text 3.

1. Instead of assignments, a practical record book should be maintained by the students. Atleast 15 programmes should be included in this record book.
2. Internal assessment examinations should be conducted as practical lab examinations by the faculty handling the paper.
3. End semester examination should focus on questions including concepts from theory and programming. However, more importance should be given to theory in the end semester examinations as internal examinations will be giving more focus on programming sessions.

Question Paper Pattern

	Section A	Section B	Section C
Module I	**2**	**2**	**1**
Module II	**3**	**2**	**1**
Module III	**3**	**2**	**1**
Module IV	**2**	**2**	**1**
Total	**10**	**8**	**4**

References

1. A primer on scientific programming with python, 3rd edition, Hans Petter Langtangen, Springer
2. Vernon L. Ceder, The Quick Python Book, Second Edition, Manning.
3. NumPy Reference Release 1.12.0, Written by the NumPy community. (available for free download at https://docs.scipy.org/doc/numpy-dev/numpy-ref.pdf)
4. S. D. Conte and Carl de Boor, Elementary Numerical Analysis – An algorithmic approach, Third Edition, McGraw-Hill Book Company.
5. S.S. Sastry, Introductory Methods of Numerical Analysis, Fifth Edition, PHI.

ME010204 COMPLEX ANALYSIS

5 Hours/Week (Total Hours : 90) **4 Credits**

Text Book : Lars V. Ahlfors, Complex Analysis, Third edition, McGraw Hill Internationals

Module-1 The spherical representation of complex numbers , Riemann Sphere, Stereographic projection, Distance between the stereographic projections

Elementary Theory of power series,Abel's Theorem on convergence of the power series, Hadamard's formula, Abel's limit Theorem

Arcs and closed curves, Analytic functions in regions, Conformal mappings, Length and area ,Linear transformations , The cross ratio, Symmetry, Oriented circles, Families of circles.

Chapter – 1 Section .Chapter – 2Sections.2.1 to 2.5,Chapter – 3 Sections 2.1, 2.2, 2.3,2.4and ,3.1 to 3.4 of the text (25 hours)

Module-2 Fundamental theorems on complex integration: line integrals, rectifiable arcs, line integrals as functions of arcs, Cauchy's theorem for a rectangle, Cauchy's theorem in a disk,

Cauchy's integral formula: the index of a point with respect to a cloud curve, the integral formula.

(Chapter 4 – Sections 1 , 2..1 and 2.2 of the text.) (20 hours.)

Module-3 Higher derivatives. Differentiation under the sign of integration, Morera's Theorem, Liouville's Theorem, Fundamental Theorem, Cauchy's estimate

Local properties of analytical functions: removable singularities, Taylor's theorem, zeroes and poles,Weirstrass Theorem on essential singularity, the local mapping, the maximum principle.Schwarz lemma

Chapter-4 sectins 2.3, 3.1,3.2,3.3, and 3.4 of the text (20 hours)

Module-4 The general form of Cauchy's theorem: chains and cycles, simple connectivity, homology, general statement of Cauchy's theorem, proof of Cauchy's theorem, locally exact differentiation, multiply connected regions

Calculus of Residues: the residue theorem, the argument principle, evaluation of definite integrals.

Chapter-4 Sections 4 and 5 of the text (25 hours)

Question Paper Pattern

	Section A	Section B	Section C
Module I	**2**	**2**	**1**
Module II	**3**	**2**	**1**
Module III	**3**	**2**	**1**
Module IV	**2**	**2**	**1**
Total	**10**	**8**	**4**

References:-

1. Chaudhary. B, The elements of Complex Analysis, Wiley Eastern.
2. Cartan. H (1973), Elementary theory of Analytic functions of one or several variable, Addison Wesley.
3. Conway .J.B, Functions of one Complex variable, Narosa publishing.
4. Lang. S, Complex Analysis, Springer.
5. H.A. Priestly, Introduction to Complex Analysis, Clarendon press, Oxford, 1990

ME010205 - MEASURE THEORY AND INTEGRATION

5 Hours/Week (Total Hours : 90) **4 Credits**

Text Book: H. L. Royden, P.M. Fitzpatrick, Real Analysis Fourth Edition, Pearson Education

Module 1: Lebesgue Measure: Introduction, Lebesgue outer measure, The σ algebra of Lebesgue mesurable sets, Outer and inner approximation of Lebesgue measurable sets , Countable additivity, continuity and Borel-Cantelli Lemma - Non measureable sets - The Canter set and Canter Lebesgue function

Chapter 2; Sections 2.1 to 2.7 (25 Hours)

Module 2: Lebesgue Measurable Functions and Lebesgue Integration: Sums, products and compositions – Sequential pointwise limits and simple approximation – The Riemann Integral – The Lebesgue integral of a bounded measurable function over a set of finite measure – The Lebesgue integral of a measurable non negative function – The general Lebesgue integral.

Chapter 3; Sections 3.1 to 3.2, Chapter 4; Sections 4.1 to 4.4(25 Hours)

Module 3: General Measure Space and Measureable Functions: Measures and measurable sets – Signed Measures: The Hanh and Jordan decompositions – The Caratheodory measure induced by an outer measure – Measureable functions

Chapter 17; Sections 17.1 to 17.3, Chapter 18; Section 18.1 upto corollory 7 (20 Hours)

Module 4: Integration over General Measure Space and Product Measures: Integration of non negative meaurable functions – Integration of general mesurable functions – The Radon Nikodym Theorem – Product measure: The theorems of Fubini and Tonelli

Chapter 18; Sections 18.2 to 18.4, Chapter 20; Section 20.1 (20 Hours)

Question Paper Pattern

	Section A	Section B	Section C
Module I	**3**	**2**	**1**
Module II	**3**	**2**	**1**
Module III	**2**	**2**	**1**
Module IV	**2**	**2**	**1**
Total	**10**	**8**	**4**

References:

1. G. de Barra : Measure Theory and integration , New Age International (P) Ltd., New DelhiNew Age International (P) Ltd., New Delhi,

2.Halmos P.R, Measure Theory, D.vanNostrand Co.

3. P.K. Jain and V.P. Gupta, Lebesgue Measure and Integration, New Age International (P) Ltd., New Delhi, 1986(Reprint 2000).

4. R.G. Bartle, The Elements of Integration, John Wiley & Sons, Inc New York, 1966.

THIRD SEMESTER COURSES

ME010301	**Advanced Complex Analysis**
ME010302	**Partial Differential Equations**
ME010303	**Multivariate Calculus**
ME010304	**Functional Analysis**
ME010305	**Optimization Technique**

ME010301 - Advanced Complex Analysis

5 Hours/Week (Total Hours : 90) **4 Credits**

Text book : Complex Analysis – Lars V. Ahlfors (Third Edition), McGraw Hill Book Company

Module 1: Harmonic Functions – Definitions and Basic Properties, The Mean-Value Property, Poisson's Formula, Schwarz's Theorem, The Reflection Principle. A closer look at Harmonic Functions – Functions with Mean Value Property, Harnack's Principle.

The Dirichlet's Problem – Subharmonic Functions, Solution of Dirichlet's Problem (Proof of Dirichlet's Problem and Proofs of Lemma 1 and 2 excluded)

(Chapter 4 : Section 6: 6.1 - 6.5, Chapter 6 : Section 3 : 3.1 - 3.2 , Section 4 : 4.1 - 4.2)

Module 2: Power Series Expansions – Weierstrass's theorem, The Taylor Series, The Laurent Series Partial Fractions and Factorization – Partial Fractions, Infinite Products, Canonical Products, The Gamma Function. Entire Functions – Jensen's Formula, Hadamard's Theorem (Hadamard's theorem - proof excluded)

(Chapter 5 : Section 1 : 1.1 - 1.3, Section 2 : 2.1 – 2.4, Section 3 : 3.1 – 3.2)

Module 3: The Riemann Zeta Function – The Product Development, The Extension of $\zeta(s)$ to the Whole Plane, The Functional Equation, The Zeroes of the Zeta Function

Normal Families – Normality and Compactness, Arzela's Theorem

(Chapter 5 : Section 4 : 4.1 – 4.4, Section 5 : 5.2 - 5.3)

Module 4: The Riemann Mapping Theorem – Statement and Proof, Boundary Behaviour, Use of the Reflection Principle

The Weierstrass's Theory – The Weierstrass's ρ - function, The functions $\zeta(s)$ and $\sigma(z)$, The Differential Equation

(Chapter 6 : Section 1: 1.1-1.3, Chapter 7 : Section 3 : 3.1 – 3.3)

Question Paper Pattern

	Section A	Section B	Section C
Module I	**2**	**2**	**1**
Module II	**3**	**2**	**1**
Module III	**3**	**2**	**1**
Module IV	**2**	**2**	**1**
Total	**10**	**8**	**4**

References:

1. Chaudhary B., The Elements of Complex Analysis, Wiley Eastern.

2. Cartan H., Elementary theory of Analytic Functions of one or several variable, Addison Wesley, 1973.

3. Conway J. B., Functions of one complex variable, Narosa publishing.

4. Lang S., Complex Analysis, Springer.

5. H. A. Priestly, Introduction to Complex Analysis, Clarendon Press, Oxford, 1990.

6. Ponnuswamy S., Silverman H., Complex Variables with Applicatio

ME010302 - PARTIAL DIFFERENTIAL EQUATIONS

5 Hours/Week (Total Hours: 90) **4 Credits**

Text Book: **Ian Sneddon , Elements of Partial Differential Equations, Mc Graw Hill Book Company**

Module 1: Methods of solutions of dx/P = dy/Q = dz/R. Orthogonal trajectories of a system of curves on a surface. Pfaffian differential forms and equations. Solution of Pfaffian differential equations in three variables, Partial differential equations. Origins of first order partial differential equation. **(20 hours)**

Module 2: Linear equations of first order. Integral surfaces passing through a given curve. Surfaces orthogonal to a given system of surfaces. Nonlinear partial differential equation of the first order . Compatible systems of first order equations . Charpits Method. Special types of first order equations. Solutions satisfying given conditions. **(25 hours)**

Module 3: Jacobi' s method The origin of second order equations. Linear partial differential equations with constant coefficients. Equations with variable coefficients. **(20 hours)**

Module 4.: Separation of variables. Non linear equations of the second order . Elementary solutions of Laplace equation. Families of equipotential surfaces. The two dimensional Laplace Equation Relation of the Logarithmic potential to the Theory of Functions. **(25 hours)**

Question Paper Pattern

	Section A	Section B	Section C
Module I	**2**	**2**	**1**
Module II	**3**	**2**	**1**
Module III	**3**	**2**	**1**
Module IV	**2**	**2**	**1**
Total	**10**	**8**	**4**

References:

1. Phoolan Prasad and Renuka Ravindran, Partial Differential Equations, New Age International
2. K Sankara Rao, Introduction to Partial Differential Equations, Prentice Hall of India
3. E T Copson, Partial Differential Equations, S Chand and Co

ME010303 - MULTIVARIATE CALCULUS AND INTEGRAL TRANSFORMS

5 Hours/Week (Total Hours : 90) **4 Credits**

Text 1: **Tom Apostol, Mathematical Analysis, Second edition, Narosa Publishing House.**

Text 2: **Walter Rudin, Principles of Mathematical Analysis, Third edition – International Student Edition.**

Module 1: The Weirstrass theorem, other forms of Fourier series, the Fourier integral theorem, the exponential form of the Fourier integral theorem, integral transforms and convolutions, the convolution theorem for Fourier transforms.

(Chapter 11 Sections 11.15 to 11.21 of Text 1) **(20 hours**.)

Module 2: Multivariable Differential Calculus

The directional derivative, directional derivatives and continuity, the total derivative, the total derivative expressed in terms of partial derivatives, An application of complex- valued functions, the matrix of a linear function, the Jacobian matrix, the matrix form of the chain rule. Implicit functions and extremum problems, the mean value theorem for differentiable functions,

(Chapter 12 Sections. 12.1 to 12.11 of Text 1) **(22 hours.)**

Module 3: A sufficient condition for differentiability, a sufficient condition for equality of mixed partial derivatives, functions with non-zero Jacobian determinant, the inverse function theorem ,the implicit function theorem, extrema of real- valued functions of one variable, extrema of real- valued functions of several variables.

Chapter 12 Sections-. 12.12 to 12.13 of Text 1

Chapter 13 Sections-. 13.1 to 13.6 of Text 1 **(28 hours.)**

Module 4: Integration of Differential Forms

Integration, primitive mappings, partitions of unity, change of variables, differential forms.

(Chapter 10 Sections. 10.1 to 10.14 of Text 2) **(20 hours)**

Question Paper Pattern

	Section A	Section B	Section C
Module I	**2**	**2**	**1**
Module II	**3**	**2**	**1**
Module III	**3**	**2**	**1**
Module IV	**2**	**2**	**1**
Total	**10**	**8**	**4**

References:-

1. Limaye Balmohan Vishnu, Multivariate Analysis, Springer.

2. Satish Shirali and Harikrishnan, Multivariable Analysis, Springer

ME010304 - FUNCTIONAL ANALYSIS

5 Hours/Week (Total Hours : 90) **4 Credits**

Text Book: **Erwin Kreyszig, Introductory Functional Analysis with applications, John Wiley and sons, New York**

Module 1: Examples, Completeness proofs, Completion of Metric Spaces, Vector Space, Normed Space, Banach space, Further Properties of Normed Spaces, Finite Dimensional Normed spaces and Subspaces, Compactness and Finite Dimension

(Chapter 1 – Sections 1.5, 1.6; Chapter 2 - Sections 2.1 to 2.5)

Module 2: Linear Operators, Bounded and Continuous Linear Operators, Linear Functionals, Linear Operators and Functionals on Finite dimensional spaces, Normed spaces of operators, Dual space

(Chapter 2 - Section 2.6 to 2.10)

Module 3: Inner Product Space, Hilbert space, Further properties of Inner Product Space, Orthogonal Complements and Direct Sums, Orthonormal sets and sequences, Series related to Orthonormal sequences and sets, Total Orthonormal sets and sequences, Representation of Functionals on Hilbert Spaces

(Chapter 3 - Sections 3.1 to 3.6, 3.8)

Module 4: Hilbert-Adjoint Operator, Self-Adjoint, Unitary and Normal Operators, Zorn's lemma, Hahn- Banach theorem, Hahn- Banach theorem for Complex Vector Spaces and Normed Spaces, Adjoint Operators

(Chapter 3 - Sections 3.9, 3.10; Chapter 4 - Sections 4.1 to 4.3, 4.5)

Question Paper Pattern

	Section A	Section B	Section C
Module I	**2**	**2**	**1**
Module II	**3**	**2**	**1**
Module III	**3**	**2**	**1**
Module IV	**2**	**2**	**1**
Total	**10**	**8**	**4**

References

1. Limaye, B.V, Functional Analysis, New Age International (P) LTD, New Delhi, 2004
2. Simmons, G.F, Introduction to Topology and Modern Analysis, McGraw –Hill, New York, 1963
3. Siddiqi, A.H, Functional Analysis with Applications, Tata McGraw –Hill, New Delhi, 1989

4. Somasundaram. D, Functional Analysis, S.Viswanathan Pvt. Ltd, Madras, 1994
5. Vasistha, A.R and Sharma I.N, Functional analysis, Krishnan Prakasan Media (P) Ltd, Meerut: 1995-96
6. M. Thamban Nair, Functional Analysis, A First Course, Prentice – Hall of India Pvt. Ltd, 2008
7. Walter Rudin, Functional Analysis, TMH Edition, 1974.

ME010305 OPTIMIZATION TECHNIQUES

5 hours/week (Total Hours : 90) **4 credits**

Text -1 **K.V. Mital and C. Mohan, Optimization Methods in Operation Research and Systems Analysis, 3rd edition.**

Text -2 **Ravindran, Philips and Solberg. Operations Research Principle and Practice, 2nd edition, John Wiley and Sons.**

Module I: **LINEAR PROGRAMMING**

Simplex Method, Canonical form of equations, Simplex Method (Numerical Example), Simplex Tableau, Finding the first BFS and artificial variables, Degeneracy, Simplex multipliers, Revised simplex method, Duality in LPP, Duality theorems, Applications of Duality, Dual simplex method, Summery of simplex methods.

(Chapter 3; sections: 9 – 21 of text – 1) **(25 hours)**

Module II: **INTEGER PROGRAMMING**

I.L.P in two dimensional space – General I.L.P. and M.I.L.P problems – cutting planes – remarks on cutting plane methods – branch and bound method – examples –general description – the 0 – 1 variable.

(Chapter 6; sections: 6.1 – 6.10 of text – 1) **(25 hours)**

Module III: **GOAL PROGRAMMING , FLOW AND POTENTIALS IN NETWORKS**

Goal programming. Graphs- definitions and notation – minimum path problem – spanning tree of minimum length – problem of minimum potential difference – scheduling of sequential activities – maximum flow problem – duality in the maximum flow problem – generalized problem of maximum flow.

(Chapter – 5 & 7 Sections 5.9 & 7.1 to 7.9, 7.15 of text - 1) **(15 hours)**

Module IV: **NON- LINEAR PROGRAMMING**

Basic concepts – Taylor's series expansion – Fibonacci Search - golden section search– Hooke and Jeeves search algorithm – gradient projection search – Lagrange multipliers – equality constraint optimization, constrained derivatives – non-linear optimization: Kuhn-Tucker conditions – complimentary Pivot algorithms.

(Chapter 11; Sections: 11.1 – 11.7, 11.9- 11.11 of text – 2) **(25 hours)**

Question Paper Pattern

	Section A	Section B	Section C
Module I	**3**	**2**	**1**
Module II	**2**	**2**	**1**
Module III	**2**	**2**	**1**
Module IV	**3**	**2**	**1**
Total	**10**	**8**	**4**

Reference:-

1. S.S. Rao, Optimization Theory and Applications, 2nd edition, New Age International Pvt.

2. J.K. Sharma, Operations Research: Theory and Applications, 3rd edition, Macmillan India Ltd.

3. Hamdy A. Thaha, Operations Research – An Introduction, 6th edition, Prentice Hall of India Pvt. Ltd.

FOURTH SEMESTER COURSES

ME010401	**Spectral Theory**
ME010402	**Analytic Number Theory**
	Elective Group A
ME800401	**Differential Geometry**
ME800402	**Algorithmic Graph Theory**
ME800403	**Combinatorics**
	Elective Group B
ME810401	**Probability Theory**
ME810402	**Operations Research**
ME810403	**Coding Theory**
	Elective Group C
ME820401	**Commutate Algebra**
ME820402	**Ordinary Differential Equations**
ME820403	**Classical Mechanics**

ME010401 - SPECTRAL THEORY

5 Hours/Week (Total Hours : 90) **4 Credits**

Text Book: **Erwin Kreyszig, Introductory Functional Analysis with applications, John Wiley and sons, New York**

Module I: Reflexive Spaces, Category theorem(statement only), Uniform Boundedness theorem (applications excluded), Strong and Weak Convergence, Convergence of Sequences of Operators and Functionals, Open Mapping Theorem, Closed Linear Operators, Closed Graph Theorem

(Chapter 4 - Sections 4.6 to 4.9, 4.12, 4.13) (20 Hours)

Module 2: Banach Fixed point theorem, Spectral theory in Finite Dimensional Normed Spaces, Basic Concepts, Spectral Properties of Bounded Linear Operators, Further Properties of Resolvent and Spectrum, Use of Complex Analysis in Spectral Theory

(Chapter5 – Section 5.1; Chapter 7 - Sections 7.1 to 7.5) (25 Hours)

Module 3: Banach Algebras, Further Properties of Banach Algebras, Compact Linear Operators on Normed spaces, Further Properties of Compact Linear Operators, Spectral Properties of compact Linear Operators on Normed spaces, Further Spectral Properties of Compact Linear Operators

(Chapter 7 - Sections 7.6, 7.7; Chapter 8 - Sections 8.1 to 8.4)

(25 Hours)

Module 4: Spectral Properties of Bounded Self adjoint linear operators, Further Spectral Properties of Bounded Self Adjoint Linear Operators, Positive Operators, Projection Operators, Further Properties of Projections

(Chapter 9 - Sections 9.1 to 9.3, 9.5, 9.6) (20 Hours)

Question Paper Pattern

	Section A	Section B	Section C
Module I	**2**	**2**	**1**
Module II	**3**	**2**	**1**
Module III	**3**	**2**	**1**
Module IV	**2**	**2**	**1**
Total	**10**	**8**	**4**

References

1. Limaye, B.V, Functional Analysis, New Age International (P) LTD, New Delhi, 2004
2. Simmons, G.F, Introduction to Topology and Modern Analysis, McGraw –Hill, New York, 1963
3. Siddiqi, A.H, Functional Analysis with Applications, Tata McGraw –Hill, New Delhi, 1989
4. Somasundaram. D, Functional Analysis, S.Viswanathan Pvt. Ltd, Madras, 1994
5. Vasistha, A.R and Sharma I.N, Functional analysis, Krishnan Prakasan Media (P) Ltd, Meerut: 1995-96
6. M. Thamban Nair, Functional Analysis, A First Course, Prentice – Hall of India Pvt. Ltd, 2008
7. Walter Rudin, Functional Analysis, TMH Edition, 1974.

ME010402 - ANALYTIC NUMBER THEORY

5 Hours/Week (Total Hours : 90) **4 Credits**

Text: **Tom M.Apostol,Introduction to Analytic Number Theory,Springer International Student Edition ,Narosa Publishing House**

Module I: Arithmetic Functions, Dirichlet Multiplication and Averages of Arithmetical functions Arithmetic Functions, Dirichlet Multiplication**:**Introduction,The Möbius function μ(n),The Euler totient function ϕ(n), a relation connecting μ and ϕ, a product formula for ϕ(n),The Dirichlet product of arithmetical functions, Dirichlet inversesand the Möbius inversion formula, The Mangoldt function Λ(n),Multiplicative functions, Multiplicative functions and DirichletMultiplication,The inverse of a completely multiplicative function,The Liouville's function λ(n),The divisor function σ_α(n),Generalized convolutions

Averages of Arithmetical functions: Introduction,The big oh notation,Asymptotic equality of functions,Eulers summation formula,Some elementary asymptotic formulas,The average order of d(n),The average order of the divisor functions σ_α(n),The average order of ϕ(n),An application to the distribution of lattice points visible from the origin,The average order of μ(n) and of Λ(n),The partial sums of a Dirichlet product, Applications to μ(n) and of Λ(n).

(Chapter 2: sections 2.1 to 2.14, Chapter 3:3.1 to 3.11) (30 hours)

Module II: **Some Elementary Theorems on the Distribution of Prime Numbers** Introduction,Chebyshev's functions ψ(x) and ϑ(x),Relation connecting ϑ(x) and π(x),Some equivalent forms of the prime number theorem,Inequalities for π(n) and P_n ,Shapiro's tauberian theorem,Applications of Shapiro's theorem,An asymptotic formula for the partial sum $\sum_{p\le x}\frac{1}{p}$.

(chapter 4: sections 4.1 to 4.8) (15 hours)

Module III: Congruences: Definitions and basic properties of congruences, Residue classes and complete residue system, Linear congruences,Reduced residue systems and Euler-Fermat theorem,Polynomial congruences modulo p,Lagrange's theorem, Applications of Lagrange's theorem,Simultaneous linear congruences,The Chinese remainder theorem, Applications of the Chinese remainder theorem.

(chapter 5: 5.1 to 5.8) (25 hours)

Module IV: Quadratic Residues,The Quadratic Reciprocity Law and Primitive Roots, Quadratic Residues,The Quadratic Reciprocity Law:Quadratic residues,Legendre's symbol and its properties,evaluation of (-1|p) and (2|p),Gauss' Lemma,The quadratic reciprocity law,Applications of the reciprocity law**.(Chapter 9; 9.1 to 9.6)**

Primitive Roots:The exponent of a number mod m, Primitive roots, Primitive roots and reduced residue systems, The nonexistence of primitive roots mod 2^α for $\alpha\ge 3$,The existence of primitive root mod p for odd primes p, Primitive roots and quadratic residues.

(chapter 10: 10.1 to 10.5) (20 hours)

Question Paper Pattern

	Section A	Section B	Section C
Module I	**3**	**2**	**1**
Module II	**2**	**2**	**1**
Module III	**3**	**2**	**1**
Module IV	**2**	**2**	**1**
Total	**10**	**8**	**4**

References:

1.David M. Burton,Elementary number Theory,Seventh edition,Tata McGraw-Hill Edition 2012

2.Kenneth H.Rosen,Elementary Number Theory and its Applications ,sixth edition,2011

3.Hardy G.H. and Wright E.M.,Introduction to the Theory of Numbers,Oxford,1981

4.Leveque W.J.,Topics in Number Theory,Addison Wesley,1961.

5.J.P.Serre, A Course in Arithmetic, GTM Vol.7,Springer-Verlag,1973.

Elective Group A

ME800401 - DIFFERENTIAL GEOMETRY

5 Hours/Week (Total Hours : 90) **3 Credits**

Text Book: John A. Thorpe, Elementary Topics in Differential Geometry

Module 1: Graphs and level sets, vector fields, the tangent space, surfaces, vector fields on surfaces, orientation.
(Chapters 1 to 5 of the text) **(20 hours)**

Module 2: The Gauss map, geodesics, Parallel transport,
(Chapters 6, 7 & 8 of the text) **(20 hours)**

Module 3: The Weingarten map, curvature of plane curves, Arc length and line integrals
(Chapters 9, 10 & 11 of the text) **(25 hours)**

Module 4: Curvature of surfaces and Parametrized surfaces
(Chapters 12 & 14 of the text). **(25 hours)**

Question Paper Pattern

	Section A	Section B	Section C
Module I	**2**	**2**	**1**
Module II	**3**	**2**	**1**
Module III	**3**	**2**	**1**
Module IV	**2**	**2**	**1**
Total	**10**	**8**	**4**

References:-

1. Serge Lang, Differential Manifolds
2. I.M. Siger, J.A Thorpe, Lecture notes on Elementary topology and Geometry, Springer – Verlag, 1967.
3. S. Sternberg, Lectures on Differential Geometry, Prentice-Hall, 1964.
4. M. DoCarmo, Differential Geometry of curves and surfaces.
5. Goursat, Mathematical Analysis, Vol – 1(last two chapters)

ME800402: ALGORITHMIC GRAPH THEORY

5 hours/week (Total Hours : 90) **3 credits**

Text Book: **Gray Chartrand and O.R Oellermann , Applied and Algorithmic Graph Theory, Tata McGraw- Hill Companies Inc**

Module I : **Introduction to Graphs and Algorithms**

What is graph? The degree of a vertex. isomorphic graphs. subgraphs, degree sequences. connected graphs. cutvertices and blocks. special graphs. digraphs. algorithmic complexity. Search algorithms, sorting algorithms. greedy algorithms., representing graphs in a computer.

(Chapter 1 Sections 1.1 to 1.9, Chapter 2 Sections 2.1, 2.2 , 2.3, 2.5 and 2.6 of the text) **(24 hours)**

Module II: **Trees, paths and distances**

Properties of trees, rooted trees. Depth-first search,. breadth – first search, . the minimum spanning tree problem

Distance in a graphs, distance in weighted graphs, .the centre and median of a graph. Activity digraphs and critical paths.

(Chapter 3 sections 3.1 to 3.3.3.4 and 3.5 , Chapter 4 sections 4.1 to 4.4 of the text) **(22 hours)**

Module III: **Networks**

An introduction to networks. the max-flow min-cut theorem. the max-flow min-cut algorithm . Connectivity and edge connectivity . Mengers theorem.

(Chapter 5 sections 5.1 , 5.2 , 5.3 and 5.5 of the text) **(22 hours)**

Module IV: **Matchings and Factorizations**

An introduction to matchings . maximum matchings in a bipartite graph,. Factorizations. Block Designs.

(Chapter 6 sections 6.1 , 6.2 , 6.4 and 6.5 of the text) **(22 hours)**

Question Paper Pattern

	Section A	Section B	Section C
Module I	**3**	**2**	**1**
Module II	**3**	**2**	**1**
Module III	**2**	**2**	**1**
Module IV	**2**	**2**	**1**
Total	**10**	**8**	**4**

Reference:-

1. Alan Gibbons, Algorithmic Graph Theory, Cambridge University Press, 1985
2. Mchugh. J.A, Algorithmic Graph Theory, Prentice-Hall, 1990

Golumbic. M, Algorithmic Graph Theory and Perfect Graphs, Academic press.

ME800403 COMBINATORICS

5 Hours/Week (Total Hours : 90) **3 Credits**

Text : **Chen Chuan Chong , Koh Khee Meng , Principles and Techniques in Combinatorics., World Scientific Publishing, 2007**

Module I Permutations and combinations: Two basic counting principles, Permutations, Circular permutations, Combinations, The injection and bijection principles, Arrangements and selections with repetitions, Distribution Problems
(Chapter 1 of the text Sections 1.1 – 1.7) **(22 hours)**

Module II The Pigeonhole Principle and Ramsey numbers: Introduction, The Pigeonhole principle, More examples, Ramsey Type problems and Ramsey numbers, Bounds for Ramsey numbers
(Chapter 3 of the text Sections 3.1 - 3.5) **(18 hours)**

Module III The Principle of Inclusion and Exclusion: Introduction, The principle, A generalization , Integer solutions and shortest routes, Surjective mappings and Stirling Numbers of second kind, Derangements and A Generalization.
(Chapter 4 of the text Sections 4.1 – 4.6) **(25 hours)**

Module IV Generating Functions & Recurrence relations: Generating Functions: Ordinary generating functions, Some modeling Problems, Partition of Integers, Exponential generating functions
Recurrence Relations: Introduction, Two examples, Linear homogeneous recurrence relations, General Linear recurrence relations.
(Chapter 5 & Chapter 6 of the text Sections 6.1- 6.4) **(25 hours)**

Question Paper Pattern

	Section A	Section B	Section C
Module I	**3**	**2**	**1**
Module II	**2**	**2**	**1**
Module III	**3**	**2**	**1**
Module IV	**2**	**2**	**1**
Total	**10**	**8**	**4**

References:-

1. V Krishnamoorthy, Combinatorics theory and applications, E. Hoewood, 1986
2. Hall,Jr, Combinatorial Theory, Wiley- Interscinice, 1998.
3 .Brualdi, R A, Introductory Combinatorics, Prentice Hall,1992

ELECTIVE GROUP B

ME810401 PROBABILITY THEORY

5 Hours/Week (Total Hours : 90) **3 Credits**

Text 1: **V.K (2001) *An Introduction to Probability and Statistics*, 2nd Edn, Wiley India (P) Ltd, New Delhi.**

Text 2: **Bhat B.R (1999) *Modern Probability Theory* , 3rd Edn, New Age International (P) Ltd, New Delhi.**

Text 3: **S.C Gupta and V.K Kapoor (2002) *Fundamentals of Mathematical Statistics*, 11th Edn, Sultan Chand & Sons, New Delhi.**

Module 1: Introduction and different approaches to probability, Probability Axioms - Addition rule, Principle of inclusion and exclusion, Bonferroni's inequality, Boole's inequality, Implication rule, Sequence of events and their limits, Conditional Probability, Multiplication rule on Probability, Baye's Theorem, Independence of Events, Borel 0-1 Criterion.

Text Book 1 : - Sections 1.2 , 1.3 (till Remarks 5), 1.5, 1.6

Text Book 2 : -Sections 9.3(b)

Module 2: Random variable, Probability distribution, Discrete and Continuous random variables, Function of a random variable, Expectation and Moments of a random variable, Generating Functions, Moment inequalities – Markov's inequality, Chebychev- Bienayme's inequality, Lyapunov's inequality.

Text Book 1 :- Chapters 2- Section 2.1 to 2.5(till example 7) and Chapter 3 –Section 3.2 except proofs of Theorem 4,5,6 , Section 3.3, Section 3.4)

Module 3: Multiple random variable, Independence of random variables, Covariance and Correlation and moments, Addition and Multiplication theorems on expectation, Cr inequality, Holder's inequality, Cauchy- Schwartz's inequality, Jensen's inequality, Minkowski's inequality, Conditional expectation.

Text Book 1 :Sections 4.2 to 4.3 (till example 6), 4.5 (till theorem 6 including its Corollary's 1 and 2, 4.6.

Text Book 2 :Section 5.3 (c) and (d).

Module 4: Convergence of sequence of random variables – Convergence in law, Convergence in probability, Convergence in r^{th} mean, Convergence almost surely. Weak Law of Large Numbers-Kintchine's Weak Law of Large Numbers, Strong Law of Large Numbers-Kolmogrov strong law of large numbers, Central Limit Theorem- Lindberg- Levy form and Liapunov'sform of Central Limit Theorem .(simple application problems)

Text Book 1 : Section 6.2 (till Theorem 12),For the remaining part of the module reference may be done from any of the Text Books 1, 2 or3.

Question Paper Pattern

	Section A	Section B	Section C
Module I	**3**	**2**	**1**
Module II	**3**	**2**	**1**
Module III	**2**	**2**	**1**
Module IV	**2**	**2**	**1**
Total	**10**	**8**	**4**

References

1. S.C Gupta and V.K Kapoor (2002) *Fundamentals of Mathematical Statistics*, 11thEdn, Sultan Chand & Sons, New Delhi
2. Mukhopadhyay, P. (2011) *An Introduction to the Theory of Probability*, World Scientific Publishing Company.
3. Billingsley P. (1985) *Probability and Measure*, Wiley India (P) Ltd.
4. Laha R.G and Rohatgi V.K (1979) *Probability Theory*, Wiley India (P) Ltd.
5. Loeve M (1963) *Probability Theory*, Allied East – West Press.
6. Feller W. (1976) *AnIntroduction to Probability Theory and Its Applications*, Vol. 2, Wiley India (P) Ltd.

ME810402 OPERATIONS RESEARCH

5 Hours/Week (Total Hours : 90) **3 Credits**

Text 1: **K.V. Mital and C. Mohan, Optimization Methods in Operations Research and System Analysis, 3rd edition, New Age International Pvt. Ltd..**

Text 2 : **A. Ravindran , Don T. Philips and James J. Solberg., Operations Research Principles and Practice, 2nd edition, John Wiley and Sons.**

Module 1: Dynamic Programming Introduction , Problem 1- Minimum path problem, Problem 2 -Single additive constraint, additively separable return, Problem 3– Single multiplicative constraint, additively separable return, Problem 4- Single additive constraint, multiplicatively separable return, Computational economy in DP , Serial multistage model, Examples of failure ,Decomposition , Backward and forward recursion , Systems with more than one constraints, Applications of D.P to continuous systems.
(Chapter 10; Sections 10.1 – 10.12 of text 1)

Module 2: Continuous time random processes An example, Formal definitions and theory, the assumptions reconsidered, Steady state probabilities, Birth death processes, The Poisson process.
(Chapter 6 ; Sections 6.11 – 6.16 of text 2)

Module 3: Queueing Systems Introduction, An example, General Characteristics, Performance Measures, Relations Among the performance Measures, Markovian Queueing Models, The M/M/1 Model, Limited Queue Capacity, Multiple Servers, An example, Finite Sources.
(Chapter 7; Sections 7.1 –7.11 of text 2)

Module 4: Inventory Models Introduction The classical Economic Order Quantity, A Numerical example, Sensitivity Analysis, Non Zero lead Time, The EOQ. with shortages allowed The Production Lot size (PLS) models ,The Newsboy Problem (a single period model) ,A Lot size reorder point model, Variable lead times, The importance of selecting the right model.
(Chapter 8; Sections: 8.1 – 8.14 of text 2)

Question Paper Pattern

	Section A	Section B	Section C
Module I	**3**	**2**	**1**
Module II	**3**	**2**	**1**
Module III	**2**	**2**	**1**
Module IV	**2**	**2**	**1**
Total	**10**	**8**	**4**

References:

1. Fundamentals of Queueing Theory, Donald Gross, Carl M. Harris, 3rd edition, John Wiley and Sons.
2. Hamdy A. Taha, Operations Research – An Introduction, 6th edition, Prentice Hall of India Pvt. Ltd.
3. Man Mohan, P.K. Gupta and Kanti Swarup, Operations Research, Sultan Chand and Sons.

ME810403 : CODING THEORY

5 hours/week (Total Hours : 90) **3 Credits**

Text : **Vera Pless 3rd Edition , Introduction to the theory of error coding codes, Wiley Inter Science**

Module I: Introduction Basic Definitions Weight, Maximum Likelihood decoding Synarome decoding, Perfect Codes, Hamming codes, Sphere packing bound, more general facts.
(Chapter 1 & Chapter 2 Sections 2.1, 2.2, 2.3 of the text) **(25 hours)**

Module II: Self dual codes, The Golay codes, A double error correction BCH code and a field of 16 elements.
(Chapter 2 Section 2.4 & Chapter 3 of the text) **(20 hours)**

Module III: Finite fields
(Chapter 4 of the text) **(20 hours)**

Module IV: Cyclic Codes, BCH codes
(Chapter 5 & Chapter 7 of the text) **(25 hours)**

Question Paper Pattern

	Section A	Section B	Section C
Module I	**3**	**2**	**1**
Module II	**3**	**2**	**1**
Module III	**2**	**2**	**1**
Module IV	**2**	**2**	**1**
Total	**10**	**8**	**4**

References:-

1. R-Lidi, G. Pliz, Applied Abstract Algebra, Springer Verlag.
2. J.H.Van Lint, Introduction to Coding Theory, Springer Verlag
3. R.E.Blahut, Error- Control Codes, Addison Wesley.

ELECTIVE GROUP C

ME820401: COMMUTATIVE ALGEBRA

5 hours/week (Total Hours : 90) **3 credits**

Text Book : **Gregor Kemper, A Course in Commutative Algebra, Springer, ISSN0072-5285, ISBN978-3-642-03544-6**

Module I: **The Algebra-Geometry Lexicon – Hilbert's Nullstellensatz**

Maximal ideals, Jacobson Rings, Coordinate Rings, Simple problems.

(Chapter1 Sections 1.1, 1.2 & 1.3 of the text) **(25 hours)**

Module II: **Noetherian and Artinian Rings.**

The Noether and Artin Properties for Rings and Modules, Notherian Rings and Modules, Simple problems

(Chapter2 Sections 2.1 & 2.2, of the text) **(20 hours)**

Module III: **The Zariski Topology**

Affine Varieties, Spectra, Noetherian and Irreducible Spaces, Simple problems.

(Chapter 3 Sections 3.1, 3.2 & 3.3 of the text) **(25 hours)**

Module IV: **A Summary of the Lexicon**

True Geometry: Affine Varieties, Abstract Geometry : Spectra , Simple problems

(Chapter 4 Sections 4.1 & 4.2, of the text). **(20 hours)**

Question Paper Pattern

	Section A	Section B	Section C
Module I	**3**	**2**	**1**
Module II	**2**	**2**	**1**
Module III	**3**	**2**	**1**
Module IV	**2**	**2**	**1**
Total	**10**	**8**	**4**

References: -

1. William W. Adams, Phillippe Loustaunau, An Introduction to Grobner bases, Graduate Studies in Mathematics 3, American Mathematical Society, 1994, [117]
2. Michael F Attiyah, Ian Grant Macdonald, Introduction to Commutative Algebra, Addison- Wesley, Reading, 1969[174]
3. Nicolas Bourbaki, General Topology, Chapters 1 – 4, Springer, Berlin, 1993, [117,118,161].

ME820402: Ordinary Differential Equations

5 hours/week (Total Hours : 90) **3 credits**

Text : **George F. Simmons, Differential Equations with Applications and Historical Notes, Second Edition, Tata McGraw Hill Publishing Company Limited**

Module I : **Qualitative properties of solutions and Boundary value problems**

Oscillations and the sturm separation theorem,the sturm comparison theorem, Eigen values, eigen functions and the vibrating string , Sturm – Liouville problems

(Sections 24, 25, 40 and 43 of the text) **(20 hours)**

Module II : **Some Special Functions of Mathematical Physics**

Legendre polynomials, Properties of Legendre polynomials, Bessel`s functions, the gamma function, properties of Bessel functions, Additional properties of Bessel functions

(Sections 44, 45, 46, 47 and Appendix C of the text) **(25 hours)**

Module III : **System of First order Equations and Non linear Equations**

General remarks on systems, Linear systems, Homogeneous linear systems with constant coefficients, Nonlinear systems. Volterra`s prey- predator equations, Autonomous systems. The phase plane and its phenonina, Types of Critical points. Stability, Critical Points and stability for linear systems, Stability by Liapunov`s direct method.

(Sections 54 to 61 of the text) **(25 hours)**

Module IV: **The Existence and Uniqueness of Solutions**

The method of successive approximations, Picard`s theorem, Systems. The second order linear equation

(Sections 68, 69 and 70 of the text) **(20 hours)**

Question Paper Pattern

	Section A	Section B	Section C
Module I	**2**	**2**	**1**
Module II	**3**	**2**	**1**
Module III	**3**	**2**	**1**
Module IV	**2**	**2**	**1**
Total	**10**	**8**	**4**

References:-

1. Shepley L. Ross - Differential Equations, 3rd ed., (Wiley India).
2. E.A. Coddington - An Introduction to Ordinary Differential Equation, PHI.
3. W.E. Boyce & R.C. Diprima - Elementary Differential Equations and boundary value Problems, (Wiley India)
4. S. Balachandra Rao & H. Ranuradha – Differential Equation with Applications and Programs (Universities Press)

ME820403 CLASSICAL MECHANICS

5 Hours/Week (Total Hours : 90) **3 Credits**

Text: **L. D. Landau and E. M. Lifshitz- MECHANICS, (Third Edition) (Butter worth – Heinenann)**

Module 1: Generalized coordinates, the Principle of least action, Galileo's relativity principle, the Legrangian for a free particle, Legrangian for a system of particle,energy, momentum, center of mass, angular momentum, motion in one dimension,determination of the potential energy from the period of oscillation, the reduced mass,motion in a central field.
(Section 1 to 9, 11 to 14 of the text) **(25 hours)**

Module 2: Free oscillation in one dimension, angular velocity, the inertia tensor, angular momentum of a rigid body, the equation of motion of a rigid body, Eulerian angle,Euler's equation.
(Section 21, 31 to 36 of the text) **(20 hours)**

Module 3: The Hamilton's equation, the Routhian, Poisson brackets, the action as a functionof the coordinates, Maupertui's principle.
(Section 40 to 44 of the text) **(25 hours)**

Module 4: The Canonical transformation, Liouville's theorem, the Hamiltonian – Jacobi equation, separation of the variables, adiabatic invariants, canonical Variables
(Section 45 – 50 of the text) **(20 hours)**

Question Paper Pattern

	Section A	Section B	Section C
Module I	**3**	**2**	**1**
Module II	**2**	**2**	**1**
Module III	**3**	**2**	**1**
Module IV	**2**	**2**	**1**
Total	**10**	**8**	**4**

References:-

1. M. G. Calkin, Lagrangian and Hamiltonian Mechanics, Allied
2. Herbert Goldstein, Classical Mechanics, Narosa
3. K C Gupta, Classical Mechanics of particles and Rigid Bodies, Wiley Eastern

3.MODEL QUESTION PAPER PATTERN

QP Code **Reg. No……..**

Name ……

M Sc (Mathematics)Degree (C.S.S) Examination, ……

……. Semester

Faculty of Science

Name of Course

(2019 admissions onwards)

Time: Three hours Max. Weight: 30

Section- A

(Answer any **eight** questions. Each question carries a weight of 1)

1.

2.

3.

4.

5.

6.

7.

8.

9.

10. **(8 x 1 = 8)**

Section B

(Answer any **six** questions. Each question carries a weight of 2)

11

12.

13.

14.

15.

16.

17.

18. (**6 x 2 = 12**)

Section C

(Answer any **two** questions. Each question carries a weight of 5.)

19.

20.

21.

22. (**2 x 5 = 10)**

Model Question Papers

QP Code **Reg. No. ……..**

Name ……

M Sc (Mathematics)Degree (C.S.S) Examination, ……

Fourth Semester

Faculty of Science

ME010101 ABSTRACT ALGEBRA

(2019 admissions onwards)

Time: Three hours Max. Weight: 30

Section- A

(Answer any **eight** questions. Each question carries a weight of 1)

1. Find all abelian groups, up to isomorphism, of order 16.
2. Find the order of $5 + < 4 >$ in the factor group $\mathbb{Z}_{12}/< 4 >$
3. If X is a G – set, prove that G_x is a subgroup of G for each $x \in X$.
4. Find the kernel of the homomorphism $\phi: \mathbb{Z}_{18} \to \mathbb{Z}_{12}$ where $\phi(1) = 10$
5. Show that every group of order 45 has a normal subgroup of order 9.
6. Give the conjugate classes and the class equation of S_3
7. Find all solutions of the congruence $12x \equiv 27(\mathrm{mod}\ 18)$
8. Show that $x^4 - 2x^2 + 8x + 1$ is irreducible over $\mathbb{Q}$.
9. Give an example to show that factor ring of an integral domain may be a field.
10. Prove that a field has no proper nontrivial ideals. **(8 x 1 = 8)**

Section B

(Answer any **six** questions. Each question carries a weight of 2)

11. Let H be a subgroup of a group G. Prove that left coset multiplication is well defined by the equation $(aH)(bH) = (ab)H$ if and only if H is a normal subgroup of G.
12. Derive Burnside's formula.
13. Let H be a subgroup of a group $G$and Let N be a normal subgroup of a group G. Prove that $(HN)/N \simeq H/(H \cap N)$
14. Prove that every group of order 255 is abelian and cyclic.
15. Prove that every field L containing an integral domain D contains a field of quotients of D.
16. State and prove Eisenstein Criterion for irreducibility of polynomials.

17. Show that the set $\mathrm{End}(A)$ of all endomorphisms of an abelian group A forms a ring under
    homomorphism addition and homomorphism multiplication.
18. Prove that a field F is either of prime characteristic p and contains a subfield isomorphic to $\mathbb{Z}_p$ or of characteristic 0 and contains a subfield isomorphic to $\mathbb{Q}$.

(**6 x 2 = 12**)

Section C

(Answer any **two** questions. Each question carries a weight of 5.)

19. a) Prove that the group $\mathbb{Z}_m \times \mathbb{Z}_n$ is cyclic and isomorphic to $\mathbb{Z}_{mn}$ if and only if m and n are relatively prime.
    b) Prove that if m divides the order of a finite abelian group G, then G has a subgroup of order m.
20. a) Let p be a prime and G be a finite group. If p divides $|G|$, prove that G has an element of order p.
    b) State and prove Third Sylow theorem.
21. a) State and prove Division Algorithm for $F[x]$.
    b) Prove that if G is a finite subgroup of the multiplicative group $(F^*, \cdot)$ of a field F, then G is cyclic.
22. a) Prove that if F is a field, then every ideal in $F[x]$ is principal.
    b) Prove that an ideal $< p(x) > \neq \{0\}$ of $F[x]$ is maximal if and only if $p(x)$ is irreducible over$F$.

(**2 x 5 = 10**)

QP Code **Reg. No. ……..**

Name ……

M Sc (Mathematics)Degree (C.S.S) Examination, ……

First Semester

Faculty of Science

ME 010103 BASIC TOPOLOGY

(2019 admissions onwards)

Time: Three hours Max. Weight: 30

Section- A

(Answer any **eight** questions. Each question carries a weight of 1)

1. 1. Define a topological space. Give two different topologies on $\mathcal{R}$.
2. Let $\{\tau_i / i \in I\}$ be an indexed collection of topologies on a set X. Show that $\tau = \bigcap_{i\in I} \tau_i$ is a topology on X.
3. Give two topologies on a topological space which are not comparable. Justify your answer.
4. Show that a subset A of a topological space X is dense in X if and only if for every non-empty open subset B of , $A \cap B = \phi$.
5. Prove that the product topology is the weak topology determined by the projection functions.
6. Prove that a subset of a topological space is open if and only if it is a neighbourhood of each of its points.
7. Let $\mathcal{C}$ be a collection of subsets of a space X such that no two members of $\mathcal{C}$ are mutually separated. Prove that $\bigcup_{C\in\mathcal{C}} C$ is connected.
8. Prove that every continuous image of a compact space is compact.
9. Let X be a locally connected space. Prove that the components of a open subsets of X are open in X.
10. Show that regularity is a hereditary property. **(8 x 1 = 8)**

Section B

(Answer any **six** questions. Each question carries a weight of 2)

11. Prove that metrisability is a hereditary property.

12. If a space is second countable, prove that every open cover of it has a countable subcover.
13. For a subset A of a space X, show that $\bar{A} = A \cup A'$.
14. Prove that every open surjective map is a quotient map.
15. Show that every second countable space is first countable.
16. Define weakly hereditary property. Give an example. Prove it..
17. Show that every path connected space is connected.
18. Show that any completely regular space is regular.. (**6 x 2 = 12**)

Section C

(Answer any **two** questions. Each question carries a weight of 5.)

19. a) Let X be a set, τ a topology on X and S a family of subsets of X. Show that S is a sub-base for τ if and only if S generates τ.
    b) Let (X, τ) be second countable and $Y \subset X$. Show that any cover of Y be members of τ has a countable subcover.
20. Let (X, τ) and (Y, u) be spaces and $f: X \to Y$ a function. Prove that the following statements are equivalent.
    (a) f is continuous
    (b) For all $V \in u, f^{-1}(V) \in \tau$
    (c) There exists a sub-base S for u such that $f^{-1}(V) \in \tau$ for all $V \in S$
    (d) For any closed subset A of Y, $f^{-1}(A)$ is closed in X
    (e) For all $A \subset X$, $f(\bar{A}) \subset \overline{f(A)}$
21. a) Prove that every continuous real valued function on a compact space is bounded and attains its extrema.
    b) State and prove Lebesgue covering lemma.
22. a) Prove that in a Hausdorff space, limits of sequences are unique.
    b) Prove that all metric spaces are T_4 (**2 x 5 = 10)**

QP Code **Reg. No. ……..**

Name ……

M Sc (Mathematics)Degree (C.S.S) Examination, ……

First Semester

Faculty of Science

ME010105 GRAPH THEORY

(2019 admissions onwards)

Time: Three hours Max. Weight: 30

Section- A

(Answer any **eight** questions. Each question carries a weight of 1)

1. State and prove the first theorem in graph theory and deduce that the number of vertices in a cubic graph is always even.

2. If G_1 and G_2 are two graphs , find the order and size of their Cartesian product in the corresponding terms of G_i, i=1,2.

3. Show that a vertex v cannot be a cut vertex of both a graph and its complement.

4. Construct a graph with vertex connectivity = 2 = edge connectivity.

5. Prove that every tree is bipartite and characterize all complete bipartite graphs which are trees.

6. Prove that an eulerian graph is bridgeless.

7. Prove that the only 3-critical graphs are odd cycles.

8. Prove that every k critical graph is 2-connected.

9. Prove that the number of faces of a planar graph G is independent from the planar drawing of G.

10. Obtain the adjacency spectrum of K_3. **(8 x 1 = 8)**

Section B

(Answer any **six** questions. Each question carries a weight of 2)

11. Prove that the set of all automorphisms on a simple graph G forms a group under the composition of functions.

12. Prove that every diconnected tournament is Hamiltonian.

13. Prove that the vertex connectivity and edge connectivity of a simple cubic graph are equal.

14. Prove that the centre of a tree consists of a single vertex or two adjacent vertices.

15. Prove that a graph G is eulerian if and only if its edges can be partitioned into edge disjoint cycles.

16. State and prove Ores theorem.

17. State and prove Eulers Formula for a connected planar graph and deduce that K_5 is nonplanar.

18. Obtain the spectrum of C_n. (**6 x 2 = 12**)

Section C

(Answer any **two** questions. Each question carries a weight of 5.)

19. Prove that

1. A graph G is bipartite if and only if it has no odd cycles.
2. Prove that the line graph of a graph G is a cycle if and only if G is a cycle.
3. Prove that every tournament contains a directed Hamiltonian path.

20 . State and prove Cayleys formula by proving all necessary lemmas.

21. State and prove Brookes theorem

22. State the four color conjecture, prove the 6 color and five color theorems.

(**2 x 5 = 10)**

QP Code **Reg. No. ……..**

Name ……

M Sc (Mathematics)Degree (C.S.S) Examination, ……

Third Semester

Faculty of Science

ME 010202 ADVANCED TOPOLOGY

(2019 admissions onwards)

Time: Three hours Max. Weight: 30

Section- A

(Answer any **eight** questions. Each question carries a weight of 1)

1. Prove that a continuous bijection from a compact space onto a Hausdorff space is a homeomorphism.
2. Let A be a subset of a space X and let $f: A \to \mathcal{R}$ be continuous. Prove that any two extensions of f to X agree on $\bar{A}$.
3. Prove that projection functions are open.
4. Prove that a product of topological spaces is completely regular if and only if each co-ordinate space is so.
5. Define the terms box and wall in a set $X = \prod_{i \in I} X_i$ where $\{X_i / i \in I\}$ is an indexed family of sets.
6. Define the evaluation function of the indexed family of functions. Prove that the evaluation function of a family of functions is one-one if and only if the family distinguishes points.
7. Prove that a topological space is completely regular if and only if the family of continuous real valued functions on it distinguishes points from closed sets.
8. Prove that the evaluation function continuous if and only if f_i each is continuous.
9. Let $S: D \to X$ be a net and F a cofinal subset of S. If $S/_F : F \to X$ converges to a point x in X, prove that x is a cluster point of S.
10. Define (a) Riemann net (b) Homotopy between two maps

    (c) Path homotopy between f and f' **(8 x 1 = 8)**

Section B

(Answer any **six** questions. Each question carries a weight of 2)

11. Prove that a compact subset in a Hausdorff space is closed.
12. State and prove Tietze characterization of normality.

13. Prove that a subset of X is a box if and only if it is the intersection of a family of walls.
14. Let C_i be a closed subset of a space X_i for $i \in I$. Prove that $\prod_{i\in I} C_i$ is closed subset of $\prod_{i\in I} X_i$ with respect to the product topology.
15. Prove that a topological space is a Tychonoff space if and only if it is embeddable into a cube.
16. Prove that a second countable space is metrisable if and only if it is T_3.
17. Prove that a topological space is Hausdorff if and only if limits of all nets in it are unique.
18. Let $(D, \geq)$ be a directed set and E is an eventual subset of D, then prove that E with the restriction of $\geq$ is a directed set. Also prove that $S: D \to X$ converges to x in X if and only if $S/_E : E \to X$ converges to x in X. (**6 x 2 = 12**)

Section C

(Answer any **two** questions. Each question carries a weight of 5.)

19. State and prove Urysohn lemma.
20. a) Prove that if the product is non-empty, then each co-ordinate space is embeddable in it.
    b) Prove that a topological spaces is regular if and only if each co-ordinate space is regular.
21. a) State and prove embedding lemma.
    b) Prove that a space is embeddable in the Hilbert cube if and only if it is second countable and T_3 .
22. a) Define subnet.
    b) Let $S: D \to X$ be a net in a topological space and let $x \in X$. Then x is a cluster point of S if and only if there exists a subnet of S which converges to x in X.

(**2 x 5 = 10**)

QP Code **Reg. No. ……..**

Name ……

M Sc (Mathematics)Degree (C.S.S) Examination, ……

Second Semester

Faculty of Science

ME010204 COMPLEX ANALYSIS

(2019 admissions onwards)

Time: Three hours Max. Weight: 30

Section- A

(Answer any **eight** questions. Each question carries a weight of 1)

1. 1. If $\sum a_n z^n$ and $\sum b_n z^n$ have radii of convergence R_1 and R_2 respectively, show that the radius of convergence of $\sum a_n b_n z^n$ is atleast R_1R_2.
2. If $T_1 z = \frac{z+2}{z+3}$ and $T_2 z = \frac{z}{z+1}$,find T_1T_2z, $T_1^{-1}T_2z$ and $T_2^{-1}T_1z$.
3. Prove that an analytic function f(z) degenerates if arg f(z) is a constant.
4. Find the linear transformation which carries 0,i,-I to 1,-1,0 respectively.
5. Prove that $\left|\int_\gamma f(z)dz\right| \le \int_\gamma |f(z)|dz$.
6. Compute $\int_{|z|=2} \frac{dz}{z^2-1}$.
7. Prove that if γ lies inside of a circle C, then $n(\gamma, a) = 0$, for all points a, outside C.
8. Compute $\int_{|z|=1} z^{-4} \sin z dz$.
9. Prove that a non constant analytic function maps open sets onto open sets.
10. Prove that reflection carries circles onto circles.

(8 x 1 = 8)

Section B

(Answer any **six** questions. Each question carries a weight of 2)

11. Prove that analytic function f(z) in a region **Ω** , is conformal at z_0 in **Ω** if and only if $f'(z_0) \neq 0$.
12. Find the linear transformation which carries the circle $|z| = 2$ into $|z+1| = 1$, the point -2 to the origin and the origin to i.
13. Derive Cauchy's integral formula.
14. State and prove Liouville's theorem.
15. State and prove Weirstrass's theorem for essential singularities.
16. State and prove the theorem on local correspondence.
17. State and prove Cauchy's theorem for a disk.
18. Use Schwarz Lemma to show that $\frac{|f'(z)|}{\left(1-|f(z)|^2\right)} \leq \frac{1}{1-|z|^2}$, where f(z) is analytic in the unit disc and $|f(z)| \leq 1$. **(6 x 2 = 12)**

Section C

(Answer any **two** questions. Each question carries a weight of 5.)

19. (a) Define cross ratio. Prove that four points z_1, z_2, z_3, z_4 are concyclic if and only if their cross ratio is real

    (b) Prove that a linear transformation carries circles onto circles

    (c)Find the most general linear transformation which maps IzI=R onto itself.

20. (a) State and prove Cauchy,s theorem for a rectangle.

    (b) Discuss the case when there are exceptional points inside the rectangle..
21. (a)State and prove the theorem on higher derivatives.

    (b)Prove that analytic function has derivatives of all orders and all are analytic.

    (c)Derive the Cauchy's estimate for n'th derivative.
22. (a)State and prove the general form of Cauchy's theorem.

    (b)Evaluate $\int_0^{\infty} \frac{\cos x\,dx}{x^2 + a^2}$; a being real. **(2 x 5 = 10)**

QP Code **Reg. No. ……..**

Name ……

M Sc (Mathematics)Degree (C.S.S) Examination, ……

Third Semester

Faculty of Science

ME 010301 ADVANCED COMPLEX ANALYSIS

(2019 admissions onwards)

Time: Three hours Max. Weight: 30

Section- A

(Answer any **eight** questions. Each question carries a weight of 1)

19. Define a harmonic function. If f(z) is an analytic function, prove that $\log|f(z)|$ is harmonic.
20. Derive the Taylor series for $\arcsin z$ about the origin. Also find the radius of convergence.
21. Define an entire function with an example. What is the connection between the genus and order of an entire function?
22. Find the residue of the Gamma function at the poles $z = -n$.
23. State the Reflection Principle.
24. State Arzela's theorem.
25. If f(z) is analytic, then prove that $\log\left(1+|f(z)|^2\right)$ is sub harmonic.
26. State the Riemann Mapping theorem.
27. Prove that the sum of residues of an elliptic function is zero.
28. Derive the Legendre's relation, $\eta_1\omega_2 - \eta_2\omega_1 = 2\pi i$.

(8 x 1 = 8)

Section B

(Answer any **six** questions. Each question carries a weight of 2)

29. State and prove Schwarz's theorem.
30. Find the Laurent series for the function $f(z) = \dfrac{1}{z(z-1)}$ and find the regions where the expansions are valid.

31. Derive the necessary and sufficient condition for the absolute convergence of the infinite product $\prod_{1}^{\infty}(1+a_n)$.

32. Derive the Poisson – Jensen's formula for $\log|f(z)|$.

33. Write a short note on the zeros of Riemann Zeta function.

34. State and prove the boundary behavior theorem for analytic functions.

35. Explain what is meant by Dirichlet's problem. State the theorem behind the Perron's method for solving the problem for arbitrary regions.

36. Derive the differential equation for the Weirstrass' $\wp$ function **(6 x 2 = 12)**

Section C

(Answer any **two** questions. Each question carries a weight of 5.)

37. (a) State and prove Mittag Leffler's theorem of partial fractions.

(b) Prove that $\pi\cot\pi z=\frac{1}{z}+\sum_{n\neq 0}\left[\frac{1}{z-n}+\frac{1}{n}\right]$.

38. (a) Obtain the product and integral representations for the Riemann Zeta function.

(b) Prove that it can be extended as a meromorphic function in the whole plane with a single simple pole at s=1.

39. Prove that a family $\Im$ is normal if its closure with respect to the distance function $\rho(f,g)=\sum_{k=1}^{\infty}\delta_k(f,g)2^{-k}$ is compact.

40. Prove that (a) $\zeta(z+u)=\zeta(z)+\zeta(u)+\frac{1}{2}\left[\frac{\wp'(z)-\wp'(u)}{\wp(z)-\wp(u)}\right]$.

(b) $\wp(z+u)=-\wp(z)-\wp(u)+\frac{1}{4}\left[\frac{\wp'(z)-\wp'(u)}{\wp(z)-\wp(u)}\right]^2$

(c) $\begin{vmatrix} \wp(z) & \wp'(z) & 1 \\ \wp(u) & \wp'(u) & 1 \\ \wp(z+u) & -\wp'(z+u) & 1 \end{vmatrix}=0$

(2 x 5 = 10)

QP Code **Reg. No. ……..**

Name ……

M Sc (Mathematics)Degree (C.S.S) Examination, ……

Third Semester

Faculty of Science

ME010304 FUNCTIONAL ANALYSIS

(2019 admissions onwards)

Time: Three hours Max. Weight: 30

Section- A

(Answer any **eight** questions. Each question carries a weight of 1)

1. Is $C[a, b]$ a Banach space? Justify your Answer.
2. If X is a finite dimensional vector space, prove that any norm on X is equivalent to any other norm on it.
3. Show that every linear operator on a finite dimensional space is bounded.
4. Show that a finite dimensional vector space is algebraically reflexive.
5. Define Dual space of a normed space. What is the dual of $\mathbb{R}^n$?
6. Give an example of a Normed space which is not an inner product space. Justify.
7. If Y is a closed subspace of a Hilbert space, then prove that $Y = Y^{\perp\perp}$
8. Give an example of $x \in l^2$ such that we have strict inequality occurs in an inner product space
9. Define a reflexive space. Give example of a space which is (a) Reflexive, (b) Non-reflexive.
10. Prove that a bounded linear operator T on a complex Hilbert space H is unitary if and only if T is isometric and surjective.

(8 x 1 = 8)

Section B

(Answer any **six** questions. Each question carries a weight of 2)

11. Prove that every finite dimensional subspace of a Normed space is complete.

12. If X is a Normed space such that the closed unit ball is compact, then prove that X is finite dimensional.
13. Let $T: D(T) \to Y$ be a bounded linear operator, where $D(T)$ lies in a Normed space X and Y is a Banach space. Prove that T has an extension $\tilde{T}: \overline{D(T)} \to Y$ where $\tilde{T}$ is a bounded linear operator of norm $\|\tilde{T}\| = \|T\|$
14. Show that the dual space of l^1 is l^∞
15. State and prove Riesz's theorem for functionals on Hilbert spaces.
16. Let H be a Hilbert space. Then prove that if H contains an orthonormal sequence which is total in H, then H is separable.
17. Prove that the adjoint operator $T^\times$ of T is linear, bounded and $\|T^\times\| = \|T\|$
18. Prove that every vector space $X \neq \emptyset$ has a Hamel basis **(6 x 2 = 12)**

Section C

(Answer any **two** questions. Each question carries a weight of 5.)

19. (i) Prove that in a finite dimensional Normed space X, any subset $M \subset X$ is compact if and only if M is closed and bounded

    (ii) State and prove Riesz's lemma.
20. (i) Let T be a linear operator. Then prove that (a) the range $R(T)$ is a vector space; (b) if $\dim D(T) = n < \infty$, then $\dim R(T) \leq n$; (c) The null space $N(T)$ is a vector space.

    (ii) Let T be a bounded linear operator. Then prove that (a) $x_n \to x$ (where $x_n, x \in D(T)$) implies $Tx_n \to Tx$. (b) The null space $N(T)$ is closed.
21. (i) State and prove Bessel inequality.

    (ii) Explain Gram-Schmidt process
22. State and prove Hahn-Banach Theorem of extension of linear functionals.

(2 x 5 = 10)

QP Code **Reg. No. ……..**

Name ……

M Sc (Mathematics)Degree (C.S.S) Examination, ……

Fourth Semester

Faculty of Science

ME010401 SPECTRAL THEORY

(2019 admissions onwards)

Time: Three hours Max. Weight: 30

Section- A

(Answer any **eight** questions. Each question carries a weight of 1)

1. Let X and Y be normed spaces, $T \in B(X,Y)$ and (x_n) a sequence in X. If $x_n \xrightarrow{w} x$ then show that $Tx_n \xrightarrow{w} Tx$
2. Of what category is the set of all rational numbers (a) in $\mathbb{R}$ (b) in itself. Of what category is the set of all integers (c) in $\mathbb{R}$ (d) in itself?
3. Prove that all matrices representing a given linear operator $T: X \to X$ on a finite dimensional Normed space X relative to various bases for X have the same eigen values.
4. Show that the spectrum of a bounded linear operator on a complex Banach space is bounded.
5. Let $S, T \in B(X,X)$, show that for every $\lambda \in \rho(S) \cap \rho(T)$, $R_\lambda(S) - R_\lambda(T) = R_\lambda(S)(T-S)R_\lambda(T)$
6. Define Compact linear operator. Prove that the identity operator on an infinite dimensional space is not compact.
7. Prove that the operator $T: l^2 \to l^2$ defined by $y = (\eta_j) = Tx$ where $\eta_j = \frac{\zeta_j}{j}$ for $j = 1,2,\ldots$ is compact
8. Prove that every non zero spectral value of a compact linear operator is an eigen value.
9. Let $T: H \to H$ be a bounded self-adjoint linear operator on a complex Hilbert space. Then prove that all eigen vectors corresponding to different eigen values of T are orthogonal.
10. If P_1 and P_2 be projections on a Hilbert space H. Then prove that the difference $P_1 - P_2$ is a projection on H if and only if $Y_1 \subset Y_2$ where $Y_j = P_j(H)$

(8 x 1 = 8)

Section B

(Answer any **six** questions. Each question carries a weight of 2)

11. Prove that every Hilbert space is reflexive.
12. (a) Prove that Strong convergence implies weak convergence with the same limit.
    (b) Is the converse true? Justify
13. State and prove Banach fixed point theorem.
14. Show that the spectrum of a bounded linear operator on a complex Banach space is non-empty.
15. If (x_n) and (y_n) are Cauchy sequences in a Normed algebra A, show that
    (a) $(x_n y_n)$ is Cauchy in A
    (b) If $x_n \to x$ and $y_n \to y$ then $x_n y_n \to xy$
16. Prove that a compact linear operator $T: X \to Y$ from a Normed space X into a Banach space Y has a compact linear extension $\tilde{T}: \hat{X} \to Y$ where $\hat{X}$ is the completion of X
17. Let H be a complex Hilbert space and $T: H \to H$ be a bounded self-adjoint linear operator. Then prove that $m = \inf_{||x||=1}\langle Tx, x\rangle$ and $M = \sup_{||x||=1}\langle Tx, x\rangle$ are spectral values of T.
18. Prove that a bounded linear operator $P: H \to H$ on a Hilbert space H is a projection if and only if P is self adjoint and idempotent (**6 x 2 = 12**)

Section C

(Answer any **two** questions. Each question carries a weight of 5.)

19. State and prove Open Mapping Theorem.
20. (i) State and prove spectral mapping theorem for polynomials
    (ii) Show that for any operator $T \in B(X, X)$ on a complex Banach space X, $r_\sigma(\alpha T) = |\alpha|\, r_\sigma(T)$ and $r_\sigma(T^k) = [r_\sigma(T)]^k$, $k \in \mathbb{N}$
21. (i) Prove that the set of eigen values of a compact linear operator $T: X \to X$ on a normed space X is countable and the only possible point of accumulation is $\lambda = 0$
    (ii) Let $T: X \to X$ be a compact linear operator and $S: X \to X$ a bounded linear operator on a Normed space X. Then prove that ST and TS are compact
22. (i) Let $T: H \to H$ be a bounded self adjoint linear operator on a complex Hilbert space H. Prove that a number λ belongs to the resolvent ser $\rho(T)$ if and only if there exists a $c > 0$ such that for every $x \in H$, $\|T_\lambda x\| \geq c\|x\|$
    (ii) Show that the spectrum $\sigma(T)$ of a bounded linear operator $T: H \to H$ on a complex Hilbert space H is real. . (**2 x 5 = 10**)

DEPARTMENT OF MATHEMATICS

Semester -I, III,V (ODD SEMESTER)

	I	II	III	IV	V
	I-Maths	I-Com (Computer)	I-Com-Computer(T)	I-English	I-H/M (Hindi/Malayalam)
	II-Com(Computer)	II-Maths	II-Maths	II-Com -Computer	II-Eng
Monday	III-Maths	III-Maths	III-OC (Maths)	III-Maths	III-Maths
	IM-Maths	lM-Maths	IM-Maths	IM-Maths	IM-Maths
	IIM-Maths	IIM-Maths	IIM-Maths	IIM-Maths	IIM-Maths
	IBCA-Maths	I BBA -Maths	IBBA-Statistics		
	I-Maths	I-H/M (Hindi/English)	I-Com - Computer(T)	I-Eng	I-Maths
	II-Com(Computer)	II-Com -Computer	II-Eng	II-Statistics	II-Maths
Tuesday	III-Maths	III-Maths	III-OC (Maths)	III-Maths	III-Maths
	IM-Maths	IM-Maths	IM-Maths	IM-Maths	IM-Maths
	IIM-Maths	IIM-Maths	IIM-Maths	IIM-Maths	IIM-Maths
	IBCA-Statistics	IBBA-Statistics	IBBA-Maths	IBCA-Maths	IIBCA-Statistics
	I-Maths	I-Com - Computer(L)	I-Hindi/Malayalam	I-Eng	I-Com - Computer(L)
	II-Maths	II-Com-Computer	II-Maths	II-Com -Computer	II-Eng
Wednesday	III-Maths	III-Maths	III-OC Maths	III-Maths	III-Maths
	IM-Maths	IM-Maths	IM-Maths	IM-Maths	IM-Maths
	IIM-Maths	IIM-Maths	IIM-Maths	IIM-Maths	IIM-Maths
	IBBA-Maths	IBBA-Statistics		IIBCA-Statistics	
		IBCA-Maths			
	I-Eng	I-Maths	I-Com-Computer(T)	I-Com (Computer) (L)	I-H/M (Hindi/ Malayalam)
	II-Maths	II-Eng	II-Statistics	II-Com-Computer	II-Com-Computer
Thursday	III-Maths	III-Maths	III-OC Maths	III-Maths	III-Maths
	IM-Maths	IM-Maths	IM-Maths	IM-Maths	IM-Maths

	IIM-Maths	**IIM-Maths**	**IIM-Maths**	**IIM-Maths**	**IIM-Maths**
		IBBA-Statistics	**IBCA-Maths**	**IIBCA-Statistics**	**IBCA-Statistics**

	I-Maths	**I-MLJ**	**I-Com -Computer (L)**	**I-English)**	**I-Hindi/Malayalam**
	II-Com - Computer	**II-Eng**	**II-Com -Computer**	**II-Maths**	**II-Com - Computer**
Friday	**III-Maths**	**III-Maths**	**III-Maths**	**III-Maths**	**III-Maths**
	IM-Maths	**IM-Maths**	**IM-Maths**	**IM-Maths**	**IM-Maths**
	IIM-Maths	**IIM-Maths**	**IIM-Maths**	**IIM-Maths**	**IIM-Maths**
	IBCA-Statistics	**IIBCA-Statistics**		**IBBA-Maths**	
				IBCA-Statistics	

AP	AMAL PAVITHRAN	**TR**	THARA REVEENDRAN
SD	SIKHA DAVID	**AMS**	ARUN M S
ARMKL	ANJITHA ROSEMARY K L	**H/M**	HINDI/MALAYALAM
JTJ	JOBINA TERESA JOSEY	**VV/NCM**	Dr.VRINDHA VIJAYAN/NOUFIYA C M
MLJ	MARIA LESLA JOLLY	**RTMJ**	RINU TRESA M J
NCN	NASRIN C N	**KS**	KEERTHANA S
MB	MILI BABU	**AR**	AISWARYA RONY
JT	JOSMY THOMAS	**OC**	OPEN COURSE
JS	JAYASREE S	**AS**	ATHIRA SHANMUGHAN
T	THEORY	**L**	LAB

DEPARTMENT OF MATHEMATICS

Time Table Semester -II, IV,VI (EVEN SEMESTER)

	I	II	III	IV	V
Monday	I-RG (OR)	I-Com -Computer	I- Maths	I-Eng	I- H/M(Hindi/Malayalam)
	II-Com (AR)	II-Maths	II-Com -Computer	II- Maths(OR)	II-Eng
	III-AP	III-Maths	III Maths	III- Maths	III-Maths
	IM-JT	IM-Maths	IM-Maths	IM-Maths	IM-Maths
	IIM-NCN	IIM-Maths	IIM-Maths	IIM -Maths	IIM-Maths
	IBCA-SB (M)	I BBA - Maths	IBBA- Maths	I M - Maths (VAC)	III - Maths (VAC)
Tuesday	I- SS (M)	I-- Hindi/Malayalam	I-Com -Computer	I-Eng (TT)	I- Maths (OR)
	II-Eng (JS)	II-Com -Computer	II-Maths	II -Com (P)	II -Com (P)
	III- SB	III-Maths	III-Maths	III-Maths	III -Maths
	IM-NJ	IM-Maths	IM-Maths	IM- Maths	IM- Maths
	IIM- NCN	IIM- Maths	IIM- Maths	IIM- Maths	IIM-Maths
		IBBA- Maths	IBBA- Maths	IBCA- Maths	IIBCA-Maths (OR)
Wednesday	I- Com (KS) (L)	I-Com -Computer(L)	I-Hindi/Mal	I-Eng	I- Maths
	II-Com (TR)	II-Maths	II- Maths (OR)	II-Com - Computer	II-Eng
	III-AP	III-Maths	III-Maths	III- Maths	III-Maths
	IM- NJ	IM- Maths	IM-Maths	IM- Maths	IM- Maths
	IIM- JT	IIM- Maths	IIM-Maths	IIM- Maths	IIM- Maths
	IBBA- SB (M)	IBBA- Maths		IIBCA-Maths (OR)	
		IBCA- Maths			
	I-Eng (AS)	I- Maths	I-Com- C o m p u t e r	I- Maths	I-Hindi/Mal
	II- RG (OR)	II-Eng	II-Maths	II -Com (P)	II -Com (P)

	III- SB	**III- Maths**	**III- Maths**	**III-Maths**	**III-Maths**

Thursday	**IM-Maths**	**IM- Maths**	**IM- Maths**	**IM- Maths**	**IM- Maths**
	IIM- Maths	**IIM-Maths**	**IIM - Maths**	**IIM-Maths**	**IIM- Maths**
				III B.Com SBR	
		IBBA- Maths	**IBCA- Maths**	**IIBCA-Maths(OR)**	
Friday	**I-Com**	**I- Maths (OR)**	**I-Computer**	**I-Eng**	**I-H/M (Hindi/Mala)**
	II-Com	**II-Eng**	**II-Maths**	**II -Com (P)**	**II -Com (P)**
	III- Maths	**III-Maths**	**III- Maths**	**III-Maths**	**III-Maths**
	IM-Maths	**IM-Maths**	**IM- Maths**	**IM- Maths**	**IM-Maths**
	IIM- Maths	**IIM-Maths**	**IIM-Maths**	**IIM- Maths**	**IIM-Maths**
			III B.Com SBR		
		IIBCA-Maths (OR)		**IBBA- Maths**	

AP	AMAL PAVITHRAN	**TR**	THARA REVEENDRAN
SS	STEPHY SIMON	**III B.Con SBR**	ROSHINI GRACE
RG	ROSHINI GRACE	**H/M**	HINDI/MALAYALAM
NJ	NIVIN JOHNY	**VV/NCM**	Dr.VRINDHA VIJAYAN/NOUFIYA C M
SB	SWEETY BASIL	**RTMJ**	RINU TRESA M J
NCN	NASRIN C N	**KS**	KEERTHANA S
MB	MILI BABU	**AR**	AISWARYA RONY
JT	JOSMY THOMAS	**TT**	THAMANNA THAJUDHEEN
JS	JAYASREE S	**AS**	ATHIRA SHANMUGHAN
VAC	VALUE ADDED COURSE	**L / P**	LAB / PROJECT

Master of Science

PHYSICS

PROGRAM STRUCTURE AND SYLLABUS

2019-20 ADMISSION ONWARDS

(UNDER MAHATMA GANDHI UNIVERSITY PGCSS REGULATIONS 2019)

BOARD OF STUDIES IN PHYSICS (PG)

MAHATMA GANDHI UNIVERSITY

2019

MAHATMA GANDHI UNIVERSITY, KOTTAYAM

Board of Studies in Physics (P G)

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CONTENTS

Preface

CHAPTER-I

1. General Scheme of the Syllabi..... 1

1.1 Theory Courses..... 3

1.2 Practicals..... 3

1.3 Project..... 3

1.4 Viva Voce..... 4

1.5 Course Code..... 4

1.6 Course Structure of M.Sc. Programme..... 4

1.7 Elective Bunch..... 6

1.8 Distribution of Credit..... 7

CHAPTER – II

2. Grading and Evaluation..... 9

2.1 Examinations..... 9

2.2 Internal Assessment..... 10

2.2.1 Attendance, Assignment and Seminar..... 10

2.2.2 Project Evaluation..... 10

2.2.3 General Instructions..... 12

2.3 External Evaluation (EA)..... 13

2.3.1 Question Paper Pattern for Theory Courses..... 13

2.3.2 Directions for question setters..... 14

2.3.3 Practical, Project and Viva Voce Examinations..... 16

2.3.4 Reappearance/Improvement..... 17

CHAPTER III

3. M.Sc Physics Syllabus..... 17

3.1 Introduction..... 17

3.2 Core Courses..... 17

3.3 Electives..... 53

3.3.1 Bunch – A: Electronics 53
3.3.2 Bunch – B: Material Science 61
3.3.3 Bunch – C: Informatics 70
3.3.4 Bunch – D: Theoretical Physics 78

CHAPTER IV

4. Parallel PG-CSS Physics Programme 85

4.1 Course Code 85
4.2 Syllabus 88

CHAPTER V

5. Model Question Papers 177

MSc. Degree program (Mahatma Gandhi University regulations PGCSS 2019 from 2019-20 academic year)

1. Aim of the program

MSc. Physics forms the final formal training of Physics and hence the program aims at providing an in depth knowledge of Physics to the student. After the successful completion of the program , a student should be capable of pursuing research in theoretical/ experimental physics or related areas.The student is expected to acquire a thorough understanding of the fundamentals ofPhysics so as to select an academic career in secondary or tertiary level.The program also aims at enhancing the employability of the student. Rigorous training requires phased teaching. With this intention credit and semester system is followed in this program.An M.Sc student should be capable of doing research at least in the preliminary way.To accomplish this ,research oriented project is made part of this curriculum

2 Eligibility for admissions

Bachelor's degree in physics with an aggregate minimum of 50%marks

3 Medium of instruction and assessment

English

4 Faculty under which the degree is awarded

Science

5 Specialization offered if any

(1)Electronics,(2) Material science,(3) Informatics (4) Theoretical physics

6 Note on compliance with the UGC minimum standards for the conduct and award of postgraduate degrees.

MSc Physics is a two year program in which credit and semester system is followed . An M.Sc student should be capable of doing research at least in the preliminary way. To accomplish this,research oriented project is made part of this curriculum .There are 18 weeks in a semester and in each week there are15 lecture hours and 10 laboratory hours. In each semester there are 270 lecture hours and 180 practical hours Thus the total calendar hours in each semester is 450 which is in compliance with the minimum 390 hours stipulated by the UGC.

PREFACE

The P.G. syllabus in Physics is restructured to suit the credit and semester system to be followed by the affiliated colleges under Mahatma Gandhi (M.G.) University, Kottayam, from the academic year 2019- 2020. Now as the continuation of the credit and semester system being followed in the U.G. courses in the university, the present restructuring of P.G. curriculum becomes inevitable.

In the restructuring of the P.G. syllabus, the Board of Studies has taken into account the emerging trends in the various fields of theoretical and experimental physics. The thrust was given to inculcate in students the spirit of hard work and research aptitude to pursue higher education in the nationally /internationally reputed institutions and laboratories. Wide discussion in this matter was carried out among the physics teaching community of the M.G. University and experts from various other universities and institutions across the country. A three day workshop was conducted on January17,18 and 19, 2019 with representatives from P.G. departments of all affiliated colleges of the university

In order to accommodate various front running fields in physics, and for the students to have option to select the courses of their interest, the Board has decided to present four Elective Bunch with three courses each in the P.G. syllabus. The elective courses are accommodated in the third and fourth semesters of the P G program. The syllabus of physics practicals is also revised keeping in view of the advances in various fields of physics and technology. Each semester will have one practical each with two practical exams at the end of even semesters. This syllabus is to be followed by all the affiliated colleges under M.G. University. The syllabi of a parallel M.Sc. program run by one college is also restructured to accommodate in the Credit and Semester System.

Chapter - I is dedicated to the General Scheme of the Syllabi. The general M.Sc. program in physics with the course structures in all four semesters are also given in this chapter. Grading and Evaluation is discussed in Chapter - II. The pattern of question papers of theory and practical and the respective internal and external evaluation schemes are discussed here. In Chapter - III, the syllabi of the general M.Sc Physics program is given. Chapter - IV is dedicated for the the syllabi of parallel M.Sc. programs.

CHAPTER-I

1. GENERAL SCHEME OF THE SYLLABI

1.1 Theory Courses: There are fifteen theory courses in all four semesters in the M.Sc. Program. Distribution of theory courses is as follows. There are twelve core courses common to all students. Semester I and Semester II will have **four** core courses each and Semester III will have **three** core courses and Semester IV will have **one** core course. **One** elective course is in semester III and **two** elective courses are in semester IV. There are four Elective Bunch offered in this syllabus. An Elective Bunch has three theory courses. A college can choose one Elective Bunch in one academic year.

1.2 Practicals: All four semesters will have a course on laboratory practicals. The laboratory practicals of Semesters I, II and IV are common courses. The Semester III laboratory practical course will change, subject to the Elective Bunch opted by the college. A minimum of 12 experiments should be done and recorded in each semester. The practical examinations will be conducted at the respective examination centers by two external examiners appointed by the university at the end of even semesters only. The first and second semester examinations of laboratory practical courses will be conducted at the end of Semester II while the third and fourth semester practical examinations will be conducted at the end of Semester IV.

1.3 Project: The project of the PG program should be relevant and innovative in nature. The type of project can be decided by the student and the guide (a faculty of the department or other department/college/university/institution). The project work should be taken up seriously by the student and the guide. The project should be aimed to motivate the inquisitive and research aptitude of the students. The students may be encouraged to present the results of the project in seminars/symposia. The conduct of the project may be started at the beginning of Semester III, with its evaluation scheduled at the end of Semester IV along with the practical examination as being practiced in the present syllabus. The project is evaluated by the external examiners. The project guide or a faculty member deputed by the head of the

department may be present at the time of project evaluation. This is to facilitate the proper assessment of the project.

1.4 Viva Voce: A viva voce examination will be conducted by the two external examiners at the time of evaluation of the project. The components of viva consists of subject of special interest, fundamental physics, topics covering all semesters and awareness of current and advanced topics.

1.5 Course Code: The 12 core courses in the program are codedaccording to the following criteria. The first two letters of the code indicates the name of program, ie. PH stands for Physics. The next two digits indicate the stream. The next two digits indicate the semester and the last two digits run for the core courses (Refer Table 1.1)The elective courses are coded as follows. In PH800403, 80 stands for the Elective Bunch A (ELECTRONICS),04 stands for fourth semester and the digit0 3 stands for the 3rd course of the Elective Bunch. (Refer Table 1.2)

Laboratory Practical courses are similarly coded. (Eg: PH0101P means I Semester, General Physics Lab).PH800302 is the Advanced Practicals in Electronics, PH810302 is the Advanced Practicals in Material Science. etc.

1.6 Course Structure of M.Sc. Physics Program:

This is the PG program followed by all affiliated colleges under Mahatma Gandhi University. Apart from this, one affiliated college has a PG progamme in Physics with different course structure. This is discussed in Chapter IV. The detailed structure of the Core courses common to all students of the program is given in Table 1.1

Table 1.1: Structure of MSc Physics under PG-CSS 2019

Semester	Course Code	Name of the courses	No of hrs / week	Credits
I	PH010101	Mathematical methods in Physics – I	3	3
	PH010102	Classical Mechanics	4	4
	PH010103	Electrodynamics	4	4
	PH010104	Electronics	4	4
	PH010105	General Physics Practicals	10	4
		Total for Semester 1	**25**	**19**
II	PH010201	Mathematical methods in Physics – II	4	4
	PH010202	Quantum Mechanics – I	3	4
	PH010203	Statistical Mechanics	4	4
	PH010204	Condensed Matter Physics	4	4
	PH010205	Electronics Practicals	10	4
		Total for Semester 2	**25**	**20**
III	PH010301	Quantum Mechanics – II	4	4
	PH010302	Computational Physics	4	4
	PH010303	Atomic and Molecular Physics	4	4
		Elective – 1	3	3
		Advanced Elective Practicals	10	5
		Total for Semester 3	**25**	**20**
IV	PH010401	Nuclear and Particle Physics	5	4
		Elective – 2	5	3
		Elective – 3	5	3
	PH010402	Computational Physics Practicals	10	4
	PH010403	Project	-	5
	PH010404	Comprehensive viva voce	-	2
		Total for Semester 4	**25**	**21**
		Grand Total		**80**

1.7 The Elective Bunches:

There are four Electives Bunches offered in this PGCSS Program. Each elective consists of a bunch of three theory courses and one laboratory course. The first theory course and the laboratory course of a bunch are placed in the Semester III, while the second and third are in Semester IV.An institution can select only one Elective Bunch in an academic year. The course structure of the Electives Bunches is given in Table 1.2

The Electives Bunches are named,

(i) Bunch A : Electronics

(ii) Bunch B : Material Science

(iii) Bunch C : Informatics

(iv) Bunch D : Theoretical Physics.

Table 1.2: The Elective Bunch

Bunch A: Electronics Specialization : Course code 80

Semester	Course Code	Course Title	No. of hrs / week	Credits
3	PH800301	Digital Signal Processing	3	3
4	PH800402	Micro Electronics and Semi Conductor Devices	5	3
4	PH800403	Communication Systems	5	3
3	PH800302	Advanced Practicals in Electronics	10	5

Bunch B: Materials Science Specialization :Course code 81

Semester	Course Code	Course Title	No. of hrs / week	Credits
3	PH810301	Solid State Physics for Materials	3	3
4	PH810402	Science of Advanced Materials	5	3
4	PH810403	Nanostructures and Materials Characterisation	5	3
3	PH810302	Advanced Practicals in Materials Science	10	5

Bunch C: Informatics Specialization:Course code 82

Semester	Course Code	Course Title	No. of hrs / week	Credits
3	PH820301	Programming in JAVA and HTML	3	3
4	PH820402	Data Communication and Computer Networks	5	3
4	PH820403	Computer applications in Physics	5	3
3	PH820302	Practicals in Informatics	10	5

Bunch D: Theoretical Physics:Course code 83

Semester	Course Code	Course Title	No. of hrs / week	Credits
3	PH830301	General Relativity and Applications	3	3
4	PH830402	Nonlinear Dynamics	5	3
4	PH830403	Quantum Field Theory	5	3
3	PH830302	Special Computational Practicals	10	5

1.8 Distribution of Credit: The total credit for the program is fixed at 80. The distribution of credit points in each semester and allocation of the number of credit for theory courses, practicals, project and viva is shown in Table 1.1 and Table 1.2.

CHAPTER - II

2. GRADING AND EVALUATION

2.1 Examinations

The evaluation of each course shall contain two parts such as Internal or In-Semester Assessment (IA) and External or End-Semester Assessment (EA). The ratio between internal and external examinations shall be 1:3.

Evaluation(Both internal and external)to be done by the teacher is based on a six point scale as shown in the table below

Grade	**Grade Points**
A+	**5**
A	**4**
B	**3**
C	**2**
D	**1**
E	**0**

Direct Grading System based on a 7 – point scale is used to evaluate the performance of students in both External and Internal Examinations .

For all courses (theory & practical) / semester/overall program letter grades and **GPA/SGPA/CGPA** are given in the following table 2.1:

Range	**Grade**	**Indicator**
4.50 to 5.00	**A+**	**Outstanding**
4.00 to 4.49	**A**	**Excellent**
3.50 to 3.99	**B+**	**Very good**
3.00 to 3.49	**B**	**Good(Average)**
2.50 to 2.99	**C+**	**Fair**
2.00 to 2.49	**C**	**Marginal**
up to 1.99	**D**	**Deficient(Fail)**

2.2 Internal or In-Semester Assessment (IA)

Internal evaluation is to be done by continuous assessments of the following components. The components of the internal evaluation for theory and practicals and their weights are as in the Table 2.2and Table2.3. . The components of the internal evaluation for project and comprehensive viva- voce and their weights are as in the Table 2.4and Table2.5The internal assessment should be fair and transparent. The evaluation of the components should be published and acknowledged by students. All documents of internal assessments are to be kept in the institution for 2 years and shall be made available for verification by the university. The responsibility of evaluating the internal assessment is vested on the teacher(s) who teach the course. The two test papers should be in the same model as the end semester examination question paper, the model of which is discussed in the Section 2.3. The duration and the number of questions in the paper may be adjusted judiciously by the college for the sake of convenience.

There shall be no separate minimum grade point for internal evaluation of Theory, Practical, Project, and Comprehensive viva-voce. No separate minimum is required for Internal evaluation for a pass, but a minimum **C** grade is required for a pass in an external evaluation. However, a minimum **C grade** is required for pass in a course.

2.2.1Attendance ,Assignment and seminar

Attendance is not a component for the internal evaluation.But students with attendance less than 75% in a course are not eligible to attend external examination of that course.. The performance of students in the seminar and assignment should also be documented.

2.2.2 Project Evaluation

The internal evaluation of the project is done by the supervising guide of the department or the member of the faculty decided by the head of the department. The project work may be started at the beginning of the Semester III. The supervising guide should keenly and sincerely observe the performance of the student during the course of project work. The supervising guide is expected to inculcate in student(s), the research aptitude and aspiration to learn and aim high in the realm of research and

development. A maximum of three students may be allowed to perform one project work if the volume of the work demands it.Project evaluation begins with (i) the selection of problem, (ii) literature survey, (iii) work plan, (iv) experimental / theoretical setup/data collection, (v) characterization techniques/computation/analysis (vi) use of modern software for data analysis/experiments (Origin, LABView, MATLAB, ...etc) and (vi) preparation of dissertation. The project internal grades are to be submitted at the end of Semester IV. The internal evaluation is to done as per the following general criteria given in Table 2.4

The internal evaluation of comprehensive viva-voce is to done as per the following general criteria given in Table 2.5

Table 2.2 Theory-Internal

For Theory(Internal)- Components and Weightage

	Components	**Weightage**
i.	Assignment	1
ii	Seminar	2
iv	Best Two Test papers	1 each (2)
	Total	**5**

Table 2.3 Practical-Internal

For Practical(Internal)- Components and Weightage

	Components	**Weightage**
	Written/Lab test	2
	Lab involvement and Record	1
	Viva	2
	Total	**5**

Table 2.4 Project- Internal

For Project(Internal)- Components and Weightage

	Components	Weightage
	Relevance of the topic and analysis	2
	Project content and presentation	1
	Project viva	2
	Total	**5**

Table 2.5 Comprehensive Viva- Internal

Comprehensive viva (Internal)- Components and Weightage

Components	Weightage
Subject of special interest, fundamental physics, topics covering all semesters and awareness of current and advanced topics.	5
Total	**5**

2.2.3 General Instructions

i. The assignments/ seminars / test papers are to be conducted at regular intervals.. These should be marked and promptly returned to the students.

ii. One teacher appointed by the Head of the Department will act as a coordinator for consolidating grade sheet for internal evaluation in the department in the format supplied by the University. The consolidated grade sheets are to be published in the department notice board, one week before the closing of the classes for end semester examinations. The grade sheet should be signed by the coordinator and counter signed by the Head of the Department and the college Principal.

iii. The consolidated grades in specific format supplied by the university areto be kept in the college for future references. The consolidated grades ineach course should be uploaded to the University Portal at the end of eachsemester as directed by the University.

iv. A candidate who fails to register for the examination in a particular semester is not eligible to continue in the subsequent semester.

v. Grievance Redress Mechanism for Internal evaluation: There will be provision for grievance redress at four levels, viz,

   a. at the level of teacher concerned,
   b. at the level of departmental committee consisting of Head of the Department, Coordinator and teacher concerned,
   c. at the level of college committee consisting of the Principal, Head of the Department and one member of the college council, nominated by the principal each year,
   d. at the university level committee consisting of Pro-Vice Chancellor /Dean of the Faculty, the controller of examinations and the Convener of the Standing Committee on Academic Affairs of the Syndicate.

College level complaints should be filed within one week of the publication of results and decisions taken within the next two weeks. University level complaints will be made within the time stipulated by the University and decisions will be taken within one month of the last date fixed for filing complaints.

2.3 External Evaluation (EA)

The external examination of all semesters shall be conducted by the university on the close of each semester. There will be no supplementary examinations.

2.3.1 Question Paper Pattern for Theory Courses.

All the theory question papers are of three hour duration. All question papers will have three parts. The question shall be prepared in such a way that the answers can be awarded **A+,A,B,C,D,E.**

Part A: Questions from this part are very short answer type. Eight questions have to be answered from among ten questions. Each question will have weight one and the Part A will have a total weight of eight. A minimum of two questions must be asked from each unit of the course.

Part B: Part B consists of problem solving and short essay type questions from the course concerned. Six questions out of eight given have to be answered. Each question has a weight two making the Part B to have total weight twelve. Minimum of three problems should be asked in Part B ..

Part C: Part C will have four questions. One question from each unit must be asked . Each question will have a weight five making the total weight ten in Part C.
Maximum weight for external evaluation is **30.**Therefore Maximum Weighted Grade Point (WGP) is **150**

Different types of questions shall be given different weights to quantify their range as shown below:

	Type of Questions	**Weight**	**Number of questions to be answered**
Part A	Short Answer type questions	1	8 out of 10
Part B	Short essay/ problem solving type questions	2	6 out of 8
Part C.	Long Essay type questions	5	2 out of 4

2.3.2 Practical, Project and Viva Voce Examinations

First and second semester practical examinations are conducted at the end of Semester II and third and fourth semester practical examinations are conducted at the end of Semester IV. The practical examinations are conducted immediately after the second and fourth semester theory examinations respectively. There will be two practical examination boards even' year to conduct these practical exams. All practical examinations will be of five hours duration. Two examiners from the panel of examiners of the university will be deputed by the board chairman to each of the examination centers for the fair and transparent conduct of examinations. Practical examination is conducted in batches having a maximum of eight students. The board enjoys the right to decide on the components of practical and the respective weights.

Project Evaluation: The project is evaluated by the two external examiners deputed from the board of practical examination. The dissertation of the project is examined

along with the oral presentation of the project by the candidate. The examiners should ascertain that the project and report are genuine. Innovative projects or the results/findings of the project presented in national seminars may be given maximum advantage. The supervising guide or the faculty appointed by the head of the department may be allowed to be present at the time of project evaluation. This is only to facilitate proper evaluation of the project. The different weight for assessment of different components is shown in Table 2.5.

Table 2.5 Project- External

For Project(External) Components and Weightage

Components	Weightage
Relevance of the topic and analysis	3
Project content and presentation	7
Project viva	5
Total	**15**

Comprehensive Viva- Voce Examination: Viva voce examination is conducted only by the two external examiners of the board of practical examinations. The viva voce examination is given a credit two. The examination should be conducted in the following format shown in Table 2.6 below.

Table2.6 Comprehensive viva-voce(External)-components and weightage

Components	Weightage
Subject of special interest, fundamental physics, topics covering all semesters and awareness of current and advanced topics.	15
Total	**15**

Both project evaluation and viva voce examination are to be conducted in batches of students formed for the practical examinations.

2.3.3 Reappearance/Improvement: For reappearance/ improvement as per university rules, students can appear along with the next regular batch of students of their particular semester. A maximum of two chances will be given for each failed paper. Only those papers in which candidate have failed need be repeated. Chances of reappearance will be available only during eight continuous semesters starting with the semester in which admission/readmission is given to the candidate.

2. Evaluation Second stage– Calculation of Grade Point Average **(GPA)** of a course (to be done by the University)

3. Evaluation Third stage -Semester Grade Point Average **(SGPA)** (to be done by the University)

4. Evaluation- Fourth stage - Cumulative Grade Point Average**(CGPA)** (to be done by the University)

CHAPTER III

3. M.Sc. PHYSICS SYLLABUS

3.1 INTRODUCTION

This chapter deals with the syllabi of all core courses, Elective courses of the MSc. Physics program. The semester wise distribution of the courses is given.

In the semester III and semester IV, the courses from elective bunch will come as opted by the colleges concerned.

3.2 CORE COURSES

SEMESTER I

PH010101: MATHEMATICAL METHODS IN PHYSICS – I

Total Credits: 3

Total Hours: 54

Objective of the course: The objective of this course is to make students have an idea of vector, matrices and tensors, it's physical interpretation and applications.

UNIT I

Vector analysis (8 hrs)

1.1 Line, Surface and Volume integrals1.2 Gradient, divergence and curl of vector Functions 1.3Gauss Divergence Theorem 1.4 Stoke's Theorem1.5Green's Theorem1.6 Potential Theory1.6.1 Scalar Potential-Gravitational Potential, Centrifugal Potential

Curvilinear co-ordinates(8 hrs)

1.7 Transformation of co-ordinates1.8 Orthogonal Curvilinear co-ordinates1.9Unit Vectors in curvilinear systems1.10Arc Length and Volume Elements1.11Gradient, Divergence and Curl in orthogonal curvilinear co-ordinates1.12 Special Orthogonal co-ordinates system 1.12.1 Rectangular Cartesian Co-ordinates 1.12.2 Cylindrical Co-ordinates 1.12.3Spherical Polar Co-ordinates

UNIT II

Linear vector space(8 hrs)

1.1 Definition of linear vector space 2.2 Inner product of vectors 2.3basis sets 2.4Gram schmidt ortho normalization 2.5Expansion of an arbitrary vector2.6Schwarz inequality

Probability theory and distribution(6 hrs)

2.7 Elementary Probability Theory 2.8 Binomial Distribution2.9 Poisson Distribution 2.10 Gaussian Distribution 2.11Central Limit Theorem

UNIT III

Matrices(12hrs)

3.1 Direct Sum and Direct Product of Matrices 3.2 Diagonal matrices 3.3 Matrices inversion (Gauss Jordan Inversion Methods) 3.4 Orthogonal, unitary and Hermitian Matrices 3.5 Pauli spin matrices, Dirac matrices, Normal matrices 3.6 Cayley Hamilton Theorem 3.7 Similarity transformation 3.8 Orthogonal & Unitary Transformations 3.9 Eigen values & Eigen Vectors 3.10 Diagonalization using normalized Eigen vectors 3.11Solution of linear equation Gauss Elimination method

UNIT IV

Tensors(12 hrs)

4.1 Definition of Tensors 4.2 Basic Properties of Tensors 4.3 Covariant, Contra variant & Mixed Tensors 4.4 Kronecker delta, Levi-Civita Tensor 4.5 Metric Tensor and its properties 4.6 Tensor algebra 4.7Associated Tensors 4.8 Christoffel Symbols & their transformation laws 4.9 Covariant Differentiation 4.10Geodesics

Recommended Text Books:

1. Mathematical methods for Physicists, G.B. Arfken& H.J. Weber 5th edition, Academic Press.
2. Mathematical Physics , V.Balakrishnan, Ane Books Pvt Limited
3. Introduction to Mathematical Physics – Charles Harper, PHI
4. Vector Analysis & Tensor Analysis – Schaum's Outline Series, M.R.Speigel, Mc Graw hill
5. Mathematical methods for physics and engineering, K F Riley, M P Hobson, S J Bence, Cambridge university press.

Recommended References:

1. An Introduction to Relativity, Jayant V. Narliker,Cambridge University Press.
2. Advanced Engineering Mathematics E.Kreyszig 7th edition John Wiley
3. Mathematical Physics, B.S.Rajput,Y.Prakash 9th editionPragatiPrakashan
4. Mathematical Physics, B.D.Gupta ,Vikas Publishing House
5. Matrices and tensors in Physics, A.W.Joshi
6. Mathematical Physics , P.K.Chatopadhyay ,New Age International Publishers
7. Mathematical Physics, Sathyaprakash, Sultan Chand & Sons

PH010102: CLASSICAL MECHANICS

Total Credits: 4

Total Hours: 72

Objective of the course:

After completing the course, the students will (i) understand the fundamental concepts of the Lagrangian and the Hamiltonian methods and will be able to apply them to various problems; (ii) understand the physics of small oscillations and the concepts of canonical transformations and Poisson brackets ; (iii) understand the basic ideas of central forces and rigid body dynamics; (iv) understand the Hamilton-Jacobi method and the concept of action-angle variables. This course aims to give a brief introduction to the Lagrangian formulation of relativistic mechanics.

UNIT 1

Lagrangian formulation (14 hrs)

1.1 Review of Newtonian Mechanics: Mechanics of a Particle; Mechanics of a System of Particles; Constraints; 1.2 D' Alembert's principle and Lagrange's equations; velocity-Dependent potentials and the Dissipation Function; Lagrangian for a charged particle in electromagnetic field; 1.3 Application of Lagrange's equation to: motion of a single particle in Cartesian coordinate system and plane polar coordinate system; bead sliding on a rotating wire.1.4 Hamilton's Principle; Technique of Calculus of variations; The Brachistochrone problem. 1.5 Derivation of Lagrange's equations from Hamilton's Principle. 1.6 Canonical momentum; cyclic coordinates; Conservation laws and Symmetry properties- homogeneity of space and conservation of linear momentum; isotropy of space and conservation of angular

momentum; homogeneity of time and conservation of energy; Noether's theorem(statement only; no proof is expected).

Hamiltonian formulation: (4hrs)

1.7 Legendre Transformations; Hamilton's canonical equations of motion; Hamiltonian for a charged particle in electromagnetic field. 1.8 Cyclic coordinates and conservation theorems; Hamilton's equations of motion from modified Hamilton's principle

UNIT II

Small oscillations (8hrs)

2.1 Stable equilibrium unstable equilibrium and neutral equilibrium; motion of a system near stable equilibrium-Lagrangian of the system and equations of motion. 2.2 Small oscillations- frequencies of free vibrations; normal coordinates and normal modes 2.3 system of two coupled pendula-resonant frequencies normal modes and normal coordinates ;free vibrations of CO_2 molecule- resonant frequencies normal modes and normal coordinates.

Canonical transformations and poisson brackets (10 hrs)

2.4 Equations of canonical transformations; Four basic types of generating functions and the corresponding basic canonical transformations. Examples of canonical transformations - identity transformation and point transformation. 2.5 Solution of harmonic oscillator using canonical transformations.

2. 6 Poisson Brackets ; Fundamental Poisson Brackets; Properties of Poisson Brackets 2.7 Equations of motion in Poisson Bracket form; Poisson Bracket and integrals of motion; Poisson's theorem; Canonical invariance of the Poisson bracket.

UNIT III

Central force problem (9hours)

3.1 Reduction of two-body problem to one-body problem; Equation of motion for conservative central forces - angular momentum and energy as first integrals; law of equal areas 3.2 Equivalent one-dimensional problem –centrifugal potential; classification of orbits. 3.3 Differential Equations for the orbit; equation of the orbit using the energy method; The Kepler Problem of the inverse square law force;

Scattering in a central force field - Scattering in a Coulomb field and Rutherford scattering cross section.

Rigid body dynamics (9hrs)

3.4 Independent coordinates of a rigid body; Orthogonal transformations ; Euler Angles. 3.5 Infinitesimal rotations: polar and axial vectors; rate of change of vectors in space and body frames; Coriolis effect. 3.6 Angular momentum and kinetic energy of motion about a point; Inertia tensor and the Moment of Inertia; Eigenvalues of the inertia tensor and the Principal axis transformation . 3.7 Euler equationsof motion; force free motion of a symmetrical top.

UNIT IV

Hamilton-Jacobi theory and action-angle variables(12 hrs)

4.1 Hamilton-Jacobi Equation for Hamilton's Principal Function; physical significance of the principal function. 4.2 Harmonic oscillator problem using the Hamilton-Jacobi method. Hamilton-Jacobi Equation for Hamilton's characteristic function 4.3 Separation of variables in the Hamilton-Jacobi Equation; Separability of a cyclic coordinate in Hamilton-Jacobi equation; Hamilton-Jacobi equation for a particle moving in a central force field(plane polar coordinates) . 4.4 Action-Angle variables; harmonic oscillator problem in action-angle variables.

Classical mechanics of relativity (6 hrs.)

4.5 Lorentz transformation in matrix form; velocity addition; Thomas precession. 4.6 Lagrangian formulation of relativistic mechanics; Application of relativistic Lagrangian to (i)motion under a constant force (ii) harmonic oscillator and (iii) charged particle under constant magnetic field.

Recommended Text Books

1. Classical Mechanics: Herbert Goldstein , Charles Poole and John Safko, (3/e); Pearson Education.
2. Classical Mechanics: G. Aruldhas, Prentice Hall 2009.

Recommended References:

1. Theory and Problems of Theoretical Mechanics (Schaum Outline Series): Murray R. Spiegel, Tata McGraw-Hill 2006.

2. Classical Mechanics : An Undergraduate Text: Douglas Gregory, Cambridge University Press.
3. Classical Mechanics: Tom Kibble and Frank Berkshire, Imperial College Press.
4. Classical Mechanics (Course of Theoretical Physics Volume 1): L.D. Landau and E.M. Lifshitz, Pergamon Press.
5. Analytical Mechanics: Louis Hand and Janet Finch, Cambridge University Press.
6. Classical Mechanics: N.C.Rana and P. S. Joag, Tata Mc Graw Hill.
7. Classical Mechanics: J.C. Upadhyaya, Himalaya Publications, 2010.
8. www.nptelvideos.in/2012/11/classicalphysics.html.

PH010103: ELECTRODYNAMICS

Total credits: 4

Total hours: 72

Objective of the course**:** Electromagnetic force is one of the four forces that exist in nature with a prominent role in the daily activities of human being. So it is necessary to know the physics of this force from the basics of two inter twinned phenomena called electricity and magnetism. Hence the course aims to impart proper understanding of electricity magnetism and electrodynamics; wave nature of electromagnetic field and its properties; electromagnetic field radiating out of accelerated charges and the impact of relativity in electromagnetism along with confined propagation of electromagnetic wave.

UNIT 1

Electrostatics, Magnetostatics and basics of Electrodynamics(18 hrs)

1.1 Electrostatics: Electric field of a polarized object- Electric field in a - conductor-dielectric - electric displacement -Gauss's law in dielectric medium-linear dielectric medium-. Boundary condition across dielectric (ε_{r1})-dielectric (ε_{r2}), conductor-dielectric (ε_r), conductor-free space (ε_r=1) interface. 1.2 Uniqueness theorem and electrostatic potential-Solving Poisson's and Laplace equations for boundary value problems 1.3 Method of images- point charge -line charge above a grounded conducting plane. 1.4 Potential at large distance-multipole expansion due to a

localized charge distribution-Electric field of a dipole. 1.5 Magnetostatics: Biot-Savart law- divergence and curl of B- Ampere's law. Magnetic vector potential-multipole expansion of vector potential-boundary conditions - Magnetic field inside matter-Magnetization (M)-Magnetic flux density (B)-Auxiliary field (H). 1.6 Electrodynamics: Electromotive force - motional emf - Faraday's law-, electrodynamic equations - displacement current. 1.7 Uniform sinusoidal time varying fields E and B and Maxwell's equations in free space and matter. Boundary conditions of electric and magnetic field 1.8 Conservation laws- continuity equation-Poynting's theorem-Maxwell's stress tensor- momentum conservation.

UNIT II

Electromagnetic waves (18 hrs)

1.1Wave equation for E and B- monochromatic plane waves- energy- momentum 1.2 Propagation of em waves through linear media- Reflection and transmission of a plane wave at normal - oblique incidence.1.3 Electromagnetic waves in a conducting medium. Reflection at conducting surface- frequency dependence of permittivity 1.4 Dispersion of electromagnetic waves in non-conductors, conductors and plasma medium

UNIT III

Electromagnetic radiation (18 hrs)

3.1Potential formulation of electrodynamics- Gauge transformations-Coulomb and Lorentz gauge 3.2 Continuous charge distribution-Retarded potential-Jefmenko's equation.3.3 Point charges- Lienard-Wiechert potentials-Field of a point charge in motion- Power radiated by a point charge 3.4 Electric dipole radiation-magnetic dipole radiation-radiation from arbitrary distribution of charges 3.5 Radiation reaction-Abraham-Lorentz formula.

UNIT IV

Relativistic electrodynamics and Waveguides (18 Hrs)

4.1Relativistic electrodynamics 4.1.1 Structure of spacetime- Four vectors-Proper time and proper velocity- Relativistic energy and momentum-Relativistic dynamics-Minkowski force. 4.1.2 Magnetism as a relativistic phenomenon. 4.1.3 Lorentz transformation of em field- field tensor-electrodynamics in tensor notation. 4.1.4 Potential formulation of relativistic electrodynamics. 4.2 Waveguides 4.2.1 Waves

between parallel planes-TE-TM-TEM waves4.2.2 Rectangular waveguide- TE-TM waves -impossibility of TEM wave. 4.2.3 Cylindrical waveguide- TE-TM waves

Recommended textbooks:

1. Introduction to Electrodynamics, David J. Griffiths, PHI.
2. Electromagnetics, John D.Kraus, McGraw-Hill International
3. Classical electrodynamics, J.D Jackson, John Wiley & Sons Inc

Recommended References:

1. Electromagnetic waves and radiating systems Edward C Jordan, Keith G Balamin, Printice Hall India Pvt.Ltd
2. Elements of Electromagnetic, Mathew N. O Sadiku, Oxford University Press
3. Antenna and wave propagation, K.D Prasad, Satyaprakashan, New Delhi
4. Electromagnetism problems with solutions, Ashutosh Pramanik, PHI.

PH010104: ELECTRONICS

Total credits: 4

Total hours: 72

Objective of the course: Electronics is the study of the flow of charge (electron) through various materials and devices such as semiconductors, resistors, inductors, capacitors, nanostructures etc. All applications of electronics involve the transmission of power and possibly information.

UNIT I

Op-amp with Negative Feedback (16 Hrs)

1.1. Differential amplifier – Inverting amplifier – Non-inverting amplifier -Block diagram representations – Voltage series feedback: Negative feedback – closed loop voltage gain 1.2. Difference input voltage ideally zero – Input and output resistance with feedback – Bandwidth with feedback – Total output offsetvoltagewithfeedback– Voltagefollower.1 . 3 v o l t a g e shuntfeedback amplifier: Closed loop voltage gain -inverting input terminal and virtual ground - input and output resistance with feedback – Bandwidth with feedback - Total output offset voltage with feedback.1.4. Current to voltage converter- Inverter.Differential amplifier with one op-amp and two op-amps.

UNIT II

The Practical Op-amp (6 Hrs)

2.1. Input offset voltage –Input bias current – input offset current – Total output offset voltage- Thermal drift.2.2. Effect of variation in power supply voltage on offset voltage – Change in input offset voltage and input offset current with time - Noise – Common mode configuration and CMRR.

General Linear Applications (with design) (14Hrs)

2.3. DC and AC amplifiers – AC amplifier with single supply voltage – Peaking amplifier – Summing, Scaling, averaging amplifiers.2.4. Instrumentation amplifier using transducer bridge. Differential input and differential output amplifier – Low voltage DC and AC voltmeter. 2.5. Voltage to current converter with grounded load – Current to voltage converter. 2.6. Very high input impedance circuit – integrator and differentiator**.**

UNIT III

Frequency Response of an Op-amp (6 Hrs)

3.1. Frequency response –Compensating networks – Frequency response of internally compensated and non-compensated op-amps – High frequency op- amp equivalent circuit.3.2. Open loop gain as a function of frequency – Closed loop frequency response – Circuit stability - slew rate**.**

Active Filters and Oscillators. (with design) (12Hrs)

3.3. Active filters – First order and second order low pass Butterworth filter3.4 First order and second order high pass Butterworth filter.3.5. Wide and narrow band pass filter - wide and narrow band reject filter. All pass filter – Oscillators: Phase shift and Wien-bridge oscillators. 3.6. Square, triangular and sawtooth wave generators-Voltage controlled oscillator.

UNIT IV

Comparators and Converters (8 Hrs)

4.1. Basic comparator- Zero crossing detector.4.2. Schmitt Trigger – Comparator characteristics- Limitations of op-amp as comparators. 4.3. Voltage to frequency and frequency to voltage converters.4.4. D/A and A/D converters- Peak detector – Sample and Hold circuit.

IC555 Timer (**3 Hrs**)

4.5.IC555 Internal architecture, Applications IC565-PLL, Voltage regulator ICs 78XX and 79XX

Analog Communication (7 Hrs)

4.6. Review of analog modulation – Radio receivers – AM receivers – superhetrodyne receiver.4.8. Detection and automatic gain control – communication receiver. 4.9. FM receiver – phase discriminators – ratio detector – stereo FM reception

Recommended Text Books:

1. Op-amps and linear integrated circuits R.A. Gayakwad 4thEdn.PHI
2. Electronic Communication Systems, Kennedy& Davis 4thEd.TMH,

Recommended References:

1. Electronic Devices (Electron Flow Version), 9/E Thomas L. Floyd, Pearson
2. Fundamentals of Electronic Devices and Circuits 5th Ed. David A. Bell, Cambridge.

PH010105:GENERAL PHYSICS PRACTICALS

Total credits: 4

Total hours: 180

** Minimum number of experiments to be done 12*

***Error analysis of the result is a compulsory part of experimental work*

1. Hall Effect in Semiconductor. Determine the Hall coefficient, carrier concentration and carrier mobility.
2. Ultrasonic- acoustic optic technique-elastic property of a liquid.
3. Magnetic susceptibility of a paramagnetic solution using Quinck's tube method.
4. Curie temperature of a magnetic material.
5. Dielectric Constant and Curie temperature of ferroelectric Ceramics.
6. Draw the hysteresis curve (B – H Curve) of a ferromagnetic material and determination of retentivity and coercivity.
7. Cornu's method- Determination of elastic constant of a transparent material
8. Determination of e/m by Thomson's method.
9. Determination of e/k of Silicon.
10. Determination of Planck's constant (Photoelectric effect).
11. Measurement of resistivity of a semiconductor by four-probe method at different temperature and determination of band gap.
12. Determination of magnetic susceptibility of a solid by Guoy's method.
13. Measurement of wavelength of laser using reflection grating.
14. Fraunhoffer diffraction pattern of a single slit, determination of wavelength/slit width.
15. Fraunhoffer diffraction pattern of wire mesh, determination of wavelength/slit width.
16. Fraunhoffer diffraction pattern of double slit, determination of wavelength/slit width.
17. Diffraction pattern of light with circular aperture using Diode/He-Ne laser.
18. Fresnel diffraction pattern of a single slit.

19. Study the beam divergence, spot size and intensity profile of Diode/He-Ne laser.
20. Determine the numerical aperture of optical fibre and propagation of light through it.
21. Determine the refractive index of the material using Brewster angle setup.
22. Absorption bands of $KMnO_4$ using incandescent lamp. Determine the wave lengths of the absorption bands. Determine the wave lengths of the absorption bands by evaluating Hartman's constants.
23. Determine the co-efficient of viscosity of the given liquid by oscillating disc method.
24. Measure the thermoemf of a thermocouple as function of temperature. Also prove that Seebeck effect is reversible.
25. Determine the Young's modulus of the material of a bar by flexural vibrations.
26. Using Michelson interferometer determine the wavelength of light.
27. Study the temperature dependence of dielectric constant of a ceramic capacitor and verify Curie-Wiess law
28. Study the dipole moment of an organic molecule (acetone).
29. Determine the dielectric constant of a non-polar liquid.
30. Photograph/Record the absorption spectrum of iodine vapour and a standard spectrum.Analyze the given absorption spectrum of iodine vapour and determine the convergence limit. Also estimate the dissociation energy of iodine (wave number corresponding to the electronic energy gap = 759800 m^{-1})
31. Determine the dielectric constant of a non-polar liquid.
32. Determine the charge of an electron using Millikan oil drop experiment.
33. Linear electro optic effect(Pockel effect), Frank Hertz experiment.
34. Frank Hertz experiment determination of ionization potential.
35. Koening's method, Poisson's ratio of the given material of bar.
36. Determination of Stefan's constant of radiation from a hot body.

References

R1. Advanced practical physics for students, B.L Worsnop and H.T Flint, University of California.

R2. A course on experiment with He-Ne Laser, R.SSirohi, John Wiley & Sons (Asia) Pvt.ltd

R3. Kit Developed for doing experiments in Physics- Instruction manual, R.Srenivasan ,K.R Priolkar, Indian Academy of Sciences.

R4. Advanced Practical Physics, S.P singh, PragatiPrakasan,

R5. Practical Physics, Gupta, Kumar, PragatiPrakasan.

R6. An advanced course in Practical Physics, D.Chattopadhayay, C.R Rakshit, New Central Book Agency Pvt. Ltd: ****for error analysis only.**

SEMESTER II

PH010201:MATHEMATICAL METHODS IN PHYSICS – II

Total Credits: 4

Total Hours: 72

Objective of the course: Introduce the concepts of Laplace and Fourier transforms. Introduce the Fourier series and it's application to solutions of partial differential equations.

UNIT 1

Complex analysis (18 hrs)

1.1Functions of a complex variable 1.2 Analytic functions1.3Cauchy-Riemann equation1.4Integration in a complex plane1.5Cauchy Theorem 1.6 Cauchy's integral formulas 1.7 Taylor expansion & Laurent expansion1.8 Residue, poles1.9 Cauchy residue theorem1.10 Cauchy's principle value theorem 1.11 Evaluation of integrals

UNIT II

Integral transforms (18 hrs)

2.1 Fourier Series 2.2 Application of Fourier series 2.2.1 Square Wave 2.2.2 Full Wave Rectifier 2.3 Fourier Integral 2.4 Fourier Transform 2.4.1 Finite Wave Train 2.5 Convolution Theorem of parseval's relation2.6Momentum representation 2.6.1 Hydrogen atom 2.6.2 Harmonicoscillator 2.7 Laplace Transform, Inverse Laplace transform 2.8 Earth Mutation 2.9 Damped Oscillator 2.10 LCR circuit

UNIT III

Special functions and differential equations (18 hrs)

3.1 Gamma Function 3.2 Beta Function 3.3 Symmetry Property of Functions 3.4 Evaluation of Beta functions3.5 Other forms of Beta Functions --Transformation of P Functions 3.6 Evaluation of Gamma Functions 3.7 Other forms of Gamma Functions-Transformation of Gamma Functions 3.8 Relation between Beta and Gamma Functions 3.9 Evaluation of Integrals 3.10 Bessel's Differential Equation, 3.11 Legendre Differential Equation 3.12 Associated Legendre Differential Equations 3.13 Hermite Differential Equations 3.14 Laguerre Differential Equations (Generating function, recurrence relation, orthogonality condition, Rodrigues formulae for all functions)

UNIT IV

Partial differential equations (18 hrs)

4.1 Characteristics of boundary conditions for partial differential equation 4.2 Solution of partial differential equations by the method of separation of variables in Cartesian, cylindrical and spherical polar co-ordinates 4.3 Solution of Laplace equation in cartesian, cylindrical and spherical polar co-ordinates4.4Heat equation in Cartesian co-ordinates 4.5 Non-Homogeneous equation 4.6 Green's function 4.7 Symmetry of Green's Function4.8Green's Function for Poisson Equation, Laplace equation, Helmholtz equation 4.9Application of Greens equation in scattering problem

Recommended Text Books:-

1. Mathematical methods for Physicists, G.B. Arfken& H.J. Weber 5th edition, Academic Press.
2. Mathematical Physics , V.Balakrishnan,Ane Books Pvt Limited

Recommended Reference Books:

1. Advanced Engineering Mathematics E.Kreyszig 7thedition John Wiley
2. Mathematical Physics, B.S.Rajput,Y.Prakash 9th edition PragatiPrakashan
2. 3.Mathematical Physics,B.D.Gupta ,Vikas Publishing House
3. 4.Matrices and tensors in Physics,A.W.Joshi
4. 5.Mathematical Physics , P.K.Chatopadhyay ,New Age International Publishers
5. 6.Mathematical Physics, Sathyaprakash, Sultan Chand & Sons

PH010202 QUANTUM MECHANICS-I

Total Credits: 4

Total Hours: 54

Objective of the course:

This course aims to develop the basic structure of quantum Mechanics. After completing the course, the student will (i) understand the fundamental concepts of the Dirac formalism (ii) understand how quantum systems evolve in time; (iii) understand the basics of the quantum theory of angular momentum. Also, this course enable the student to solve the hydrogen atom problem which is a prelude to more complicated problems in quantum mechanics.

UNIT I

Basics Formulation of Quantum Mechanics (20 hours)

1.1 Development of the idea of state vectors from sequential Stern-Gerlach experiments ;Dirac notation for state vectors: ket space, bra space and inner products; 1.2 Operators; Associative axiom; outer product; 1.3 Hermitian adjoint; Hermitian operator; Eigenkets and eigenvalues of Hermitian operators. Eigenkets of observables as base kets; concept of complete set. Projection operators. 1.4 Matrix representations of operators, kets and bras 1.5 Measurements in quantum mechanics; expectation value ; Compatible observables and existence of simultaneous eigenkets; General Uncertainty Relation. 1.6 Unitary operator, change of basis and transformation matrix, unitary equivalent observables. 1.7 Position eigenkets, infinitesimal translation operator and its properties, linear momentum as generator of translation, canonical commutation relations. Wavefunction as an expansion coefficient; eigenfunctions, momentum eigen function 1.8 momentum space wavefunctions and the relation between wavefunctions in position space and momentum space. Gaussian wave packet- compuatation of dispersions in position and momentum.

UNIT II

Quantum Dynamics (16 hours)

2.1 Time evolution operator and its properties 2.2 Schrodinger equation for the time evolution operator; solution of the Schrodinger equation for different time dependences of the Hamiltonian 2.3 Energy eigenkets; time dependence of

expectation values 2.4 time evolution of a spin half system and spin precession 2.5 Correlation amplitude; time-energy uncertainty relation and its interpretation.

2.6 Schrodinger picture and Heisenberg picture; behavior of state kets and observables in Schrodinger and Heisenberg pictures; Heisenberg's equation of motion 2.7 Ehrenfest's theorem; time evolution of base kets; transition amplitudes. 2.8 Simple Harmonic Oscillator: Energy eigenvalues and energy eigenkets.

UNIT III

Theory of Angular Momentum (14 hours)

3.1 Non-commutativity of rotations around different axes; the rotation operator; fundamental commutation relations for angular momentum operators 3.2 rotation operators for spin half systems; spin precession in a magnetic field 3.3 Pauli's two component formalism; 2X2 matrix representation of the rotation operator 3.4 ladder operators; eigenvalue problem for angular momentum operators 3.5 matrix representation of angular momentum operators.3.6 Orbital angular momentum ; orbital angular momentum as a generator of rotation 3.7 Addition of orbital angular momentum and spin angular momentum; addition of angular momenta of two spin-1/2 particles. General theory of Angular Momentum addition-Computation of Clebsch - Gordon coefficients.

UNIT IV

The Hydrogen Atom (4 hours)

4.1 Behaviour of the radial wavefunction near the origin; the Coulomb potential and the hydrogen atom; hydrogenicwavefunctions; degeneracy in hydrogen atom.

Recommended Text Books:

1. Modern Quantum Mechanics : J. J. Sakurai, Pearson Education.
2. A Modern Approach to Quantum Mechanics: J S Townsend, Viva Books.

Recommended References:

1. Quantum Mechanics (Schaum's Outline) :Yoav Peleg *etal*. Tata Mc Graw Hill Private Limited, 2/e.

2. Quantum Mechanics: 500 Problems with Solutions: G Aruldhas, Prentice Hall of India.
3. Quantum Mechanics Demystified: David McMohan, McGrawHill 2006.
4. Introductory Quantum Mechanics: Richard L Liboff, Pearson Education .
5. Introduction to Quantum Mechanics: D.J. Grifith, Pearson Education.
6. Quantum Mechanics : V. K. Thankappan, New Age International.
7. Quantum Mechanics: An Introduction: Walter Greiner and Allan Bromley, Springer.
8. Quantum Mechanics : Non-Relativistic Theory(Course of Theoretical Physics Vol3): L. D. Landau and E. M. Lifshitz, Pregamon Press.
9. The Feynman Lectures on Physics Vol3, Narosa.
10. www.nptel/videos.in/2012/11/quantum-physics.html
11. https://nptel.ac.in/courses/115106066/

PH010203 STATISTICAL MECHANICS

Total Credits: 4

Total Hours: 72

UNIT I (22 hrs)

1.1. The Statistical Basis of Thermodynamics1.1.1. Macroscopic and microscopic states.1.1.2.Connection between thermodynamics and statistics.1.1.3.Classical ideal gas.1.1.4.Entropy of mixing and Gibbs paradox.1.1.5. Correct enumeration of micro states.1.2. Elements of Ensemble Theory 1.2.1. Phase space of a classical system.
1.2.2. Liouville's theorem.1.2.3. Micro-canonical ensemble.1.2.4. Quantum states and phase space.1.3. Canonical ensemble.1.3.1. Equilibrium between a system and a heat reservoir.1.3.2. System in canonical ensemble.1.3.3. Physical significance of statistical quantities in canonical ensemble.1.3.4. Classical systems.1.3.5. Energy fluctuations in canonical ensemble.1.3.6.Equipartition theorem.

UNIT II(18 hrs)

2.1. Grand canonical Ensemble2.1.1. Equilibrium between system and energy-particle reservoir.2.1.2.A system in grand canonical ensemble.2.1.3.Physical significance of various statistical quantities.2.1.4. Examples.2.1.5. Fluctuations in grand canonical ensemble.2.2. Formulation of Quantum Statistics2.2.1.Quantum mechanical ensemble

theory.2.2.2.Density matrix.2.2.3.Statistics of various ensembles.2.2.4.Examples (an electron in magnetic feilds, free particle in a box).

2.2.5. A system composed of indistinguishable particles.

UNIT III(22hrs)

3.1. Quantum Theory of Simple Gases3.1.1. Ideal gas in quantum-micro canonical ensemble.3.1.2.Ideal gas in other quantum mechanical ensembles.3.1.3.Statistics of the occupation numbers3.2.Ideal Bose Systems3.2.1.Thermodynamic behaviour of ideal Bose gas.3.2.2.Thermodynamics of black body radiation. The field of sound waves .3.3. Ideal Fermi Systems3.3.1.Thermodynamics of ideal Fermi gas.3.3.2.Magnetic behaviour of ideal fermi gas.3.3.3.Electron gas in metals.4.

UNIT IV(10 hrs)

4.1. Phase Transitions4.1.1. Phases.4.1.2. Thermodynamic potentials, 4.1.3. Approximation.4.1.4. First order phase transition.4.1.5. Clapeyron equation.

Recommended Text books:

1. Text book- R.K. Pathria, Statistical Mechanics, second edition (1996), Butterworth, Heinemann. (For Modules I, II and III.)
2. R Bowley and M. Sanchez, Introductory Statistical Mechanics, second edition, Oxford University Press. (For Module IV)

Recommended Reference Books:

1. Kerson Huang, Statistical Mechanics, John Wiley and Sons (2003).
2. F. Rief, Fundamentals of Statistical and Thermal Physics, McGraw Hill (1986).
3. D. Chandler, Introduction to Statistical Mechanics, Oxford University Press (1987)
4. L.D Landau and E.M Lifshitz, Statistical Physics (Vol-1),3rd Edition. Pergamon Press(1989)
5. Yung-Kuo Lim, Problems and Solutions in Thermodynamics and Statistical Mechanics, World Scientific (1990).

PH010204: CONDENSED MATTER PHYSICS

Total Credits: 4

Total Hours: 72

UNIT 1

Wave Diffraction and the Reciprocal Lattice (5Hrs)

1.1 Diffraction of waves by crystals-Bragg's Law- **1.2** Scattered wave amplitude-reciprocal lattice vectors- diffraction condition-Laue equations-Ewald construction-**1.3** Brillouin zones- reciprocal lattice to SC, BCC and FCC lattices-properties of reciprocal lattice- **1.4** diffraction intensity - structure factor and atomic form factor-physical significance.

Crystal Symmetry (7Hrs)

1.5 Crystal symmetry-symmetry elements in crystals-point groups, space groups

1.6 Ordered phases of matter-translational and orientational order- kinds of liquid crystalline order-Elements of Quasi crystals

Free Electron Fermi Gas (12 Hrs)

1.7. Energy levels in one dimension-quantum states and degeneracy- density of states-**1.8** Fermi-Dirac statistics -Effect of temperature on Fermi-Dirac distribution –**1.9** Free electron gas in three dimensions- **1.10** Heat capacity of the electron gas- relaxation time and mean free path - **1.11** Electrical conductivity and Ohm's law - Widemann-Franz-Lorentz law - electrical resistivity of metals.

UNIT II

Energy Bands (8 Hrs)

2.1 Nearly free electron model- Origin of energy gap-Magnitude of the Energy Gap-**2.2** Bloch functions – **2.3** Kronig-Penney model –**2.4** Wave equation of election in a periodic potential-Restatement of Bloch theorem-Crystal momentum of an Electron-Solution of the central equations-**2.5** Brillouin zone- construction of Brillouin zone in one and two dimensions – extended, reduced and periodic zone scheme of Brillouin zone (qualitative idea only) - **2.6** Effective mass of electron –**2.7** Distinction between conductors, semiconductors and insulators.

Semiconductor Crystals (10 Hrs)

2.8. Band Gap-**2.9.**Equations of motion-Effective mass-Physical interpretation of effective mass - Effective mass in semiconductors-Silicon and Germanium-**2.10** Intrinsic carrier concentration- **2.11** Impurity conductivity-Thermal ionization of Donors and Acceptors-Thermoelectric effects-semimetals-super lattices-Bloch Oscillator-Zener tunnelling.

UNIT III

Phonons

Crystal Vibrations and Thermal Properties (16 Hrs)

3.1 Vibrations of crystals with monatomic basis –First Brillouin zone-Group Velocity-**3.2** Two atoms per Primitive Basis – **3.3** Quantization of elastic waves –**3.4** Phonon momentum-**3.5** Inelastic scattering of phonons.-**3.6** Phonon Heat Capacity-Plank distribution-Density of States in one and three dimensions-Debye model for density of states-Debye T^3 Law-Einstein Model for Density of states- **3.7** Anharmonic Crystal interactions-Thermal Expansion- **3.8** Thermal Conductivity-thermal resistivity of phonon gas-Umklapp Processes-Imperfections

UNIT IV

Magnetic Properties of Solids (14 hrs)

4.1 Quantum theory of paramagnetism–Hunds rules-crystal field splitting-spectroscopic splitting factor-**4.2** Cooling by adiabatic demagnetization – Nuclear Demagnetization- **4.3** Ferromagnetic order-Curie point and the exchange integral-Temperature dependence of the saturation-Magnetization-Saturation Magnetization at absolute Zero-**4.4** Magnons- Quantization of spin waves-Thermal excitation of Manganons-**4.5** Neutron Magnetic Scattering-**4.6** Ferromagnetic order-curie temperature and Susceptibility-**4.7** Antiferromagnetic order-susceptibility below Neel-Temperature-**4.8** Ferromagnetic domains-Anisotropic Energy-transition region between Domains-origin of domains - Corecivity and Hysteresis-**4.9** Single Domain Particles-Geomagnetism and Biomagnetism-Magnetic scope microscopy **4.10** Elements of superfluidity

Recommended Textbooks:

1. Introduction to Solid State Physics, Charles Kittel, Wiely, Indian reprint (2015).
2. Solid State Physics, A.J. Dekker, Macmillan & Co Ltd. (1967)
3. Introduction to Solids, L V Azaroff, McGRAW-HILL BOOK COMPANY, INC.New York (1960)

Recommended References:

1. Solid State Physics, N.W. Ashcroft & N.D. Mermin, Cengage Learning Pub.11th IndianReprint (2011).
2. Solid State Physics, R.L. Singhal, KedarNath Ram Nath& Co (1981)
2. Elementary Solid State Physics, M. Ali Omar, Pearson, 4th Indian Reprint (2004).
3. Solid State Physics, C.M. Kachhava, Tata McGraw-Hill (1990).
4. Elements of Solid State Physics, J. P. Srivastava, PHI (2004)
5. Solid State Physics, Dan Wei, Cengage Learning (2008)
6. Solid State Physics, J S Blackemore, Cambridge University Press (1985)
2. 8.Electronic Properties of Crystalline Solids, Richard Bube, Academic Press New York (1974)

PH010205:ELECTRONICS PRACTICAL

Total credit: 4

Total hours: 180

* *Minimum number of experiments to be done 12*

***Error analysis of the result is a compulsory part of experimental work*

**** PC interfacing facilities such as ExpEYES can be used for the experiments*

1. Op-Amp parameters (i) Open loop gain (ii) input offset voltage (iii) input bias current (iv)) CMRR (v) slew rate (vi) Band width
2. Design and construct an integrator using Op-Amp (*μA741)*, draw the input output curve and study the frequency response.
3. Design and construct a differentiator using Op-Amp (*μA741) for sin wave and square wave input* and study the output wave for different frequencies.

4. Design and construct a logarithmic amplifier using Op-Amp (*μA741) and study the output wave form*.
5. Design and construct a square wave generator using Op-Amp (*μA741) for a frequency* f_0.
6. Design and construct a triangular wave generator using (*μA741) for a frequency* f_0.
7. Design and construct a saw tooth wave generator using Op-Amp (*μA741)* generator.
8. Design and construct an Op-Amp Wien bridge oscillator with amplitude stabilization and study the output wave form.
9. Design and construct a Schmidt trigger using Op-Amp μA741, *plot of the hysteresis curve.*
10. Design and construct an astable multivibrator using *μA741 with duty cycle other than 50%*
11. Design and construct a RC phase shift oscillator using *μA741for a frequency* f_0.
12. Design and construct a first and second order low pass Butterworth filter using *μA741 and plot the frequency response curve.*
13. Design and construct a first and second order high pass Butterworth filter using *μA741 and study the frequency response.*
14. Design and construct a first order narrow band pass Butterworth filter using *μA741.*
15. Solving differential equation using *μA741*
16. Design and construct ccurrent to voltage and voltage to current converter (*μA741*)
17. Astable multivibrator using 555 timer, study the positive and negative pulse width and free running frequency.
18. Monostable multivibrator using 555 timers and study the input output waveform.
19. Voltage controlled Oscillator using 555 timer
20. Design and construct a Schmitt Trigger circuit using IC 555.
21. Design and test a two stage RC coupled common emitter transistor amplifier and find th bandwidth, mid-frequency gain, input and output impedance.
22. Design and test a RC phase shift oscillator using transistor for a given operating frequency.
23. Voltage controlled Oscillator using transistor

24. Study the function of (i) analog to digital converter using IC 0800 (ii) digital to analog converter DAC 0808
25. Study the application of op-Amp (*μA741) as a d*ifferential amplifier.
26. Solving simultaneous equation using op-Amp (*μA741).*

References:

R1. Op-Amp and linear integrated circuit
Ramakanth A Gaykwad, Eastern Economy Edition, ISBN-81-203-0807-7
R2. Electronic Laboratory Primer a design approach
S. Poornachandra, B.Sasikala, Wheeler Publishing, New Delhi
R3. Electronic lab manual Vol I, K ANavas, Rajath Publishing
R4. Electronic lab manual Vol II, K ANavas, PHI eastern Economy Edition
R5. Electronic lab manual Vol II, Kuriachan T.D, Syam Mohan, Ayodhya Publishing
R6. An advanced course in Practical Physics, D.Chattopadhayay, C.R Rakshit, New Central
Book Agency Pvt. Ltd: ****For error analysis only.**

SEMESTER III

PH010301: QUANTUM MECHANICS-II

Total Credits: 4

Total Hours: 72

Objective of the course:

This course aims to extend the concepts developed in the course ‘ Quantum Mechanics-I . After completing this course, the student will (i) understand the different stationary state approximation methods and be able to apply them to various quantum systems; (ii) understand the basics of time-dependent perturbation theory and its application to semi-classical theory of atom-radiation interaction; (iii) understand the theory of identical particles and its application to helium; (iv) understand the idea of Born approximation and the method of partial waves. Also, this course will introduce the student to the basic concepts of relativistic quantum mechanics.

UNIT I

Approximation Methods for Stationary States(18 hrs)

1.1 Non-degenerate Perturbation Theory: First order energy shift; first order correction to the energy eigenstate; second order energy shift. Harmonic oscillator subjected to a constant electric field. 1.2 Degenerate Perturbation theory First order Stark effect in hydrogen; Zeeman effect in hydrogen and the Lande g-factor.

1.3 The variational Method; Estimation of ground state energies of harmonic oscillator and delta function potential 1.4 Ground State of Helium atom ; Hydrogen Molecule ion.

1.5 The WKB method and its validity; The WKB wavefunction in the classical region; non-classical region ; connection formulas(derivation not required) 1.6 Potential well and quantization condition; the harmonic oscillator. 1.7 Tunneling; application to alpha decay.

UNIT II

Time-Dependent Perturbation Theory (18 hrs)

2.1 Time dependent potentials; interaction picture; time evolution operator in interaction picture; Spin Magnetic Resonance in spin half systems 2.2 Time dependent perturbation theory; Dyson series; transition probability 2.3 constant perturbation; Fermi's Golden Rule ; Harmonic perturbation 2.4 interaction of atom with classical radiation field; absorption and stimulated emission; electric dipole approximation; photoelectric effect 2.5 Energy shift and decay width.

UNIT III

Identical Particles andScattering Theory (18hrs)

3.1 Bosons and fermions; anti-symmetric wave functions and Pauli's exclusion principle. 3.2 The Helium Atom.3.3 The Asymptotic wave function - differential scattering cross section and scattering amplitude 3.4 The Born approximation-scattering amplitude in Born approximation; validity of the Born approximation; Yukawa potential ; Coulomb potential and the Rutherford formula. 3.5 Partial wave analysis- hard sphere scattering; S-wave scattering for finite potential well; Resonances and Ramsauer-Townsend effect .

UNIT IV

Relativistic Quantum Mechanics(18 hrs)

4.1 Klein-Gordon Equation; continuity equation and probability density in Klein-Gordon theory. 4.2 Non-relativistic limit of the Klein-Gordon equation 4.3 Solutions of the Klein –Gordon equation for positive, negative and neutral spin0 particles; Klein-Gordon equation in the Schrodinger form.

4.4 Dirac Equation in the Scrodinger form; Dirac's matrices and their properties 4.5 Solutions of the free particle Dirac equation; single particle interpretation of the plane waves; velocity operator; *zitterbewegung*4.6 Non-relativistic limit of the Dirac equation; spin of Dirac particles; Total angular momentum as a constant of motion. 4.7 Negative energy states and Dirac's hole theory.

Recommended Text Books:

1. Modern Quantum Mechanics: J. J. Sakurai, Pearson Education.
2. A modern Approach to Quantum Mechanics: John Townsend, Viva Books New Delhi
3. Introduction to Quantum Mechanics: D.J. Griffith, Pearson Education
4. Relativistic Quantum Mechanics: Walter Greiner, Springer-Verlag

Recommended References:

1. Quantum Mechanics (Schaum's Outline Series): Yoav Peleg etal., Tata McGraw Hill .Education Private Limited, 2/e.
2. Quantum Mechanics: 500 Problems with Solutions: G Aruldhas, Prentice Hall of India.
3. Problems and Solutions in Quantum Mechanics: Kyriakos Tamvakis, Cambridge University Press.
4. Introductory Quantum Mechanics: Richard L Liboff, Pearson Education.
5. Quantum Mechanics: V. K. Thankappan, New Age International.
6. A Textbook of Quantum Mechanics: P M Mathews and R Venkatesan, Tata McGraw Hill.
7. Quantum Mechanics: Non Relativistic Theory (Course of Theoretical Physics Course Vol3) : L. D. Landau and E. M. Lifshitz, Pregamon Press.

8. Relativistic Quantum Mechanics: James D Bjorken and Sidney D Drell, Tata McGraw Hill 2013
9. www.ntpel/videos.in/2012/11/quantum-physics.html
10. https://nptel.ac.in/courses/115106066/

PH010302: COMPUTATIONAL PHYSICS

Total Credits:4

Total Hours: 72

Objective of the Course:

To help the students to have the basic idea about the techniques used in physics to solve problems with the help of computers when they cannot be solved analytically with pencil and paper since the underlying physical system is very complex. After the completion of this course students might be able to develop their own Algorithms of every method described in the syllabus.

UNIT I
CurveFittingandInterpolation (20Hrs)

1.1 The least squares method for fitting a straight line, 1.2 The least squares method for fitting a parabola, 1.3 The least squares method for fitting a power curves, 1.4 The least squares method for fitting an exponential curves. 1.5 Interpolation - Introduction to finite difference operators,1.6 Newton's forward and backward difference interpolation formula, 1.7 Newton's divided difference formula, 1.8 Cubic spline interpolation.

UNIT II

Numerical Differentiation and Integration(16 Hrs)

2.1 Numerical differentiation, 2.2 cubic spline method,2.3errors in numerical differentiation, 2.4 Integration of a function with Trapezoidal Rule, 2.5 Simpson's 1/3 2.6 Integration of a function with Simpson's 3/8 Rule and error associated with each. 2.7RelevantAlgorithmsforeach.

UNIT III

Numerical Solution of Ordinary Differential Equations (20Hrs)

3.1 Euler method, 3.2 modified Euler method 3.3 Runge - Kutta 4^{th} order methods – 3.4 adaptive step size R-K method, 3.5Higher order equations. 3.6 Concepts of stability.

Numerical Solution of System of Equations

3.7 Gauss-Jordan elimination Method, 3.8 Gauss-Seidel iteration method, 3.9 Gauss elimination method 3.10 Gauss-Jordan method to find inverse of a matrix. 3.11 Power method 3.12 Jacobi's method to solve eigenvalue problems.

UNIT IV

Numerical solutions of partial differential equations (16Hrs)

4.1 Elementary ideas and basic concepts in finite difference method, 4.2 Schmidt Method, 4.3 Crank - Nicholson method,4.4 Weighted average implicit method.

4.5 Monte Carlo evaluation of integrals, 4.6 Buffon's needle problem, 4.7 requirement for random number generation.

Recommended Text Books:

1. Numerical Methods for Scientists and Engineers , K SankaraRao,PHI Pvt. Ltd .
2. Introductory Methods of Numerical Analysis, S.S. Sastry, PHI Pvt. Ltd.
3. Mathematical Methods, G. Shanker Rao, K. Keshava Reddy, I.K. International Publishing House, Pvt. Ltd.

Recommended Reference Books:

1. .An Introduction to Computational Physics, Tao Pang, Cambridge University Press
2. Numerical methods for scientific and Engineering computation M.K Jain,S.R.KIyengar, R.K. Jain, New Age International Publishers
3. Computer Oriented Numerical Methods, V. Rajaraman, PHI, 2004.
4. Numerical Methods, E. Balagurusami, Tata McGraw Hill, 2009.
5. Numerical Mathematical Analysis, J.B. Scarborough, 4PthP Edn, 1958
6. Explorations in Monte Carlo Methods Ronald W Shonkwiler and Franklin Mendivil , Springer

PH010303: ATOMIC AND MOLECULAR PHYSICS

Total Credits: 4

Total Hours: 72

Objective of the course**:** This course isintented to develop the basic philosophy of spectroscopy. Its aims to equip the student with the understanding of (1)atomic structure and spectra of typical one- electron and two-electron systems. (2)the theory of microwave and infra-red spectroscopies as well as the electronic spectroscopy of molecules;(3)the basics of Raman spectroscopy and the nonlinear Raman effects; (4)the spin resonance spectroscopies such as NMR and ESR. This course also introduces the student to the ideas of Mossbauer spectroscopy .

UNIT 1

Atomic Spectra (18 Hrs)

1.1 The quantum mechanical treatment of hydrogen atom- quantum numbers *n, l* and m_l.; spectra of alkali metal vapours 1.2 Derivation of spin-orbit interaction energy in hydrogen-like atoms; extension to penetrating orbits; fine structure in sodium atom 1.3 Normal Zeeman effect; Anomalous Zeeman effect- magnetic moment of the atom and g factor; spectral frequencies; Lande g-formula. 1.4 Paschen–Back effect – splitting of sodium D-lines ; Stark effect – quadratic Stark effect in potassium doublet. 1.5 L S coupling scheme -spectroscopic terms arising from two valence electrons; terms arising from two equivalent s-electrons; derivation of interaction energy - combination of s and p electrons; Hund's rule, Lande interval rule. 1.6 The jj coupling scheme in two electron systems -derivation of interaction energy- combination of s and p electrons ;Hyperfine structure .(qualitative ideas only).

UNIT II

Microwave and Infra Red Spectroscopy (18 Hrs)

2.1 Width of spectral lines-natural width, collision broadening, Doppler broadening. Classification of molecules- linear, symmetric top, asymmetric top and spherical top molecules. 2.2 Rotational spectra of rigid diatomic molecules; effect of isotopic substitution; intensity of spectral lines; energy levels and spectrum of non–rigid rotor

2.3 Information derived from rotational spectra(molecular structure, dipole moment , atomic mass and nuclear quadrupole moment).2.4Vibrational energy of a diatomic molecule- simple harmonic oscillator –energy levels; diatomic molecule as anharmonic oscillator- energy levels; infrared selection rules; spectrum of a vibrating diatomic molecule. 2.5 Diatomic vibrating rotator –P and R branches; break down of Born-Oppenheimer approximation. 2.6 Vibrations of polyatomic molecules – fundamental vibrations and their symmetry; overtone and combination frequencies; Analysis by IR techniques- skeletal vibrations and group frequencies.

UNIT III

Raman Spectroscopy and Electronic Spectroscopy. (18 Hrs)

3.1Quantum theory of Raman effect**;** classical theory-molecular polarizability ;Pure rotational Raman spectra of linear molecules 3.2 Raman activity of vibrations; rule of mutual exclusion; vibrational Raman spectra ;rotational fine structure 3.3 Structure determination from Raman and IR spectroscopy. 3.4 Non- linear Raman effects - hyper Raman effect - classical treatment; stimulated Raman effect - CARS, PARS - inverse Raman effect. 3.5 Electronic spectra of diatomic molecules –Born-Oppenheimer approximation, vibrational coarse structure-progressions and sequences ; intensity of spectral lines- Franck – Condon principle 3.6 Dissociation energy and dissociation products; Rotational fine structure of electronic-vibrational transition ; Fortrat parabola; Predissociation.

UNIT IV

Spin Resonance Spectroscopy (18 Hrs)

4.1 Nuclear Magnetic Resonance (NMR)-resonance condition ; relaxation processes - Bloch equations 4.2 Chemical shift ; indirect spin–spin interaction4.3 CW NMR spectrometer; Magnetic Resonance Imaging.4.4 Electron Spin Resonance(ESR)-Principle of ESR; thermal equilibrium and relaxation; ESR spectrometer; characteristics of the g-factor. 4.5 Total Hamiltonian for an electron; Hyperfine Structure- ESR spectrum of hydrogen atom. 4.6 Mossbauer effect - recoilless emission and absorption; Experimental techniques in Mossbauer spectroscopy 4.7 Isomer shift; quadrupole interaction ; magnetic hyperfine interaction.

Recommended Text Books:

1. Spectroscopy, B.P. Straughan& S. Walker, Vol. 1, John Wiley &Sons
2. Introduction of Atomic Spectra, H.E. White, Mc Graw Hill.
3. Fundamentals of molecular spectroscopy, C.N. Banwell and E M McCash, TataMcGraw Hill Education Private Limited.
4. Molecular structure and spectroscopy, G. Aruldhas, PHI LearningPvt. Ltd.

Recommended References:

1. Spectroscopy (Vol. 2 & 3), B.P. Straughan& S. Walker, Science
2. paperbacks 1976
3. Raman Spectroscopy, D.A. Long, Mc Graw Hill international, 1977
4. Introduction to Molecular Spectroscopy, G.M. Barrow, Mc Graw Hill
5. Introduction to Spectroscopy, D L Pavia, G M Lampman and G S Kriz, Thomson Learning Inc.
6. Modern Spectroscopy, J M Hollas, John Wiley .
7. Elements of Spectroscopy, Gupta, Kumar & Sharma, PragathiPrakshan.
8. https:// teaching.shu.ac.uk/hwb/chemistry/tutorials/molspec/nmr1.htm
9. https://ntpel.ac.in/courses/15101003/downloads/modu21/lecture23.pdf
10. https://www.ias.ac.in/article/fulltext/reso/009/0034-0049
11. https://ntpel.ac.in/courses/122101001/downloads/modu21/lec-15.pdf
12. https://www.youtube.com/watch?v=Q2Fo5BARe Go

SEMESTER IV

PH010401 NUCLEAR AND PARTICLE PHYSICS

Total Credits: 4

Total Hours: 90

Weightage:

Objective of the course:

This course aims to provide the student to build up the fundamentals of nuclear and particle physics. After undergoing this course, the student will have a knowledge about (1) the basic properties of the nucleus and the nuclear forces. (2) Major models of the nucleus and the theory behind the nuclear decay process; (3) the physics of nuclear reactions (4)the interaction between elementary particles and the conservation

laws in particle physics. This course intents to impart some idea about nuclear astrophysics and the practical applications of nuclear physics.

Unit I

Nuclear Properties and Force between Nucleons (18 Hrs)

1.1 The nuclear radius- distribution of nuclear charge (isotope shift, muonic shift, mirror nuclei); distribution of nuclear matter. Mass and abundance of nuclides, nuclear binding energy.

1.2 Nuclear angular momentum and parity ; Nuclear electromagnetic moments-quadrupole moment. 1.3 The deuteron-binding energy, spin, parity, magnetic moment and electric quadrupole moment. 1.4 Nucleon-nucleon scattering; proton-proton and neutron-nuetron interactions 1.5 Properties of nuclear forces 1.6 Exchange force model.

Unit II

Nuclear Models and Nuclear Decay (18 Hrs)

2.1 Liquid drop model, Bethe–Weizacker formula, Applications of semi- emperical binding energy formula. 2.2 Shell Model-Shell model potential, Spin-orbit potential, Magnetic dipole moments, Electric quadrupole moments, Valence Nucleons .2.3 Collective structure- Nuclear vibrations, Nuclear rotations.

2.4 Beta decay- energy release in beta decay ; Fermi theory of beta decay 2.5 Angular momentum and parity selection rules- allowed and forbidden transitions. Comparative half lives and forbidden decays; non-conservation of parity in beta decay 2.6 Gamma decay- angular momentum and parity selection rules ; internal conversion.

Unit III Nuclear Reactions (18Hrs)

3.1Types of reactions and conservation laws, energetics of nuclear reactions, isospin. 3.2 Reaction cross sections, Coulomb scattering- Rutherford formula, nuclear scattering. 3.3 Scattering and reaction cross sections in terms of partial wave amplitudes. 3.4 Compound-nucleus reactions; Direct reactions. 3.5 Resonance Reactions.

Unit IV

Particle Physics (18 Hrs)

4.1 Yukawa's hypothesis; properties of pi mesons- electric charge, isospin, mass, spin and parity. 4.2 Decay modes and production of pi-mesons 4.3 Types of interactions between elementary particles, Hadrons and leptons .4.4 Symmetries and conservation laws, C P and CPT invariance, applications of symmetry arguments to particle reactions, parity non-conservation in weak interactions.4.5 Quark model, confined quarks, coloured quarks and gluons, experimental evidences for quark model, quark-gluon interaction, quark dynamics.4.6 Grand unified theories, standard model of particle physics.

Unit V: Nuclear Astrophysics and Practical Applications of Nuclear Physics(18 Hrs.)

5.1 Particle and nuclear interactions in the early universe, primordial nucleosynthesis 5.2 Stellar nucleosynthesis (for both A<60 and A>60) 5.3 Higg's boson and the LHC experiments; detection of gravitational waves and LIGO (qualitative ideas only)

5.4 Rutherford Backscattering spectroscopy and applications 5.5 Computerized Axial Tomography (CAT) 5.6 Positron Emission Tomography (PET)

Recommended Text Books:

1. Introductory Nuclear Physics, K. S. Krane JohnWiley
2. Nuclear Physics, S.N. Ghoshal, S. Chand & Company.
3. Nuclear Physics: Problem-based Approach Including MATLAB, Hari M Agarwal, PHI Learning Private Limited, Delhi .

Recommended References:

1. Problems and Solutions in Atomic, Nuclear and Particle Physics: Yung-Kuo Lim, World Scientific.
2. Nuclear Physics, S.N. Ghoshal, S. Chand & Company.
3. Introduction to Nuclear and Particle Physics : V M Mittal , R C Verma, S C Gupta (Prentice Hall India .

4. Concepts of Nuclear Physics: B L Cohen, Tata McGrawHill
5. Nuclear Physics: An Introduction – S B Patel, New Age International.
6. Nuclear Physics: R R Roy and B P Nigam, New Age International.
7. Nuclear Physics: R Prasad, Pearson.
8. Atomic Nucleus: R D Evans, Mc GrawHill, New York.
9. Nuclear Physics: I Kaplan, Narosa, New Delhi (2/e)
10. Nuclear and Particle Physics, B R Martin, John Wiley & Sons, New York, 2006.
11. Introduction to Elementary Particles : David Griffith, Wlley-VCH.
12. https://nptel.ac.in/ course/115104043
13. https://www.ias.ac.in/article/fulltext/reso/022/03/0245-0255
14. https://www.ias.ac.in/article/fulltext/reso/017/10/0956-0973
15. https://atlas.cern/updates/atlas-feature/higgs-boson

PH010402 COMPUTATIONAL PHYSICS PRACTICALS

Note

- Develop algorithm / Flowchart for all experiments
- Codes can be developed in any package / programming language. Candidate should be trained to explain parts of the codes used.
- Plotting can be done in any plotting package and can be separate from the programming package / environment.
- Verify numerical results with analytical results wherever possible.
- Repeat experiments for various initial values / functions / step-sizes.
- Training may be given to use methods discussed below to solve real physics problems.

Introduction to computational facility in the Centre

Introduction to the IDE used in the center and commands for execution of a program. Inputting data and variables, outputting results on a console. Achieving arithmetic operations and use of data and variables in the software used at the Centre .Usage of decisions and loops. Creating an array and using array operations. Method of declaring functions and function calling. Writing data to a file and reading data from a file. Getting a graph from a data available using plotting software available with the Centre.

1. Find the root of the given non-linear equations by the bisection method

2. Find the root of the given non-linear equations by the Newton-Raphson method

3. A thermistor gives following set of values. Calculate the temperature corresponding to the given resistance using Lagrange interpolation.

Temperature	1101.0 K	911.3 K	636.0 K	451.1 K	273 K
Resistance	25.113 Ω	30.131 Ω	40.120 Ω	50.128 Ω	?

(This is only a sample data. Students should be capable to interpolate any set of data)

4. Newton's forward interpolation / backward interpolation.

5. Using appropriate technique and the given "Table", Calculate the pressure at the temperature asked.

Steam Table

Temperature in C	140	150	160	170	180
Pressure kgf/cc	3.685	4.854	6.302	8.076	10.22

Temperature: 1750 C (This is only a sample data. Students should be capable to handle another set of data from any other physical phenomena)

6. Value of some trigonometric function [say $f(\theta) = \tan(\theta)$] for θ=15,30,45,60,75 are given to you. Using appropriate interpolation technique calculate value of $f(\theta)$ for a given value.
7. Numerical integration by the trapezoidal rule.
8. Using the trapezoidal rule, calculate the inner surface area of a parabolic reflecting mirror. (length of semi major axis , semi minor axis and height are to be given)
9. Numerical integration by the Simpson rule (both 1/3 and 3/8 rule).
10. Fit a straight line using method of least square to a set of given data without using any built in function of curve fitting. Compare your result with any built in curve fitting technique.
11. Find out the normal equations and hence fit a parabola using method of least square to a set of given data without using any built in function of curve fitting. Compare your result with any built in curve fitting technique.

12. Fit a exponential curve to the given set of data using method of least square with out using any built in curve fitting technique. Compare your result with any built in curve fitting technique.
13. Study the given function as a sum of infinite series. Compare your value with the available standard value.
14. Numerical solution of ordinary first-order differential equations using the Euler methods or the fourth order Runge-Kutta method.
15. Using technique of Monte Carlo method obtain the value of π correct to two decimal places .
16. Using Monte Carlo technique calculate the value of the given integral. Compare your result with result obtained by analytical method.
17. Write a program to solve the given system of linear equations by the Gauss elimination method.
18. Find out inverse of a given matrix by using Gauss-Jordan method.
19. Numerical solution of second-order differential equations using the fourth order Runge-Kutta method.
20. Fast Fourier Transform of a given signal.
21. Solution of Heat equation / Diffusion equation using Finite Difference Method.
22. A Duffing oscillator is given by $\ddot{x} + \delta \dot{x} + \beta x + \alpha^3 = \gamma \cos \omega t$ where δ is damping constant>0. Write a program to study periodic and aperiodic behavior
23. Study of path of a Projectile in motion with and with out air drag and compare the values .
24. A study of Variation of magnetic field B(T) with critical temperature in superconductivity
25. Generation of output waveform of a Half wave / full wave rectifier.
26. Charging /discharging of a capacitor through an inductor and resistor
27. Variation in phase relation between applied voltage and current of a series L.C.R circuit
28. Phase plot of a pendulum (driven and damped pendulum)
29. Study variation of intensity along a screen due to the interference from Young's double slit experiment. Also study the variation of intensity with variation of distance of the screen from the slit.

30. Study variation of intensity along a screen due to the diffraction due to a grating .Also study the variation of intensity with variation of distance of the screen from the grating.
31. A particle obeying F-D statistics is constrained to be in 0 to 2eV at 300K. Calculate Fermi energy of this particle assuming kT =.025eV at 300K
32. Solve the following differential equation and study periodic and aperiodic behavior.

$$\frac{dy}{dx} = \sigma(y - x), \qquad \frac{dy}{dx} = x(\rho - z) - y, \qquad \frac{dy}{dx} = xy - \beta z$$

33. Study the difference equation $X_{n+1} = mX_n (1 - X_n)$ and obtain periodic and aperiodic behavior.
34. Generate a standing wave pattern and study change in pattern by changing its various parameters.

Reference books

1. Computational Physics: An Introduction, R.C. Verma, P.K. Ahluwalia & K.C. Sharma, New Age India, Pvt. Ltd ,2014.
2. An Introduction To Computational Physics, 2nd Edn,Tao Pang Cambridge University Press, 2010
3. Numerical Recipes: The Art of Scientific Computing 3rd Edn, William H. Press Cambridge University Press, 2007.

ELECTIVES

BUNCH-A: ELECTRONICS

PH800301: DIGITAL SIGNAL PROCESSING

Total Credits: 3

Total Hours: 54

Objective of the Course: To study about **discrete** time systems and to learn about FFT algorithms. To study the design techniques for FIR and IIR digital filters.

UNIT I

Discrete time signals and Linear systems (16 Hours)

1.1 Examples of Signals -1.2 Classification of signals -1.3 System-1.4 Examples of discrete time 1.5System models 1.5-Signal processing-1.6 Advantages ,Limitations and applications of DSP- 1.7 Elementary continuous time signals-1.8 Representation of discrete time signals-1.9 Elementary discrete time signals-1.10 Classification of discrete time signals-1.11 Operation on signals-1.12 Sampling and Aliasing -1.13 Discrete time system-Classifications-1.14 Representation of an arbitrary sequence-1.15 Impulse response and convolution sum-properties-Causality-1.15 FIR,IIR, stable and unstable systems-1.16Correlation of two sequences.

UNITII

DSP Techniques (10 Hrs)

2.1Frequency analysis of Discrete Time signals – 2.2 Discrete frequency spectrum and frequency range -2.3 Development of DFT from DTFT – 2.4 Definition of Discrete Fourier transform-2.5 Frequency spectrum using DFT- 2.6 Properties of Discrete Fourier transform-2.7Relationship of the DFT to other transforms-Properties-2.8 Fast Fourier Transform (FFT) – 2.9Decimation in time algorithm –Radix- 2 FFT - 8 point DFT using Radix -2 DIT FFT

UNIT III

Z Transform (12 Hrs)

3.1 Z-Transform & ROC -properties -3.2 Z transform of finite duration ,infinite duration and two sided sequence – 3.3 System function – 3.4 Poles and Zeros-

Stability criterion 3.5 (Problems based on determination of Z trasform,ROC and Properties are expected)

UNIT IV

Digital Filters (16 Hrs)

4.1 IIR filters-frequency selective filters-4.2 Design of digital filters from Analog filters-4.3 Analog low pass filter design-4.4 Design of IIR filters from Analog filters-4.5Approximation of derivatives -4.6 Design of IIR filter using impulse invariance Technique-4.7 Bilinear transformation-4.8Direct form I structure of IIR systems-4.9Cascade form realization of IIR systems-4.10 Realization of digital filters-4.11 Direct form I realization-4.12 Direct form II realization-4.13 FIR filters-4.14 Linear phase FIR filters-4.15 Design of FIR filter using rectangular window-4.16The Fourier series method of designing FIR filters

Recommended Text Books:

1. Digital Signal Processing, Fourth edition P. Ramesh Babu, Scitech
2. Digital signal Processing – A NagoorKani, Tata Mc Grow Hill
3. Digital Signal Processing: Theory, Analysis and Digital-Filter Design, B. Somanathan Nair, PHI (2004)
4. Digital Signal Processing, Alan V. Oppenheim & R.W. Schafer, PHI
5. Digital Signal Processing -A practical Guide for scientists and Engineers- Steven W Smith
6. Digital signal processing -Hand book – Vijay K Madisetty & Douglas B Williams

Recommended References:

1. Computer applications in physics, Suresh Chandra, Alpha Science International (2006)
2. Digital Signal Processing, S. Salivahanan, A. Vallavaraj, C.Gnanapriya, TMH
3. Signals and Systems, Allan V. Oppenheim, Alan S. Willsky, S.H.Nawab, PHI
4. Digital Signal Processing, John G. Proakis, Dimitris G. Manolakis, PHI
5. Digital signal processing, Sanjay Sharma, S.K. Kataria& Sons, 2010
6. Mathematical Methods for Physicists,G.B.Arfken&H.J.Weber.Elsavier, Academic Press
7. Digital signal; processing – V K Khanna S.Chand
8. Digital Signal Processing and Applications - Dag Stranneby&William Walker

PH800402: MICROELECTRONICS AND SEMICONDUCTOR DEVICES

Credits: 3

Number of hours: 90

Objective:The objective of the course is to expose to the students to the architecture and instruction set of basic microprocessors. This course also covers fundamentals of semiconductor devices and their processing steps in detail. The student will be able to use the knowledge of semiconductor fabrication processes to work in industry in the area of semiconductor devices.

UNIT I

Introduction to microprocessors (20Hrs)

1.1Microprocessor organization- General organization of a microprocessor based microcomputer system 1.2 Memory organization – main memory array –memory management, cache memory, virtual memory 1.3 Input/output operation - Standard I/O – memory mapped I/O- interrupt driven I/O –DMA1.4 8085 Microprocessor – Architecture1.5 8085 addressing modes, instruction set, Pin out diagram,1.6 Simple programming concepts.

UNIT II

8086 Microprocessor (16Hrs)

2.1 The Intel 8086- Architecture - MN/MX modes –Pin diagram 2.2 8086 addressing modes 2.3 8086 instruction set- instruction format- assembler directives and operators 2.4.Programming with 8086- Familiarisation with Debug utility2.5. Interfacing memory and I/O ports.

UNIT III

Microcontrollers (19 Hrs)

3.1 Introduction to microcontrollers and embedded systems 3.2 Comparison of microprocessors and microcontrollers 3.3 The 8051 architecture - Register set of 8051 – important operational features 3.4 I/O pins of 8051, ports and circuits - external memory - counters and timers – interrupts 3.5 Instruction set of 8051 - Basic programming concepts 3.6 Applications of microcontrollers - (basic ideas) – Embedded systems(basic ideas)

UNIT IV

Metal-semiconductor and semiconductor hetero-junctions(17Hrs)

4.1 Metal-semiconductor - Schottky barrier diode - qualitative characteristics – ideal junction properties- 4.2 Current voltage relationship, Comparison with junction diode 4.3 Metal semiconductor ohmic contact 4.4 Idealnon rectifying barriers – tunneling barrier – specific contact resistances 4.5 Semiconductor hetero-junctions – hetero-junction materials – energy band diagram –Two dimensional electron gas 4.6equilibrium electrostatics – current voltage characteristics.

UNIT V

Integrated Circuit Fabrication and Characteristics (18 Hrs)

5.1 Integrated circuit technology – basic monolithic IC – epitaxial growth –marking and etching 5.2 diffusion of impurities – transistor for monolithic circuit 5.3.Monolithic diodes – integrated resisters, capacitors and inductors5.4 monolithic circuit layout - additional isolation methods -MSI, LSI, VLSI– the metal semiconductor contact.

Recommended Text books:

1. Microprocessor Architecture Programming and Applications with 8085, R.S. Gaonkar – Penram int. Pub. Mumbai
2. Fundamentals of Microprocessors and microcomputers- B. Ram (DhanpatRaiPub.)
3. Microprocessors and Microcomputer based system design, H. Rafiquizzaman, Universal Book stall, New Delhi
4. The 8051 microcontroller, Architecture Programming and Applications, Kenneth J Ayala- Penram Int. Pub. Mumbai
5. Semiconductor Physics and Devices, Donald A. Neamen, McGraw Hill
6. Integrated Electronics-Analogue and Digital Circuits and Systems, J Millmann and C C Halkias, TMGH

Recommended References:

1. 0000 to 8085 Introduction to Microprocessors for Engineers and Scientists.- P.K. Gosh & P.R. Sridhar, PHI
2. Advanced microprocessors and peripherals, A.K. Ray & K.M. Burchandi –TMH

3. Microprocessor and microcontroller, R. Theagarajan- SCITECH Publications India Pvt. Ltd.
4. Microprocessor and Peripherals, S.P. Chowdhury& S. Chowdhury- SCITECH Publications.
5. Operating system Principles, Abraham Silberschatz& Peter Baer Galvin & Greg Gagne, John Wiley
6. Solid state electronic devices, Streetman and Banerjee, PHI (2010).
7. Physics of Semiconductor Devices, Michael Shur, PHI (2002).
8. Introduction to Semiconductor materials and Devices, M.S. Tyagi, John Wiley and Sons (2000)

PH800403: COMMUNICATION SYSTEMS

Total Credits: 3

Total Hours: 90

Objective of the Course:To understand the basic concepts of different communication systems.

UNIT 1

Digital Communication(18 hrs)

1.1 Pulse Communication -Introduction - Pulse modulation :– PAM - PWM – PPM-PCM 1.2 PCM:– Sampling theorem- Quantisation -Noise Generation and demodulation of PCM- Companding - DPCM- ADPCM-Delta modulation 1.3 Information theory-Coding-Noise-Data Communication – Digital codes – Error detection and correction 1.4 Data sets and interconnection requirements-Modem classification and interfacings1.5 Multiplexing techniques -Frequency division multiplex -Time division multiplex1.6 Digital transmission techniques:-ASK- FSK-PSK-QPSK.

UNIT II

Mobile communication(20 hrs)

2.1Introduction to Wireless Communication Systems-Mobile Radio System Around the World- Examples of wireless communication systems: - Paging system-Cordless Telephone System- Cellular Telephone System—How a Cellular Telephone Call is

Made- Comparison of Common Mobile Radio Systems- Trends in Cellular and Personal Communications2.2 Wireless communication systems—2G-3G - 4G

2.3 The Cellular Concept-Frequency Reuse-Channel Assignment Strategies-Handoff Strategies:—Prioritizing handoffs and practical handoff consideration-Interference and System Capacity-Improving Coverage and Capacity in Cellular Systems:—Cell splitting- Sectoring-Microcell zone concept 2.4 Basic idea of Path Loss and Multipath Fading 2.5Multiple Access Techniques –Introduction-FDMA-TDMA-SSMA:- FHMA-CDMA-Hybrid Spread Spectrum Techniques-SDMA 2.6 GSM.

UNIT III

Satellite Communication (16 hrs)

3.1 Satellite Communication Fundamentals-Satellite Orbits-Satellite Positioning-Frequency Allocations-Polarization-Antennas—gain-beam width-Multiple Access Techniques 3.2 Geostationary Satellite communication-Satellite parameters 3.3VSAT (Basic Idea) 3.4Geostationary Satellite Path/Link Budget 3.5 Satellite TV Systems-Satellite TV broadcasting 3.6GPS.

UNIT IV

Fiber Optics Communication(20 hrs)

4.1 Introduction 4.2 Ray theory transmission-Total Internal Reflection-Acceptance Angle-Numerical aperture-Skew rays 4.3 Electromagnetic mode theory for optical propagation-Electromagnetic waves-Modes in a planar guide-Phase an group velocity 4.4 Fiber Classification-cylindrical fiber-Step Index- Graded Index-Single mode fiber:- Cut off wave length-Group delay -Photonic crystal fibers:-Index guided micro structures-Photonic band gapfibers 4.5 Dispersion:- chromatic-intermodal-Non linear effects 4.6 Optical fiber connection-Fiber Splices:-Fusion splices- Mechanical splices-Multiple splices-Fiber connectors:- Cylindrical ferrule connectors, Duplex and multiple-fiber connectors-Fiber couplers(basic idea).

UNIT V

Radar Systems (16 hrs)

5.1 Basic Principles –Fundamentals:- Basic radar Systems-Development of Radar-Radar Performance Factors:—Radar range equation-factors influencing maximum range-Effects of noise- Target properties 5.2 Pulsed Systems-Block diagram and

description-Antennas and Scanning:-Antennas Scanning- Antenna tracking-Display Methods5.3 Pulsed radar systems-Moving Target Indication:- Doppler Effect-Fundamentals of MTI-Delay Line- Blind speeds-Radar Beacons5.4Other radar systems-CW Doppler Radar-Frequency Modulated CW Radar-Phased ArrayRadars-Planar Array Radars.

Recommended Text Books:

1. Electronic Communication Systems by Kennedy/Davis, Mc Graw Hill Publication, 4th edition,(Module-1 and 5).
2. Wireless Communication Principles and Practice by Theodore S Rappaport, Person Publication, 2nd Edition, (Module-2).
3. Telecommunication Transmission Systems by Robert G Winch, McGrawHill Publication,2nd edition,(Module-3).
4. Optical fiber communications-Principles and Practice John M Senior, Pearson publications, 3rdedition, (Module-4).

Recommended References:

1. Optical Fiber Communications by Gerd Keiser(Module-2).
2. Satellite Communications by Dennis Roddy, Mc Graw Hill Publication,3rd edition.
2. Introductions to RADAR Systems by Skolnik, McGraw Hill, 3rd edition
3. Satellite communication by Dr.D.C Agarwal.
4. Electronics Communication Systems by Wayne Thomas, Pearson Publication, 5 th Edition.

PH800302: ADVANCED PRACTICALS IN ELECTRONICS

Total credit: 5

Total hours: 180

(Minimum of 12 Experiments should be done choosing at least 2 experiments from each group)

[A] Microprocessors and Micro Controllers (use a PC or 8086-µp kit)

1. Sorting of numbers in ascending/descending order.
2. Find the largest and smallest of numbers in array of memory.

2. Conversion of Hexadecimal number to ASCII and ASCII to Hexadecimal number.
3. Multi channel analog voltage measurements using AC card.
4. Generation of square wave of different periods using a microcontroller.
5. Measurement of frequency, current and voltage using microprocessors.

[B] Communication Electronics

6. Generation PAM and PWM
7. Frequency modulation and demodulation using IC –CD4046.
8. Multiplexer and demultiplexer using digital IC 7432.
9. Radiation characteristics of a horn antenna.
10. Measurement of characteristic impedance and transmission line parameters of a coaxial cable.

[C] Electronic Instrumentation

11. DC and AC milli-voltmeter construction and calibration.
12. Amplified DC voltmeter using FET.
13. Instrumentation amplifier using a transducer.
14. Generation of BH curve and diode characteristics on CRO.
15. Voltage to frequency and frequency to voltage conversion.
16. Construction of digital frequency meter.
17. Characterization of PLL and frequency multiplier and FM detector.

[D] Optoelectronics

18. Characteristic of a photo diode - Determination of the relevant parameters.
19. Beam Profile of laser, spot size and divergence.
20. Temperature co-efficient of resistance of copper.
21. Data transmission and reception through optical fiber link.

References

1. Sedra, Adel S., Smith, Kenneth C., “Microelectronics Circuits”, 5th Edition, Oxford University Press,NewYork.
2. Smith, Kenneth C., “Laboratory Explorations for Microelectronic Circuits”, 4th Edition, Oxford University Press,New York

3. Mims, Forrest, M., "Engineer's Mini-Notebook, Op-Amp Circuits", 2nd Edition, Siliconcepts
4. Microelectronics Circuit Analysis and Design, D. A. Neamen, McGraw Hill, 4th Edition
5. Electronics Lab Manual Volume 1,2,3 K. A. Navas, Rajath Publishers, Kochi Electronics lab Manuel, T D Kuryachan, S. Shyam Mohan, Ayodhya Publication.
6. Basic Electronics: A text. Zbar, Paul.B Lab Manual M C Graw Hill Tata
7. Edminister, Joseph, Electric Design, M C Graw Hill Tata

BUNCH-B MATERIAL SCIENCE

PH810301: SOLID STATE PHYSICS FOR MATERIALS

Total Credits: 3

Total Hours: 54

UNIT 1

Crystal defects [18h]

1.1 Crystal Imperfection- point imperfections- vacancy, Frenkel and Schottky imperfections,

1.2 dislocations- Edge, screw, Burger's vector critical resolved shear stress,

1.3 dislocation motion , dislocation reaction, dislocation energy, slip;

1.4 surface and volume imperfections – stacking faults; Fracture, twinning [Ref. 5]

1.5 Voids in close packing- size, coordination and significance,

1.6 Pauling's rule and applications; Allotropy, polymorphism [Ref. 4]; polytypism

UNIT II

(A) Atomic Diffusion [6h]

2.1 Fick's laws, solution and applications;

2.2 Kirkendall effect, Atomic model of diffusion and other diffusion processes and mechanisms

(B) Crystal binding: [12h]

2.3 Crystals of inert gas, Van der Waals- London interaction, Repulsive interaction, equilibrium lattice constants, cohesive energy,

2.4 Ionic crystals- Madelung energy, Madelung constant,

2.5 Covalent crystals, metals, hydrogen bond; Born-Haber cycle

UNIT III

(A) Phase diagrams: [6h]

3.1 Phase diagram rules, unary and binary phase diagrams,

3.2 microstructural changes during cooling, applications

(B) Excitations in solids [12h]

3.3 Plasma optics, plasmons;

3.4 Polaritons, LST relation;

3.5 electron-phonon interaction: polarons;

3.6 Kramers Kronig Relations; excitons- Frenkel and Wannier excitons, electron hole drops;

3.7 Magnons- spin wave quantization and thermal excitation of magnons.

Recommended textbooks:

1. Materials Science and Engineering- V Raghavan-PHI
2. Introduction to solid state physics- C Kittel- Wiley India
3. Solid State Physics- Wahab- Narosa

Recommended References:

1. Lectures on Solid State Physics- Georg Busch & Horst Schade; Pergamon Press
2. Callister's Materials Science and Engineering- Wiley India
3. Elementary Solid State Physics: M Ali Omar- Pearson
4. Solid State Physics- S O Pillai- New Age;
5. Introduction to solids- Azaroff-TMH;
6. Solid State Physics- Adrianus J Dekker- Macmillan

PH810402: SCIENCE OF ADVANCED MATERIALS

Total Credits: 3

Total Hours: 90

UNIT 1:
Ceramics, polymers and composites [25h]

(A) Ceramics:

1.1 Types, properties and applications of ceramics: Glass, clay, refractories, abrasives, cements, advanced ceramics, piezoelectric ceramics,

1.2 mechanical and glass properties, heat treatment of glasses, Perovskite structure, Classification of ferroelectric materials, dielectric breakdown [Ref 3].

(B) Polymers:

1.3 polymer structure and configurations, thermosetting and thermoplastic , copolymers, conducting polymers, mechanical behaviour of polymers,

1.4 Mechanisms of deformation and strengthening, crystallization, melting and glass transition; polymer types-plastics, elastomers, fibers, polymerisation and applications.

(C) Composite materials:

1.5 particle reinforced composites, fiber –reinforced composites, structural composites, Semimetals

UNIT II
(A) Optical properties of materials [10h]

2.1 Absorption processes, photoconductivity, photovoltaic effect, colour centers-types and generation

2.2 Luminescence – photoluminescence, cathodoluminescence, electroluminescence, injection luminescence, radiative recombinationGaussian Beam- Amplitude, properties, quality; [Ref 1]Optical coherence- temporal, spatial [Ref 2]

(B) Lasers [10h]:

1.3 Absorption of radiation, threshold conditions, lineshape function, population inversion and pumping threshold conditions, laser modes,

1.4 semiconductor lasers, hetero junction lasers. Methods of pulsing lasers – Q switching and mode locking

UNIT III

Photonic materials and Applied Photonics [20h]

3.1 **LEDs [5h]:** Principles, structure, materials and characteristics, heterojunction LED, SLED and ELED

3.2 **Solar cells [5 h]**- principles, characteristics, PERL, heterojunction, cascaded, and schottky barrier cells, material and design considerations [Ref 5]

3.3 Basic concepts and features of Photonic crystals, [Ref 6] Liquid crystals, [Ref 7] optics of metamaterials, [Ref 1] Amorphous semiconductors. [Ref 7] detector arrays-CCDs

3.4 Electro-optic effect, magneto-optic effect, acousto-optic effect.

UNIT IV

Superconductors, Thin films and crystal growth [25 h]

(A) Superconductors: [12 h]

4.1 Thermodynamics and electrodynamics,

4.2 BCS theory, flux quantization, type I &II superconductors,

4.3 single particle tunnelling, Josephson tunnelling, high temperature superconductors

(B) **Thin films: [7h]**

4.4 Nature- deposition technology-Resistance heating, Cathodic sputtering, interferometric film thickness measurement, Applications: Antireflection coating, solar cells and sensors.

(C) **Crystal growth:[6h]**

4.5 Mechanism of crystal growth, nucleation, classification of crystal growth methods, growth from melt-Czochralski, Bridgeman, Floatzone techniques, growth from solution - gel growth. [Ref 8, 11]

Recommended Text Books:

1. Solid State Physics- Wahab- Narosa;
2. Optoelectronics- Wilson & Hawkes- Pearson 2018;
3. Optoelectronics- Wilson & Hawkes- Pearson 2018;
4. Optoelectronics and Photonics: Principles and Practices- S O Kasap- Pearson
5. Introduction to solid state physics- C Kittel- Wiley India
6. Thin film fundamentals: A Goswami- New Age ;
7. Semiconductor Physics and devices, S.S. Islam, Oxford University press.

Recommended References:

1. Fundamentals of Photonics- Saleh and Teich- wiley India;
2. Lasers and Nonlinear Optics: B B Laud; New Age,
3. Solid State Physics- S O Pillai- New Age;
4. Solid State Physics- Wahab- Narosa;
5. Semiconductor Optoelectronic Devices: Pallab Bhattacharya- Pearson
6. Introduction to nanotechnology: Charles P Poole, Frank J Owens-wiley india
7. Elementary Solid State Physics: M Ali Omar- Pearson
8. Crystal growth: processes and methods- P.S. Raghavan and P. Ramasamy, KRU publications
9. Materials Science and Engineering- V Raghavan-PHI.
10. Essentials of Crystallography- M A Wahab- Narosa
11. Semiconductor Devices: Physics and Technology- S M Sze- Wiley India
12. Fiber optics and Optolelectronics- R P Khare- Oxford

PH810403: NANOSTRUCTURES AND MATERIALS CHARACTERISATION

Total Credits: 3

Total Hours: 90

UNIT 1

Nanostructures: Synthesis and properties [25 h]

1.1Applications of Schrodinger equation in nanoworld: particle confined in one dimension, quantum leak, penetration of barrier, 1.2 nanostructures for electronics- quantum dots, nanowires, superlattices and heterostructures1.3 Preparation of quantum nanostructures, size and dimensionality effects, single electron tunnelling. Metal nanoclusters, semiconducting nanoparticles, rare gas and molecular clusters. Self assembly and catalysis 1.4 Synthesis routes: bottom up approaches- PVD, CVD, MBE, PLD, wet chemical; 1.5 top down synthesis routes- mechanical alloying, nanolithography.

UNIT II

Nanomaterials and applications [20 h]

2.1Carbon nanostructures: carbon clusters, fullerenes, CNTs- fabrication, properties and applications , 2-D nanostructure- graphene [Ref 6]2.2 Nanostructured materials:

superparamagnetic nanoparticles, GMR, ferrofluids, colossal magnetoresistance, nanostructured thermal devices, superhydrophobic nanostructured surfaces, biomimetics; 2.3 nanomachines and nanodevices- MEMs,NEMs, nanosensors, 2.4 molecular and supramolecular switches, nanocatalysts, properties and applications of nano ZnO and TiO_2, dendrimers, micelles

UNIT III

Optical Absorption and Emission spectroscopy [20 h]

3.1Instruments for absorption photometry – radiation sources, wavelength selection, cells and sampling devices, detectors; Fundamental laws of photometry (Beer Lambert's law), spectrophotometric accuracy, precision, absorptivity, bathochromic and hypsochromic shift, Jablonski diagram 3.2 Principles of Fourier transform optical measurements- advantages of Fourier transform spectrometry, time domain spectrometry, fourier transform of interferograms. 3.3 optical atomic spectra- atomic line widths, effect of temperature;3.4 Principles and applications of Differential, difference and derivative spectroscopy, photoacoustic and thermal lens spectroscopy; General applications of uv absorption spectroscopy 3.5 Theory of fluorescence and phosphorescence spectrophotometry, PL power, total luminescence spectroscopy, fluorescence lifetime measurements, quenching and applications, principle and applications of chemiluminescence, Qualitative ideas of resonance raman spectroscopy, surface enhanced raman spectroscopy,

UNIT IV

Chemical, thermal and X-ray diffraction methods [25 h]

4.1X ray diffraction- production and detection of X-rays and X-ray spectra, Moseley's law, Geometry of an X-ray diffractometer, [Ref 3] 4.2 X-ray photoelectron spectroscopy, X-ray fluorescence, Particle size determination, Debye Scherrer formula, stress measurementAuger recombination, Auger Emission Spectroscopy, 4.3 Working of SEM, TEM, AFM and STM with instrumentation 4.4 **Mass spectrometry**: ionization methods, mass spectrometers and analyzers, correlation of mass spectra with molecular structure. 4.5 **Thermal methods**: thermogravimetry, DTA, DTG, DSC, microthermal analysis; Principles of pH measurement, potentiometry, voltammetry and electrogravimetry

Recommended Text Books: (Unit 1 & 2)

1. Introduction to nanotechnology: Charles P Poole, Frank J Owens-Wiley india
2. Textbook of nanoscience and nanotechnology- B S Murty, P Shankar, Baldev Raj, B B Rath, James Muday- Springer Univ. Press
3. Introduction to nanoscience and nanotechnology- KK Chattopadhyay and A N Banerjee-PHI
4. Introduction to Nanoscience- S M Lindsay, Oxford University Press.

Recommended Text Books: (Unit 3&4)

1. Instrumental methods of analysis- Williard, Merritt, Dean, Settle- CBS
2. Introduction to nanoscience and nanotechnology- KK Chattopadhyay and A N Banerjee-PHI
3. Introduction to Nanoscience- S M Lindsay, Oxford University Press.
4. Principles of Instrumental analysis- Holler, Skoog, Crouch-Cenage

Recommended references:

1. Instrumental methods of chemical analysis-Chatwal, Anand- Himalaya
2. Instrumental methods of chemical analysis- Galen W Ewing-MGH
3. X ray diffraction a practical approach :C Suryanarayana, M Grant Norton; Springer
2. Nanophotonics- Paras N Prasad: Wiley
3. Nanostructures and nanomaterials- G Cao and Y Wang- World Sci.
4. Graphene: Synthesis, Properties and Applications in Transparent electronic devices- P Kumar etal- Reviews in Advanced Sciences and Engineering, vol 2, pp1-21, 2013

PH810302: ADVANCED PRACTICALS IN MATERIAL SCIENCE

Total credit: 5

Total hours: 180

** Minimum number of experiments to be done 12*

***Error analysis of the result is a compulsory part of experimental work*

1. Malu's law- verification
2. Optical activity- specific rotation measurement
3. Stefan's constant- torch bulb filament resistance measurement
4. Absorption coefficient of solution- path length and concentration dependence
5. XRD- Crystal Structure Determination Cubic/Hexagonal
6. XRD-Lattice Parameter Measurements
7. XRD- Phase Diagram Determination
8. XRD-Determination of Crystallite Size and Lattice Strain
9. Zeeman effect- shift of atomic energy levels
10. Laser- measurement of thread angle, pitch and the diameter of a micrometre screw
11. Thin film thickness- Newton's rings/ Michelson interferometer
12. Magneto-optic effect - Determination of Verdet constant
13. Michelson interferometer /Edser Butler method/ Fresnel's biprism- mica sheet thickness
14. Bandgap- semiconductor diode
15. Laser –Young's double slit - interference
16. Refractive index of liquid- Newton's ring /Laser/ Fresnel's biprism
17. Resolving power- lens- Laser
18. Rydberg constant- Hydrogen discharge tube
19. Particle size – corona plate
20. Comparison of thickness of thin sheets by air wedge
21. Band gap and type of optical transition (direct or Indirect using Tauc relation) from absorption spectra
22. Synthesis of metallic (Ag or Au) nanoparticles in aqueous medium and estimation particle size using absorption spectrum

23. Thermal analysis of materials from experimental data
24. Analysis of FTIR spectrum
25. Solar cell- efficiency& Fill factor
26. Laser diffraction- comparison of thickness of wires of different gauges
27. Thermistor –parameters [energy band gap]
28. Temperature sensor- silicon diode and thermocouple
29. Optical fiber- bending loss
30. Fermi energy of copper
31. ESR spectrometer- g factor
32. Verification of laws of geometrical optics- reflection and transmission coefficients, critical angle, refractive index of glass slab/ prism
33. Study of Bravais lattices with the help of models
34. Verification of Fresnel's equations
35. Spring constant-static and dynamic method
36. Coherence length of LED
37. Comparison of resistance variation of a carbon film resistor, metal wire, semiconductor and thermistor with temperature
38. Thermal diffusivity of brass
39. Young's modulus- strain gauge
40. Michelson interferometer- Sodium D lines separation
41. Fresnel's biprism- wavelength of monochromatic light

References:

1. A course of experiments with He-Ne laser- R S Sirohi, Wiley
2. Practical Physics- C L Arora, S Chand
3. X ray diffraction a practical approach :C Suryanarayana, M Grant Norton; Springer
4. Practical Physics: D Chattopadhyay, P C Rakshit; New Central Book Agency
5. Advanced practical physics: Chauhan, Singh; Pragati Prakashan

BUNCH C- INFORMATICS

PH820301: PROGRAMMING IN JAVA AND HTML

Total Credits : 3

Total Hours : 54

Objectives:

To equip the students with concepts of object oriented programming principles and skills in web programming.

UNIT I : (14 Hrs)

Fundamentals of Object Oriented Programming, Overview of Java Language – constants, variables and data types: Integers - Floating point – Characters – Boolean, type conversion and casting, Operators: Arithmetic operators –Bitwise operators, Relational operators – Boolean logical operators – Assignment operators – Conditional operators - expressions

Decision making and branching: simple if, if - else, if - else if, switch - case, Decision making and Looping: for, while, do - while, example programs

UNIT II: (16 Hrs)

Strings, arrays: one dimensional array – multidimensional array, vectors, class: fundamentals – declaring objects – introducing methods – constructors – garbage collection – finalize() method, overloading methods, inheritance: basics – types – use of super keyword – method overriding, interfaces – basics only, packages – introduction – importing packages , access protection, exception handling – introduction – exception types – using try and catch, Multithreaded programming: java thread model – life cycle, Applets – introduction only.

UNIT III: (14 Hrs)

Basic Hypertext elements – HTML, Head, Title, Body tags - paragraphs, formatting of text: headings - formatting tags – pre tag – font tag – anchors – links - lists: unordered list- ordered list – Definition list, tables - <table>, <tr>, <td> tags, cell spacing, cell padding, colspan and rowspan, forms: forms and input tag – text box – radio button – check box – select tag and pull down list – submit and reset.

UNIT IV (10 Hrs)

Introduction to scripting, purpose of scripting, javascript: variables – data types – statements – operators , control structures: conditional statements - loop statements, break and continue, functions, Document methods: write and writeln methods, message boxes: dialog boxes – alert - prompt- and confirm boxes. Events familiarization: OnLoad, OnClick, OnSubmit.

Recommended Text Books:

1. Programming With Java – A Primer, E. Balagurusamy 3rd Edn TMH. Text Book
2. HTML, The Complete Reference, Tata Mc Graw Hill
3. Beginning JavaScrpit, Paul Wilton, Wrox Press Inc. 1st

Recommended Reference Books:

1. JAVA2, The Complete Reference, Herbert Schidlt, 4th Edn. TMH
2. HTML4, 2nd Edn. Rick Darnell, Techmedia
3. Mastering HTML4 – Ray D S and Ray E J - BPB
4. Eloquent Java Script A modern introduction to programming – Marijn Haverbeke
5. Essential Javascript – A javascript Tutorial
6. JavaScript Programmers Reference, Cliff Wootton, Wrox Press Inc.

PH820402: DATA COMMUNICATION AND COMPUTER NETWORKS

Total Credits : 3

Total Hours : 90

Objectives:

To equip the students with concepts of data communication techniques and network principles and security features.

UNIT I (24 Hrs)

Data Communication Terminology: – Channel – Baud – Bandwidth - Frequency. Modes of data transmission : Serial and Parallel - Synchronous, Asynchronous & Isochronous Communications - Analog & Digital Data Transmission - Transmission impairments – Attenuation-Delay Distortion Noise - Concept of Delays. Transmission

Media and its Characteristics: – Magnetic media - Twisted pair-Base band coaxial cable - Broadband Coaxial cable - Optical Fiber - Comparison between optical fiber and copper wire - Wireless transmission – Microwave Transmission - Radio Transmission - Infrared and millimeter waves - Wireless LAN.

UNIT II (18 Hrs)

Multiplexing: FDM – TDM, Switching paradigms: circuit - packet and cell switching – propagation delay – clock synchronization. Network access control: Centralized – decentralized - distributed Overview of satellite communication – Fourier series & transforms and their applications to data communication.

UNIT III (20 Hrs)

Computer Networks: Importance of Networks – Components of Networks - Classification of Networks: Broadcast networks - Switched networks, Switching Techniques, Types of Networks: LAN – MAN – WAN. Networking Models: OSI reference model – TCP/IP reference model, Network Topology: Bus-Star-Ring-Tree-Mesh-Cellular, Network Architecture: Client/Server - Peer-to-Peer.

UNIT IV (28 Hrs)

The Internet: Internet Protocols: Internet Protocol (IP) - Transmission Control Protocol (TCP), Internet Address: Structure of Internet Servers Address - Address Space, Internet Infrastructure, Services on Internet, Domain Name System, SMTP and Electronic mail, Http and World Wide Web, Usenet and News groups-FTP-Telnet(18 Hrs) Network Security: Security requirements and attacks - Cryptography – introduction - Substitution ciphers - Transposition ciphers -Ideas of secret key Algorithms and Public key Algorithms - Digital Signature, E-mail Privacy - Internet Tools – Search Engines-Web browsers (10 Hrs)

Recommended Text Books:

1. Data and Computer communication, William Staling, 7th Edn. PHI
2. Computer Networks, A.S. Tanenbaum, PHI
3. Internet and World Wide Web, Harvey M. Deitel, PHI

PH 8204 03: COMPUTER APPLICATIONS IN PHYSICS

Total Credits : 3

Total Hours : 90

Objectives:

To equip the students with knowledge in MATAB and Python Programming language.

UNIT I (28Hours)

Introduction to MATLAB

Representing numbers in a computer – Machine precision – Introduction to numerical errors – Errors in mathematical approximations – Error propagation – Introduction to MATLAB – Workspace – Creating arrays –Matrix operators – Generating vectors– Infinite loops –Introduction to *M*files– Graphics in MATLAB – Creating 2D graphs –Introduction to Mesh and Surface plots (12 Hrs).

Constructing Real and Complex Variables, Symbolic Math Functions, Derivatives of Expressions with Several Variables, Integration with Complex Parameters, Symbolic Summation, Taylor Series, Finding the Maximum, Minimum and inflexion points, Singular Value Decomposition, Systems of Nonlinear Equations. (16 Hrs).

UNIT II (20 Hours)

MATLAB Toolboxes

Introduction to tool boxes - MATLAB Tools for Fourier Analysis, Short-Time Fourier Analysis, MATLAB tools for Wavelet Analysis, Continuous Wavelet Transform, Scaling, Shifting, ,One-Dimensional Complex Continuous Wavelet Analysis – instrument control toolbox – partial differential equation toolbox – finite element method.

Ordinary Differential Equations, Decay of a Radioactive Sample, Simple Harmonic Oscillator, Basics of Artificial Neural Network and its applications.

UNIT III (18 Hours)

Introduction to Python

Variables and Data Types, Strings, Lists (split, join, copy), Operators and Precedence, I/O operations, Iteration: while and for, Conditional Executions, Functions, Modules

and Packages, File Input/output, Dictionaries. Numpy Module, Creating Arrays, Vectorized Functions, Exception Handling.

UNIT IV (24 Hours)

Visualisation of Data using Matplotlib

Matplotlib Module - Multiple plots, Polar plots, Pie Charts, Plotting Sine, Log, Exponential, Plotting mathematical functions, Fourier Series

Numerical Methods: Derivative of a function, Numerical Integration, Polynomials, Finding roots of an equation, System of Linear Equations, Least Squares Fitting, Interpolation.

Recommended Textbooks:

1. Introduction To Matlab, Ross L. Spencer And Michael Ware
2. Artificial Neural Networks-B.Vegnanarayana
3. Duane C. Hanselman and Bruce L. Littlefield (2004).*Mastering MATLAB 7*.Prentice Hall
4. Introduction to Matlab, R.L. Spencer & M. Ware, Brigham Young University (2010)
5. Python for Education, Ajith Kumar B.P.,
6. Computational Physics Problem Solving with Python, RUBIN H. LANDAU, JOSE, CRISTIAN, Publisher: Wiley, Third Edition.

Recommended References:

1. J.M. Thijssen (1999). *Computational Physics*.Cambridge University Press.
2. NEURAL NETWORKS-Algorithms, Applications and Programming Techniques – James A Freeman and David M. Skapura
3. Tao Pang (1997). *An Introduction to computational physics* .Cambridge University Press.
4. Rubin H. Landau (1997). *Computational Physics: Problem solving with computers*. John Wiley.
5. James B. Scarborough. *Numerical mathematical analysis*. Oxford IBH
6. Python Essential Reference, David M. Beazley, Pearson Education
7. Core Python Programming, Wesley J Chun, Pearson Education
8. www.python.org

PH820302 PRACTICALS IN INFORMATICS

Total Credit 5

Total hours 180

1. (a)Create an interface having two methods – division and modulus. Create a class which overrides these methods.

   (b)Write and execute a program in java to display the names and register numbers of students. Initialize the respective array variables for 10 students. Handle ArrayIndexOutOfBounds Exception so that any such problem does not cause illegal termination of program.
2. Write a java program to find the area of Square, Rectangle, and Triangle using the concept of polymorphism.
3. A program to demonstrate multilevel inheritance.
4. Write and execute a program to introduce method overloading.
5. Write a java program to create a thread using Thread class.
6. Write a java program to create and implement an Interface.
7. Define a class called student with data members name, roll number and age. Write a suitable constructor and method output() to display the details. Derive another class student1 from student with data members height and weight. Write a program to read and display data.
8. (a)Write a program for generating two threads, one for printing even numbers and the other for printing odd numbers.

   (b)Write a program to read a statement from console, covert it into upper case again print it on console.
9. Write and execute a java program to display an ordinary working calculator on the screen. The digits and arithmetic signs are to be displayed on the buttons.
10. Write a program to introduce a ‘text filed’ and ‘text area’ activated by three buttons.
11. Write and execute an applet in Java to display the applet with following conditions

    (a) There should be a menu with options LINE,RECTANGLE, CIRCLE, ELLIPSE and EXIT.

    (b) If the option ELLIPSE is selected and if the mouse is clicked and dragged, an ellipse with varying size should be displayed on the screen.

(c) Suitable display should be generated when other options other than EXIT are selected.

(d) When EXIT is selected the applet should exit from the screen.

12. Write a Java applet which reads your name and address in different text fields and when a button named find is pressed the sum of the length of characters in name and address is displayed in another text field. Use appropriate colors and layout to make your applet look good.
13. (a)Create a Web page with appropriate content and insert an image towards the left hand side of the page. When the user clicks on the image it should open another web page.(b) Create a Web page. When the user clicks on the link it should go to the bottom of the page.
14. Design a single page web site for a university containing a description of the courses offered. It should also contain some general information about the university such as its history, the campus and its unique features and so on. The site should be colored and each section should have a different color.
15. Make out a brief Bio – data of yours and code it as an HTML page. Use tables to show your academic history.
16. Create a web page having two frames, one containing the links and when the links are clicked appropriate contents should be displayed in frame2.
17. Design a page with a text box called “name” and a button with label “enter”. When you click on the button another page should open, with the message “welcome <name>” where the name should be equal to the name entered in the first page.
18. Create a web page having minimum of four pages with home page containing links to other pages and also should have return links. Use maximum number of tags in the program.
19. Create an HTML form that inputs student details and when submitted display the same on the HTML page.
20. Design a biodata form.
21. Create a web page showing your personal information using text boxes, radio buttons, check boxes, Select tag and Pull Down lists. The form should contain First name, Middle name, Last name, Date of Birth, Marital status, Gender, Pin code, Country, Education, Annual income, City, state, Occupation, Industry etc.

22. (a). Write a Java Script code block using arrays and generate the current date in words. This should include the day, the month and the year.(b) Write a java script code that converts the entered text into upper case.(c) Write a program to display the multiplication table.
23. (a)Write a Java script code to accept radius and display the area of the circle.(b) Write a code to create a Scrolling text in a text box. (c) Using Java script create a digital clock.

24. Write and execute a Matlab program to simulate a single phase half – wave diode rectifier supplying a resistive load of 2 ohms from an ac source of 230V and 50Hz. Draw the wave form of output voltage and current delivered to the load with following assumptions.
    (a) The switch is ideal, the diode resistance Rd = ; source inductance Ls = 0
    (b) The switch is ideal, the diode resistance RD = 0.2 ohms; source inductance Ls = 0
25. Write and execute a Matlab program to design an IIR low pass filter using Butterworth prototype and impulse invariant transformation.

BUNCH D – THEORETICAL PHYSICS

PH830301 : GENERAL RELATIVITY AND APPLICATIONS

Total Credits : 3

Total Hours : 54

Objectives: To introduce General Relativity and its mathematical techniques along with important applications so as to initiate students towards a wide spectrum of research problems that make use of these.

Unit I (18 hours)Basics of relativity, Tensor analysis

1.1 Overview of special relativity-Principles of special relativity, 1.2 Line interval - Proper time, 1.3 Lorentz transformation, 1.4 Minkowski spacetime Lightcones, 1.5 Relativistic momentum 4-vectors, 1.6 Lorentz transformation of electromagnetic field, 1.7 Energy Momentum tensor for a fluid, perfect fluid, 1.8 Conceptual foundations of GR and curved spacetime - Principle of equivalence, 1.9 Connection between gravity and geometry, 1.10 Metric tensor and its properties, metric in Newtonian limit 1.11 Concept of curved spaces and spacetimes, 1.12 Tangent space and four vectors, Tensor algebra, 1.13 Tensor calculus, Covariant differentiation.

Unit II (18 Hours) Einstein's field equations

2.1 Parallel transport, 2.2Riemann curvature tensor, 2.3 Geodesics - Particle trajectories in gravitational field, 2.4 Einstein's field equations, 2.5 Definition of the stress tensor, 2.6 Bianchi identities and conservation of the stress tensor, 2.7 Einstein's equations for weak gravitational fields, Newtonian limit. 2.8 Derivation of Schwarzschild metric, Basic properties of Schwarzschild metric coordinate- systems and nature of R=2M surface, 2.8 Effective potential for particle orbits in Schwarzschild metric, 2.8 Deflection of ultra relativistic particles, 2.9 Gravitational red-shift.

Unit III (9 Hours)Applications of General Relativity

3.1 Gravitational waves - Wave equation in linearised theory, 3.2 Plane waves, 3.3 Transverse traceless gauge, 3.4 Effect on test particles, 3.5 Principles of detection and

generation of gravitational waves, 3.6 Types of detectors(qualitative), 3.7 Hulse Taylor binary pulsar.

Unit IV (9 Hours) Cosmology

4.1 Models of the universe, 4.2 Einstein universe, 4.3 Expanding universe, Simplifying assumptions, 4.4 Hubble's law, 4.5 Friedmann models: Einstein equations, 4.6 Energy tensors - Solutions to Friedman equations.

Text Books:

1. First course in general relativity, B. F. Schutz; Cambridge University Press. (Units I, II, III)
2. Introduction to Cosmology, 3rd Edition, J. V. Narlikar, Cambridge University Press. (Unit IV)

Reference:

1. Gravitation and Cosmology: Principles and Applications of General Theory of Relativity, Steven Weinberg; John Wiley & Sons.
2. Classical Theory of Fields, Vol. 2: L. D. Landau and E. M. Lifshitz, Oxford : Pergamon Press.
3. General Relativity and Cosmology, J. V. Narlikar Delhi: Macmillan Company of India Ltd.
4. Gravitation, Charles W. Misner, Kip S. Thorne, John A. Wheeler; W. H. Freeman and Company.

PH830402: NONLINEAR DYNAMICS

Total Credits : 3

Total Hours : 90

Objective: To introduce the students the Philosophy and Methods of Nonlinear dynamics. For a complete course, numerical experiments are necessary and a portion of the time is allocated for computational implementation of a few important topics in each unit.

Unit I (33 hrs)

1.1 A brief history of Nonlinear dynamics. 1.2 Importance of Nonlinear dynamics. 1.3 World as a dynamical system. 1.4 One dimensional flows. 1.5 fixed points. 1.6 Linear stability analysis. 1.7 Bifurcations. 1.8 saddle-Node bifurcation. 1.9 Transcritical bifurcation. 1.10 Pitchfork bifurcation. 1.11 Potentials. 1.12 Uniform and non uniform oscillators. 1.13 Two dimensional flows. 1.14 Phase portraits. 1.15 existence and uniqueness. 1.16 Fixed points and linearization linearization (of one dimensional flows). 1.17 Limit cycles. 1.18 Poincare Bendixon theorem.

Unit II (12 hrs)

2.1 Phase portraits. 2.2 Numerical computation of phase portraits. 2.3 Fixed points and linearization (of two dimensional flows). 2.4 Lorenz equations. simple properties of Lorenz equations. 2.5 Chaos on a strange attractor. 2.6 Defining Attractor and Strange attractor. 2.7 Lorenz map-ruling out stable limit cycles. 2.8 exploring parameter space.

Unit III (30 hrs)

3.1 One dimensional maps. 3.2 Fixed points and linear stability. 3.3 Logistic map: numerics. 3.4 Logistic map: analysis. 3.5 Liapunov exponent. 3.6 Fractals. 3.7 countable and uncountable sets. 3.8 Cantor set. 3.9 Dimension of self similar fractals. 3.10 Box dimension 3.11 Pointwise correlation dimensions. 3.11 Baker's map, Henon map 3.12 Elementary properties of Henon map 3.12 Roessler system. 3.13 Forced double well oscillator - Magneto-Elastic mechanical system.

Unit IV (15 hrs)

4.1 Chatter in Machine Tools 4.2 Correlations among data points. 4.3 Prediction of the displacement. 4.4 Reconstruction of Phase space. 4.5 Observed Chaos. 4.6 Embedding: Phase space reconstruction. 4.7 Geometry of Phase space reconstruction.

Text Book

1. Strogatz, Steven H. Nonlinear Dynamics and Chaos: With Applications to Physics, Biology, Chemistry, and Engineering. Westview Press, 2014.

2. Analysis of Observed Chaotic Data, Abarbanel, Henry D.I., Springer, 1995.

Reference Books:

1. Deterministic Chaos, N. Kumar, Universities Press.
2. Chaos and Nonlinear Dynamics, RC. Hilborn, Oxford University Press.
3. Chaotic Dynamics: An Introduction, G.L. Baker, and J.P. Gollub, CUP, 1993.
4. Chaos in Dynamical System, E. Ott, Cambridge University Press.
5 . S. Neil Rasband, Chaotic Dynamics of Nonlinear Systems, Courier Dover Publications

PH830403: QUANTUM FIELD THEORY

Total Credits : 3

Total Hours : 90

Objectives: To introduce quantum field theory and its techniques so as to enable the student to take up independent study of advanced techniques as well as research in high energy physics, statistical mechanics, condensed matter physics and various newly emerging applications.

Unit I (27 Hours) Classical fields

1.1 Lagrangian, symmetries, gauge fields, 1.2 Real scalar – variational principle, Noether theorem, 1.3 Complex scalar field, Electromagnetic field, 1.4 Yang-Mills field, 1.5 Maxwell and Proca equations, Canonical quantization: 1.6 Klein-Gordon field as Harmonic Oscillators, 1.7 Klein-Gordon field in space-time, 1.8 Lorentz invariance in wave equations, 1.9 Dirac equation, 1.10 Free particle solutions, 1.11 Dirac Matrices, Dirac Field Bilinears, 1.12 Quantization of Dirac field, 1.13 Discrete Symmetries of Dirac Theory

Unit II (20 Hours)Interactions

2.1 Perturbation theory, 2.2 Perturbation Expansion of Correlation Functions, 2.3 Wick's Theorem, 2.4 Feynman diagrams, 2.5 Feynman rules for Fermions.

Unit III (20 hours) Path integral formulation of perturbation theory

3.1 Path integral formulation, 3.2 Perturbation theory and S-matrix, 3.3 Coulomb scattering, 3.4 Functional calculus and properties of path integrals,3.5 Generating functional for scalar fields - functional integration, 3.6 Free particle Green's functions, 3.7 Generating functional for interacting fields.

Unit IV (23 hours)S-matrix, Renormalization, Faddeev-Popov method

4.1. Phi-4 Theory, 4.2 Generating functional for connected diagrams, 4.3 Fermions using functional methods, 4.4 S-matrix and reduction formula, 4.5 Divergences in Phi-4 theory, 4.6 Dimensional regularization of Phi-4 theory, 4.7 Renormalization of Phi-4 theory, 4.8 Faddeev-Popov quantization, Feynman rules for QED, 4.9 Ward-Takahashi identity.

Textbooks

1. Quantum Field Theory, Lewis H Ryder, 2nd Edn, Cambridge University Press (1996). (1.1– 1.5 of Unit I, Unit III, Unit IV)
2. An Introduction to Quantum Field Theory, Michael E Peskin, Daniel V Schroeder, Westview (1995). (1.6 – 1.13 of Unit I, Unit II)

Reference:

1. The Quantum Theory of Fields, Steven Weinberg, Cambridge University Press.
2. Quantum Field Theory, M Srednicki, Cambridge University Press (1996).
3. Critical Properties of Phi-4 Theories, Hagen Kleinert, Verena Schulte-Frohlinde, World Scientific (2001)
4. Relativistic Quantum Fields, J D Bjorken and S D Drell, McGraw Hill Company
5. Quantum Field Theory, C Itzykson, J-B Zuber, McGraw Hill Inc (1980).
6. Field theory: A Modern Primer, P Ramond, Benjamin-Cummins Publishing Co (1981)
7. Introduction to the Theory of Quantized Fields, N N Bogoliubov, D V Shirkov New York, (1959)

PH830302 : SPECIAL COMPUTATIONAL PRACTICALS

Total credit: 5

Total hours: 180

Objective: Equip the students to develop algorithms and programs for numerical experiments and handling data. Students may use any programming language and/or packages of their choice.

1. Trajectory of motion of (a) projectile without air resistance (b) projectile with air resistance.
2. Phase space of the harmonic oscillator with and without damping.
3. Phase space of a pendulum with and without damping.
4. Phase space of a driven damped pendulum.
5. Lyapunov exponents of the Logistic map with varying parameters.
6. Self similar structure of the Henon Map.
7. Phase space of chaotic Duffing Oscillator.
8. Bifurcation diagram of the Duffing Oscillator..
9. Poincaré section of chaotic Duffing Oscillator.
10. Bifurcation diagram of the Lorenz system.
11. Bifurcation diagram of the Roessler system system
12. Poincaré section of the Lorenz system.
13. Poincaré section of the Roessler system.
14. Lyapunov exponents of the Lorenz system.
15. Plotting of Julia set.
16. Plotting of Mandelbrot set.

CHAPTER IV

PARALLEL PG-CSS PHYSICS PROGRAMME

In this chapter, the details of a parallel PG-CSS programme is presented. This M.Sc. Physics-Material Science programme is taught in Catholicate College, Pathanamthitta affiliated to MG University. The number of hours per week, number of credit per course and the total hours per semester allocated to this course will remain the same as those for M.Sc. Physics programme as described in chapter 1. This programme has 12 core courses and 3 elective courses. The examination pattern and question paper model remain the same as that described in chapter 2. The details are given in the table.

4.1 COURSE AND COURSE CODE OF M.Sc. PHYSICS - MATERIAL SCIENCE

Course Code

The first two letters '**PH'** stand for Physics and the digit '**02'** stands for model two: Material Science. The fifth and sixth character of the Code running from '**01** to **04'** indicates the semester concerned. All others are same as explained in section 1.5 of general description. Course and Course code of M.Sc. Physics - Material Science are given in Table.4.1

Table 4.1: Structure of M.Sc. Physics - Material Science under PG-CSS 2019

SEM	NAME OF THE COURSE WITH COURSE CODE	No. of credit	No.of hrs/ week	No.of hrs/ SEM
I	**PH020101:** APPLIED MATHEMATICS FOR PHYSICS- I	**4**	**4**	**72**
	PH020102: BASIC QUANTUM MECHANICS	**4**	**4**	**72**
	PH020103: CONDENSED MATTER PHYSICS	**4**	**4**	**72**
	PH020104: CLASSICAL MECHANICS AND RELATIVITY	**3**	**3**	**54**
	PH020105: GENERALPHYSICS PRACTICALS	**4**	**10**	**180**
II	**PH020201:** APPLIED MATHEMATICS FOR PHYSICS – II	**4**	**4**	**72**

	PH020202:ELECTRODYNAMICS AND ELECTROMAGNETIC WAVES	**4**	**4**	**72**
	PH020203:ADVANCED ELECTRONICS AND COMMUNICATION	**4**	**4**	**72**
	PH020204: ADVANCED NUCLEAR PHYSICS	**4**	**3**	**54**
	PH020205: ELECTRONICS PRACTICALS	**4**	**10**	**180**
III	**PH020301:**STATISTICAL PHYSICS AND ASTROPHYSICS	**4**	**4**	**72**
	PH020302:NUMERICAL METHODS IN PHYSICS	**4**	**4**	**72**
	PH020303: ADVANCED QUANTUM MECHANICS	**4**	**4**	**72**
	ELECTIVE -1	**3**	**3**	**54**
	PH020304:COMPUTATIONAL AND ADVANCED ELECTRONICS PRACTICALS	**5**	**10**	**180**
IV	**PH020401:** ATOMIC AND MOLECULAR SPECTROSCOPY	**4**	**5**	**90**
	ELECTIVE -2	**3**	**5**	**90**
	ELECTIVE-3	**3**	**5**	**90**
	ELECTIVE PRACTICALS	**4**	**10**	**180**
	PH020402: PROJECT	**5**	**-**	**-**
	PH020403:COMPREHENSIVE VIVA VOCE	**2**	**-**	**-**
	Total Credit	**80**		

The Elective Bunches:

There are two Electives Bunches offered in this parallel PG-CSS Physics programme. Each elective consists of a bunch of three theory courses and one laboratory course. The first theory course is placed in the Semester III, while the second and third theory and the laboratory course of a bunch are in Semester IV. An institution can select only one Elective Bunch in an academic year. The course structure of the Electives Bunches is given in Table 4.2

The Electives Bunches are named,

(i) Bunch A : Material Science-I

(ii) Bunch B : Material Science-II

Table 4.2: The Elective Bunch

Bunch A: Material Science-I **Course code: 84**

Semester	Course Code	Course Title	No. of hrs / week	Credits
3	PH840301	THIN FILM SCIENCE AND CRYSTAL GROWTH TECHNIQUES	3	3
4	PH840402	NANOSCIENCE AND NANOTECHNOLOGY	5	3
4	PH840403	MATERIALS SCIENCE AND ENGINEERING	5	3
4	PH840404	MATERIAL SCIENCE PRACTICALS	10	5

Bunch B: Material Science-II **Course code: 85**

Semester	Course Code	Course Title	No. of hrs / week	Credits
3	PH850301	OPTOELECTRONICS	3	3
4	PH850402	SEMICONDUCTOR DEVICES	5	3
4	PH850403	CERAMICS AND BIOMATERIALS	5	3
4	PH850404	ADVANCED MATERIAL SCIENCE PRACTICALS	10	5

4.2 SYLLABUS

SEMESTER – I

PH020101: APPLIED MATHEMATICS FOR PHYSICS- I

Credit-4 (72 hours)

Objective of the course: The purpose of the course is to introduce students to methods of mathematical physics and to develop required mathematical skills to solve problems in quantum mechanics, electrodynamics and other fields of theoretical physics. The first objective of this course is to develop student's facility with certain mathematical techniques. The second objective is to highlight applications of mathematical methods to physical systems. Applications shed light on both the mathematics and the logic underpinning physical models. This allows students to develop valuable intuition for subsequent courses where these same methods will be applied.

Unit I

Vector Algebra and Vector Spaces (18 hrs)

1.1 Review of vector analysis-vector calculus- Differential Calculus: Gradient, Divergence, Curl - Successive applications of grad – Integral calculus: line, surface & volume integrals 1.2 Fundamental theorem for gradients, divergences and curls - Equation of continuity - Potential theory - Gauss's law and Poissons equation 1.3 Orthogonal curvilinear coordinates: Spherical & Cylindrical - Differential vector operators in orthogonal coordinates 1.4 Linear vector spaces 1.4.1 Self adjoint, unitary & projection operators –Eigen values&Eigen vectors of self adjoint operators 1.5 Inner product space-Schmidtorthogonalisation - Hilbert space 1.6 Schwartz inequality

Text Books

1. Mathematical Methods for Physicists, G.B. Arfken & H.J. Weber 4th Edition, Academic Press (Chapter 1 & 2)
2. Mathematical Physics, P.K Chattopadhyay, New Age International (chapter 7)
3. Theory and problems of vector analysis, Murray R. Spiegel (Schaum's outline series)

Unit II

Matrices, Error analysis and Probability (12 hrs)

2.1 The algebra of matrices - Special matrices 2.2 Elementary transformations - Similarity transformation - unitary and orthogonal transformation.2.3 Matrix inversion (Gauss-Jordan inversion method) - Solution of linear equation- Gausselimination method- 2.4Eigen values and eigenvectors - Diagonalisation using normalized eigenvectors –2.5Cayley-Hamilton theorem 2.6Linear operators. Matrix representation - Orthoganal, Unitary and Hermitian matrices, normal matrices, Pauli spin matrices – Matrix mechanics (Qualitative Ideas)

Text Books

1. Mathematical Methods for Physicists, G.B. Arfken&H.J. Weber 4th Edition, Academic Press (Chapter 3)
2. Mathematical Physics, P.K Chattopadhyay, New Age International (Chapter 7)
3. Mathematical Physics, H.K. Dass, S. Chand & Co. New Delhi.

Error analysis and Probability (6 hrs)

2.7 Error analysis- Propagation of errors- Standard deviation 2.8 Binomial, Poisson and Gaussian distributions.

Text Books

1. Mathematical methods for Physics and Engineering, K.F. Riley, M.P Hobson, S. J. Bence, Cambridge University Press (Chapter 24)
2. Mathematical Methods for Physicists, G.B. Arfken&H.J. Weber 4th Edition, Academic Press. (Chapter 19)
3. An Introduction to Error Analysis: The Study of Uncertainties in Physical Measurements, John R. Taylor - Univ. Science Books

Unit III

Linear Differential Equations and Special Functions (20 hrs)

3.1 Linear ordinary differential equations of first & second order 3.2 Gamma and Beta Functions (review of properties) 3.3 Dirac delta function – its property and integral forms3.4 Bessel's differential equations3.5 Legendre differential equations 3.6 Hermite differential equation 3.7 Laguerre differential equation Generating Functions – recurrence relation – orthogonality – Rodrigue's formula (to be discussed for all equations).

Text Books

1. Mathematical Methods for Physicists, G.B. Arfken&H.J. Weber 4th Edition, Academic Press
2. Mathematical Physics, B.S Rajput, PragatiPrakashan

Unit IV

Tensors (16 hrs)

4.1 Tensor analysis - Coordinate transformations 4.1.1 Rank of a tensor, Classification of tensors 4.2 Addition, Subtraction 4.3 Outer product, Inner product and Contraction 4.3.1 Symmetric and antisymmetric tensors 4.4 Quotient law4.5 Metric tensor - Conjugate tensor 4.5.1 Levi-Civita symbol - Kronecker delta function 4.6 Associated tensors - Raising and lowering of indices – geodesic4.7 The Christoffel symbols and their transformation laws 4.7.1Covariant derivative of tensors.

Text Books

1. Introduction to Mathematical Physics, Charlie Harper, PHI
2. Vector analysis and tensors, Schaum's outline series, M.R. Spiegel, Seymour Lipschutz, Dennis Spellman, McGraw Hill
3. Mathematical Physics, B.S. Rajput, Y. Prakash 9th Ed, Pragati Prakashan
4. Tensor Calculus: Theory and problems, A. N. Srivastava, Universities Press
5. Matrices and Tensors in Physics – A W Joshi

Reference Books:

1. Mathematical Methods for Physicists, G.B. Arfken&H.J. Weber 4th Edition, Academic Press
2. Mathematical Physics, B.D. Gupta, VikasPub.House, New Delhi
3. Advanced Engineering Mathematics, E. Kreyszig, 7th Ed., John Wiley
4. Introduction to mathematical methods in physics, G.Fletcher, Tata McGraw Hill
5. Advanced engineering mathematics, C.R. Wylie, & L C Barrett, Tata McGraw Hill
6. Advanced Mathematics for Engineering and Physics, L.A. Pipes &L.R.Harvill, Tata McGraw Hill
7. Mathematical Methods in Physics, J. Mathew & R.L. Walker, India Book House.
8. Mathematical Physics, H.K. Dass, S. Chand & Co. New Delhi.

PH020102: BASIC QUANTUM MECHANICS

Credit-4 (72 hours)

Objective of the course: After studying the course, the student will (i) understand the fundamental concepts of quantum mechanics-operator formalism-Bra, Ket-representation –wave functions - and be able to apply them to various problems,(ii) understand the physics of time evolution and different pictures in quantum mechanics,(iii) understand not only the concept of angular momentum and its addition but also the rotation operator and its significance,(iv) understand the concept of perturbation and get ideas of different approximation methods –WKB method, Variation method etc. This course aims to give a brief introduction to Dirac's approach to quantum mechanics, operator formalism and its applications.

Unit I

Fundamental Concepts (16 hrs)

1.1 The Stern - Gerlach experiment- Dirac notation for state vectors- Ket space, bra space, Hilbert Space 1.2 Algebraicmanipulation of operators – unitary operators &Hermitian operators-Eigenkets and eigenvalues – concept of complete set. 1.3 Matrix representation of operators, kets & Bras- Expectation values, Measurements, Observables - Generalized uncertainty relation 1.4 Change of basis – Transformation Operator, transformation matrix ,unitary equivalent observables 1.5 Position, Momentum and Translation-Infinitesimal translation operator and its properties 1.6 Wave functions in position space and momentum space - Relations between operator formalism and wave function formalism 1.7 Gaussian wave packet –Computation of expectation values x, x^2, p and p^2

Text Book

1. Modern Quantum Mechanics, J. J. Sakurai, Pearson Education (Chapter 1)

Unit II

Time Evolution and Pictures of Quantum Mechanics (18 hrs)

2.1 Time evolution operator and its properties 2.1.1 Schrodinger equation for the time evolution operator 2.1.2 Energy eigenkets - Time dependence of expectation values 2.2 Time energy uncertainty relation 2.3 Schrodinger picture and Heisenberg picture 2.3.1 Behaviour of state kets and observables in Schrodinger picture and Heisenberg

picture 2.3.2 Heisenberg equation of motion- Ehrenfest's theorem 2.4 Time evolution of base kets - Transition amplitude 2.5 Energy eigenket and eigen values of a simple harmonic oscillator using creation and annihilation operators-Time development of the Oscillator

Text Book

1. Modern Quantum Mechanics, J.J. Sakurai, Pearson Education(Chapter 2)

Unit III

Angular momentum (18 hrs)

3.1Infinitesimal rotations in quantum mechanics 3.1.1 Representation of the rotation operator - Rotation matrix 3.1.2 Properties of the rotation matrix - Orbital angular momentum as a rotation generator 3.2 Fundamental commutation relations of angular momentum 3.2.1 Commutation relations for J^2, J_Z - Eigenvalues of J^2 and J_Z - Matrix elements of angular momentum operators 3.3 Rotation operator for spin ½ system - Pauli two component formalism – Pauli spin matrices 3.4 Addition of angular momentum-Computation of Clebsch-Gordon coefficients

Text Book

1. Modern Quantum Mechanics, J.J. Sakurai, Pearson Education

Unit IV

Perturbation Theory (7 hrs)

4.1 Nondegenerate Energy levels - First and second order corrections in energy and wave function - Anharmonic oscillator 4.1.1 Degenerate Energy levels - First order correction-the ground state of Helium 4.2 First order Stark effect 4.3 Zeeman effect in Hydrogen atom

The Variation Method (6 hrs)

4.4 The variational principle-Rayleigh-Ritz method 4.4.1Applications-The ground state of Helium and Hydrogen molecule ion

WKB Approximation (7 hrs)

4.5 The WKB method - The connection formula (proof not needed) - validity of WKB method 4.6 Barrier penetration-Alpha Emission

Text Book

1. Quantum Mechanics, G Aruldhas, PHI, 2002, (Chapter 9, 10, 11)

Reference Books:

1. A Modern approach to quantum mechanics, John S. Townsend, Viva Books MGH.
2. Basic Quantum Mechanics, A. Ghatak, Macmillan India 1996
3. Quantum Mechanics, an Introduction, W Greiner, Springer Verlag
4. Quantum Mechanics, E. Merzbacher, John Wiley, 1996
5. Introduction to Quantum Mechanics, D.J. Griffiths, Pearson.
6. Quantum Mechanics, L.I. Schiff, Tata McGraw Hill
7. A Text Book of Quantum Mechanics, P.M. Mathews & K. Venkatesan, TMGH.
8. Quantum Mechanics, Concepts and Applications, N. Zettily, John Wiley &Sons.
9. Fundamentals of Quantum Mechanics Y.R. Waghmare, S Chand & Co.
10. Advanced Quantum Mechanics, Satya Prakash. KedarNathRamnath Publications.

PH020103: CONDENSED MATTER PHYSICS

Credit-4 (72 hours)

Objective of the course: The objectives of this subject are to challenge the students to expand their knowledge of condensed matter physics and provide a foundation for further advanced studies. To develop a deep understanding of how condensed matter is characterised on the atomic scale.To broaden their appreciation of how condensed matter physics integrates into the discipline of physics overall.To understand the systems and acquire a fundamental understanding of a range of physical phenomena in condensed matter systems. Also to understand the phenomenon of superconductivity and their relation with the magnetic properties of materials.

Unit I

Lattice Vibrations and Thermal properties of Solids (16 hrs)

1.1 Phonons - Quantization of lattice vibrations - Vibrations of monatomic and diatomic lattices - acoustic and optical modes 1.2 Phonon Momentum - Inelastic scattering of neutrons by phonons 1.3 Anharmonic crystal Interactions - Thermal Expansion 1.4 Lattice Heat Capacity 1.4.1 Einstein model - Density of modes in one

and three dimensions 1.4.2 Debye model of lattice heat capacity – Debye's T^3 law 1.5 Thermal conductivity of solids - Thermal resistance of solids - N process – U process.

Text books

1.Solid State Physics-Structure and Properties of materials, M.A.Wahab. Narosa.

2. Solid State Physics, A.J.Dekker, Macmillan, 1967

3. Solid State Physics-J.S. Blakemore, Cambridge University Press.

Unit II

Free Electron Theory (8 hrs)

2.1 Energy levels and density of states in one dimension - Free electron gas in three dimensions 2.2 F D Statistics 2.3 Heat capacity of the electron gas 2.4 Electrical conductivity of metals and Ohm's law 2.4.1 Thermal conductivity of metals - Wiedemann-Franz law 2.4 Motion of electrons in Electric and magnetic fields - Hall effect.

Band Theory of Solids (16 hrs)

2.5 Effective mass of electron 2.6 Bloch theorem - Kronig-Penney model 2.7 Brillouin zone construction in one and two dimensions – extended, reduced and periodic zone scheme of Brillouin zone 2.8 Nearly free electron model- Tight binding Approximation- OPW method- Pseudopotential method 2.9 Construction of Fermi surfaces 2.10 Experimental study of Fermi surfaces-Anomalous skin effect, cyclotron resonance, de Hass-Van Alphen Effect.

Text books

1.Solid State Physics-Structure and Properties of materials, M.A.Wahab. Narosa.

2. Solid State Physics, A.J.Dekker, Macmillan, 1967

Unit III

Dielectrics and Ferroelectrics (8 hrs)

3.1 Theory of Dielectrics: Polarisation - Dielectric constant - Local Electric field - Dielectric polarisability 3.1.1 Polarisation from dipole orientation - Dielectric losses 3.2 Ferroelectric crystals 3.2.1 Landau theory of ferroelectric phase transitions 3.2.2 Ferroelectric domain 3.3 Antiferroelectricity 3.4. Piezoelectricity - Applications of Piezoelectric Crystals.

Superconductivity (10 hrs)

3.5 Sources of super conductivity 3.5.1 The Meissner Effect-Heat capacity- Energy gap - Isotope effect 3.5.2 Free energy of superconductor in magnetic field and the stabilization energy 3.5.3 London equation and penetration of magnetic field 3.6 Cooper pairs and the BCS ground state 3.7 Flux quantization 3.8 Single particle tunneling 3.8.1 DC and AC Josephson effects 3.9 High Tc superconductors - Applications of Superconductivity.

Text books

1. Solid State Physics-Structure and Properties of materials, M.A.Wahab.Narosa.
2. Solid State Physics, S.O.Pillai, New Age International 6th Edn. 2010

Unit IV

Magnetic properties (14 hrs)

4.1 Diamagnetism and Para magnetism 4.1.1 Langevin's diamagnetism 4.2 Cooling by adiabatic Demagnetization 4.3 Quantum theory of paramagnetism - Hund's rule 4.3.1 Paramagnetic susceptibility of conduction electrons 4.4 Ferro, Anti and Ferri magnetism: Curie point and the exchange integral 4.4.1 Ferrimagnetic order - Curie temperature and susceptibility of ferrimagnets 4.5 Antiferromagnetic order - Weiss theory of ferromagnetism - Ferromagnetic domains.

Text books

1. Solid State Physics-Structure and Properties of materials, M.A.Wahab.Narosa.
2. Solid State Physics, S.O.Pillai, New Age International 6th Edn. 2010

Reference Books:

1. Introduction to Theory of Solids, H.M. Rosenberg, Prentice Hall
2. Solid State Physics, N.W.Ashcroft and N.D. Mermin, CengageLearning Pub.
3. Elements of Solid State Physics, J.P. Srivastava, Prentice Hall ofIndia (2nd Edition)
4. Solid State Physics-J.S. Blakemore, Cambridge University Press.
5. Solid State Physics, Gupta Kumar, Pragati Prakasan
6. Introduction to Solid State Physics, C. Kittel, Wiley Eastern.
7. Elementary Solid State Physics, M. Ali Omar, Pearson.

PH020104: CLASSICAL MECHANICS AND RELATIVITY

Credit-3 (54 hours)

Objective of the course: After completing the course, the student will (1) understand the fundamental concepts of the Lagrangian and the Hamiltonian methods and be able to apply them to various problems, learn Hamilton-Jacobi method and the concept of action- angle variables. (2) Understand the physics of small oscillation and the concepts of canonical transformations and Poison brackets, (3) understand the basic ideas of rigid body dynamics, (4) This course also provide the basic ideas of special and general theory of relativity , non-linear dynamics and chaos.

Unit I

Lagrangian and Hamiltonian Methods (18 hrs)

1.1 Review of Lagrangian dynamics-Applications of Lagrange's equations-Velocity dependent potentials 1.2 Hamilton's equations of motion -Cyclic coordinates - Symmetry and conservation theorems 1.3 Variational principle and Hamilton's equations - Physical significance of principle of least action –Proof1.4 Canonical transformations 1.4.1 Equation of canonical transformation-example of canonical transformation-harmonic Oscillator 1.5 Lagrange brackets- Poisson brackets – Equation of motion in Poisson bracket form – Canonical invariance of poisson bracket 1.6 Hamilton's characteristic function 1.7 Hamilton Jacobi theory – Harmonic Oscillator- Kepler Problem-1.8 Action angle variables – Harmonic Oscillator- Kepler problem.

Text books

1. Classical Mechanics, J C Upadhyaya
2. Classical Mechanics , G Aruldas
3. Classical Mechanics , H.Goldstein

Unit II

Rigid Body Dynamics (18 hrs)

2.1 Independent Coordinates 2.2 Euler's Angles- Euler's equation of motion 2.3 Infinitesimal rotation – Rate of change of a vector 2.4 Force free motion of a symmetric top - Heavy Symmetric top 2.5 Coriolis Force and its effects. 2.6 Theory of Small Oscillations -Formulation of the problem – Eigen value equation –

Normalcoordinates- normal modes- Two coupled oscillators -Oscillations of linear triatomic molecules

Text books

1. Classical Mechanics, J C Upadhyaya
2. Classical Mechanics , G Aruldas
3. Classical Mechanics , H.Goldstein

Unit III

Special and General Theory of relativity (18 hrs)

3.1 The postulates of Special Theory of relativity 3.2 Relativistic kinematics and mass–energy equivalence 3.3 Relativistic Lagrangian and Hamiltonian of a particle-Lorentz co-variance 3.4 Four vectors - Invariance of Maxwell's equations under Lorentz transformations 3.5 General theory of relativity-Principle of Equivalence-space curvature-Gravitational red shift. 3.6 Nonlinear dynamics and introduction to chaos - Linear and Nonlinear systems3.6.1 Phase space dynamics-Bifurcation-logistic map- Attractors-Universality of chaos-Fractals (Qualitative ideas only).

Text book

1. Classical Mechanics, G Aruldas

Reference Books:

1. Classical mechanics, N. C. Rana & P.S. Joag - TMGH.
2. Classical mechanics, Satyaprakash, Sultan Chand & Company.
3. Classical mechanics, Gupta & Kumar, Pragati Prakasan.
4. Classical Mechanics, A.K. Raychauduri, Oxford Univ. Press

PH020105: GENERAL PHYSICS PRACTICALS

Credit-4 (180 hours)

(Minimum of 12 Experiments with Error analysis of the experiment is to be done)

1. Magnetic susceptibility - Quincke's method
2. Magnetic susceptibility - Guoys method
3. Y, n, σ Cornu's method, (a) Elliptical fringes
4. Y, n, σ Cornu's method, (b) Hyperbolic fringes
5. Young's modulus and Poisson's ratio – Koenig's method
6. Michelson interferometer – λ and dλ/ thickness of mica
7. Absorption spectrum-$KMnO_4$ solution- telescope and scale arrangement- Hartmann'sformula
8. e/m of electron – Thomson's method
9. Thermistor characteristics
10. Determination of e/k – silicon transistor
11. Hydrogen spectrum – Rydberg constant
12. Ultrasonic – Acousto-optic technique- elastic property of a liquid.
13. Oscillating disc – viscosity of liquid
14. Determination of e – Milliken's method
15. Characteristics of a photodiode
16. B-H curve – Anchor ring
17. Mutual inductance – Carey Foster's bridge
18. Self and mutual inductance – Anderson's bridge
19. Arc spectrum of Iron, Copper and Brass
20. Absorption spectrum of Iodine- photographic method
21. Raman effect in liquids – plate measurement
22. Identification of elements by spectroscopic method
23. Dielectric constant of a non-polar liquid
24. Temperature dependence of a ceramic capacitor and verification of Curie Wiess law
25. Electrical and thermal conductivity of copper and determination of Lorentz Number
26. Silicon diode as temperature sensor

27. Verification of stephan's law and determination of Stephan's constant of Radiation
28. Diffraction of light by cross wire and wire mesh using laser.
29. Diffraction of light by double slit and grating using laser.
30. Cauchy's constant of liquid and liquid mixture using holoprism and spectrometer.
31. Surface tension of a liquid using Jaegger's method.
32. Characteristics of a phototransistor.
33. I-V characteristics of LED and LDR circuits.
34. Wavelength of He-Ne Laser using Vernier Calipers.
35. Identification of Fraunhoffer lines in solar spectrum.

SEMESTER – II

PH020201: APPLIED MATHEMATICS FOR PHYSICS – II

Credit-4 (72 hours)

Objective of the course: The purpose of the course is to introduce students to methods of mathematical physics and to develop required mathematical skills to solve problems in quantum mechanics, electrodynamics and other fields of theoretical physics. The first objective of this course is to develop students' facility with certain mathematical techniques. The second objective is to highlight applications of mathematical methods to physical systems. Applications shed light on both the mathematics and the logic underpinning physical models. This allows students to develop valuable intuition for subsequent courses where these same methods will be applied.

Unit I

Functions of Complex Variables and Analysis (20 hrs)

1.1 Introduction to complex variable - Analytic functions 1.2 Cauchy–Riemann equations - C-R equation in polar form 1.3 Cauchy's Integral Theorem - Cauchy's theorem for multiply connected domains 1.3.1 Cauchy's integral formula 1.3.2 Derivatives of analytic functions 1.4 Taylor & Laurent expansion 1.5 Singularities – Poles - Residue theorem 1.6 Evaluation of definite integrals

Text Books

1. Mathematical Methods for Physicists, G.B. Arfken&H.J. Weber 4thEdition, Academic Press.
2. Mathematical Physics, H.K. Dass and Dr. Rama Verma,S. Chand & Company Ltd., New Delhi.
3. Higher Engineering Mathematics- Dr. B.S. Grewal- 42ndEdn.-Khanna Pub.-New Delhi

Unit II

Elements of Abstract Algebra (18 hrs)

2.1 Introductory definitions and concepts - cyclic groups 2.2 groups of transformations- multiplication table-point groups 2.3 Reducible and irreducible

representations 2.4 Schur's lemmas and Orthogonality theorem 2.5 Group character table 2.5.1 Applications in molecular and crystal physics 2.6 Lie group and lie algebra 2.6.1 3D rotational group 2.6.2 Poincare and Lorentz group 2.7 SU(2) and SU(3) groups.

Text Books

1. Elements of Group Theory for Physicists, A.W. Joshi, New Age India
2. Mathematical Physics with Classical mechanics-SatyaPrakash, SultanChand& Sons, New Delhi.
3. Group theory- Schaum's series, Benjamin Baumslag& Bruce Chandler, MGH.

Unit III

Fourier transforms and Fourier series (9 hrs)

3.1 Fourier transforms- Fourier Cosine and Sine Transform 3.1.1 Fourier Transform of Gaussian function - finite wave train 3.1.2 Momentum representation for hydrogen atom ground state & harmonic oscillator3.4 Fourier Series – Fourier series of square wave - full wave rectifier.

Laplace Transforms (9 hrs)

3.5 Introduction to Laplace Transform3.6 Inverse Laplace Transform3.7 Solution of differential equation3.7.1 L T Earth's mutation, LCR circuit, Driven oscillator with damping

Text Books

1. Mathematical Methods for Physicists, G.B. Arfken&H.J. Weber 4th Edition, Academic Press.
2. Mathematical Physics, H.K Dass&Dr. Rama Verma, S. Chand &Co.

Unit IV

Partial Differential Equations and Green's Functions (16 hrs)

4.1 Partial differential equation – characteristics - boundary conditions 4.2 classes of partial differential equations- Heat equation, Laplace's equation, Wave equation4.3 Non-linear partial differential equation and boundary conditions 4.4 Separation of variables in Cartesian, circular cylindrical and spherical polar coordinates 4.5 Non

homogeneous equation - Green's function 4.6 Symmetry of Green's functions-Forms of Green functions4.6.1 Poisson's equation.

Text Books

1. Mathematical Methods for Physicists, G.B. Arfken& H.J. Weber, 4th Edition, Academic Press.
2. Mathematical Physics with Classical mechanics-SatyaPrakash, SultanChand& Sons, New Delhi.
3. Mathematical Physics, B.S Rajput, PragatiPrakashan.

Reference Books:

1. Introduction to mathematical methods in physics, G.Fletcher, Tata McGraw Hill
2. Advanced engineering mathematics, C.R. Wylie, & L C Barrett, Tata McGraw Hill
3. Advanced Mathematics for Engineering and Physics, L.A. Pipes &L.R.Harvill, Tata McGrawHill.
4. Mathematical Methods in Physics, J. Mathew & R.L. Walker, India Book House.
5. Introduction to Mathematical Physics, Charlie Harper, PHI
6. Vector analysis and tensors, Schaum's outline series, M.R. Spiegel, Seymour Lipschutz, Dennis Spellman, McGraw Hill

PH020202: ELECTRODYNAMICS AND ELECTROMAGNETIC WAVES

Credit-4 (72 hours)

Objective of the course: To apprise the students regarding the concept of electrodynamics and Maxwell's equations and use them in various situations. At the end of the course, the leaner should able to (i) explain the use of Maxwell's equations in analysing the electromagnetic field due to time varying charge and current distribution (ii) describe the nature of electromagnetic waves and its propagation through different media and interfaces (iii) acquire knowledge of principles of relativistic electrodynamics (iv) discuss radiation from localized time varying electromagnetic sources.

Unit I

Electrostatics, Magnetostatics and Electrodynamics (18 hrs)

1.1 Laplace's Equation – in one, two, three dimensions and its solutions. 1.2 Boundary conditions and Uniqueness theorems - Conductors and the second Uniqueness theorem. 1.3 Multipole expansion - Approximate Potentials at large distances - The Monopole and Dipole terms - Origin of coordinates in Multipole expansions - The electric field of a dipole. 1.4 Magnetostatics- Divergence and curl of B- Magnetic vector potential - Magnetostatic boundary conditions-1.5 Multipole expansion of the vector potential - The auxiliary field H -Ampere's law in magnetized materials 1.6 Maxwell's Equations - Maxwell's equations in matter 1.6.1 Poynting`s theorem 1.6.2 Maxwell's StressTensor

Text Book

1. Introduction to Electrodynamics, David J Griffiths, PHI Learning, 2009 (Chapter 3,5,8)

Unit II

Electromagnetic Waves and Wave guides (18 hrs)

2.1 Electromagnetic Waves - Waves in one dimension 2.1.1 Electromagnetic waves in vacuum 2.1.2 Electromagnetic waves in matter 2.2 Reflection and transmission at normal incidence - Reflection and transmission at oblique incidence2.3 Absorption and Dispersion 2.4 Guided waves – waves between parallel conducting plane TE, TM and TEM waves 2.4.1 TE and TM Waves in Rectangular wave guides 2.4.2 The coaxial transmission lines

Text Book

1. Introduction to Electrodynamics, David J Griffiths, PHI Learning,2009

Unit III

Relativistic Electrodynamics (20 hrs)

3.1 Relativistic Mechanics - Proper time and velocity-Relativistic energy and Momentum 3.2 Relativistic Kinematics 3.2.1 Two-body scattering3.2.2 Decay of a particle 3.3 Relativistic dynamics.3.4 Relativistic Electrodynamics - Magnetism as a relativistic phenomenon 3.4.1 Transformation of the fields3.4.2 Electromagnetic field

tensor 3.4.3 Electrodynamics in tensor notation 3.4.4 Potential formulation of relativistic electrodynamics**.**

Text Book

1. Introduction to Electrodynamics, David J Griffiths, PHI Learning,2009 (Chapter 12)

Unit IV

Radiation (16 hrs)

4.1 Potentials and Fields -The Potential formulation - Continuous Distributions 4.2 Retarded Potentials – Jefimenko's equations 4.3 Point Charges - Lienard-Wichert Potentials.4.4 Dipole radiation 4.4.1 Electric dipole radiation 4.4.2 Magnetic dipole radiation 4.4.3 Radiation from an arbitrary source. 4.4.4 Point Charges - Power radiated from a point charge.

Text Book

1. Introduction to Electrodynamics, David J Griffiths, PHI Learning.

Reference Books:

1. Classical Electrodynamics, J.D. Jackson 3rd Ed. Wiley, 1993.
2. Introduction to Classical Electrodynamics, Y K Lim, World Scientific,1986.
3. Electromagnetic waves and radiating systems, E.C. Jordan & K. G. Balmain PHI,1968
4. Electromagnetic fields, S. Sivanagaraju, C. Srinivasa Rao, New Age International.
5. Electromagnetic Waves and Fields, V. V. Sarwate, Wiley Eastern Ltd, New Age International
6. The Feymann Lectures in Physics, Vol. 2, R. P. Feymann, R.b. Leighton & M. Sands

PH020203: ADVANCED ELECTRONICS AND COMMUNICATION

Credit-4 (72 hours)

Objective of the course: To apprise the students regarding the concept of advanced electronics and communication. At the end of the course, the leaner should able to (i) explain the use of special semiconductor devices and different types of negative feed back characteristics. (ii) Describe the nature of practical op- amp and frequency response of an op-amp. (iii) Acquire knowledge of signal processing and communications (iv) discuss various types of active filters and oscillators.

UnitI

Special Semiconductor Devices (8hrs)

1.1 Review of Bipolar junction Transistor (BJT) biasing and characteristics- FET, JFET1.2 Structure and working, I/V Characteristics under different conditions, biasing circuits 1.3 MOSFET: Depletion and Enhancement type MOSFFT

Signal processing and Communication Systems (10hrs)

1.4 Modulation-Amplitude modulation - Frequency spectrum of AM- Representation of AM - Power relation in AM 1.5 Single Side Band: Evolution, Balanced modulator 1.6 Theory of frequency and Phase modulation, Generation of frequency modulation1.7Pulse communications - Pulse amplitude modulation– Pulse width, Pulse position, Pulsecode modulations. 1.8 Multiplexing techniques: Frequency division and time division multiplexing.

Text Book

1. Basic Electronics solid state, B.L Theraja,S (2005) Chand and company.
2. Electronic communication systems: Kennedy and Davis(4th Edn).

UnitII

Negative Feedback Op-amp Characteristics (12 hrs)

2.1 Differential Amplifier 2.1.1 Inverting Amplifier-Non Inverting Amplifier-Block Diagram Representations 2.2 Voltage series feedback: Closed loop voltage gain, Difference Input voltage ideally zero-Input and output resistance with feed back-Band widthwith feed back – Total out put off set voltage with feedback 2.3 Voltage

follower 2.4 Voltage shunt feed back amplifier: Closed loop voltage gain –Inverting input terminal at virtual ground- Input and output resistance with feedback-Band width with feed back- Total output offset voltage with feed back 2.5Current to voltage converter, Inverter 2.6 Differential amplifier with one Op-amp and two Op-amps.

The Practical Op-amp(6 hrs)

2.7 Input off set voltage, Input bias current, Input off set current-Total output offset voltage 2.8 Thermal drift- Effect of variation in power supply voltages on offset voltage 2.10 Change ininput offset voltage and inputoff se tcurrent withtime -Noise, Common mode configuration and CMRR.

Text Book

Op-amps and linear integrated circuits: R.A.Gayakwad.

UnitIII

General Linear Application (withdesign)(12hrs)

3.1 DC and AC amplifiers, AC amplifier with supply voltage 3.2 Peaking Amplifier 3.3Summing, Scaling and averaging amplifiers 3.4 Instrumentation Amplifiers using transducer bridge3.5 Differential input and differential output amplifier, Low voltage DC and AC voltmeter 3.6 Voltage to current converter with grounded load, Current to voltage converter, Very high input impedance circuit 3.7 Integratorand differentiator

Frequency Response of an Op-amp(6 hrs)

3.8 Frequency response 3.9 Compensating networks, Frequency response of internally compensated and non- compensated Op-amps 3.10 High frequency op-amp equivalent circuit 3.11 Open loop gain as a function of frequency 3.12 Closed loop frequency response 3.13 Circuit stability, Slewrate.

Text Book

Op-amps and linear integrated circuits: R.A.Gayakwad.

Unit IV

Active Filters and Oscillators (with design)(12 hrs)

4.1 Activefilters 4.1.2 Firstor derand second order low pass Butter worth filter 4.1.3 First order and second order high pass Butter worth filter 4.1.4 Wide and narrow band pass filter 4.1.5 Wide and narrow band reject filter 4.1.6 All passfilter, 4.2 Oscillators 4.2.1 Phase shift and Wienbridge oscillators 4.3 Square, triangular and saw-tooth wave generators 4.4 Voltage controlled oscillator.

Comparators and IC555 Timer (6 hrs)

4.5 Basic comparators 4.5.1 Zero crossing detector 4.5.2Schmitt Trigger 4.5.3 Comparator characteristics 4.5.4 Limitations of Op-amps & comparators

4.6 I C555 Internal architecture 4.6.1 Applications IC565PLL 4.7 Voltage regulator IC 4.7.1 Fixed Voltage regulator.

Text Book

Op-amps and linear integrated circuits: R.A.Gayakwad.

Reference Books:

1. Electronic Principles Albert P. Malvino, David J Bates, McGraw-Hill Companie
2. Introduction to Semiconductor Devices by M.S. Tyagi, John Wiley & Sons
3. Electronic Principles Albert P. Malvino, David J Bates, McGraw-Hill Companie
4. L.Floyd, Electronic Devices, “Pearson Education” New York (2004)
5. Power Electronics,V. Subrahmanyam, 2nd Edition, 2006
6. ElectronicCommunications:DennisRoddyandJohnCoolen4thEdnPearson.
7. A textbook of Applied Electronics, R.S.Sedha,S.Chand&Co.
8. Principles of Electronics, V.K.Mehta and Rohit MehtaS.Chand & Co.

PH020204: ADVANCED NUCLEAR PHYSICS

Credit-4 (54 hours)

Objective of the course: After completing this syllabus the student will (a) have an understanding of the nuclear structure and the decay processes, they will also have an understanding of different nuclear models. (b) be able to understand different nuclear interactions including fission and fusion, they will also get an idea about the recent developments in controlled fission and fusion reactions (c) have an idea about the families of elementary particles and the fundamental interactions governing them.

Unit I

Nuclear Structure and Decay (18 hrs)

1.1 Basic properties of nuclei, Masses and relative abundances 1.2 Mass defect - size and shape, nuclear binding energy 1.2.1 Nuclear stability - nuclear angular momentum and parity 1.3 Nuclear electromagnetic moments 1.3.1 Magnetic dipole moment and electric quadrapole moments 1.4 Liquid drop model – Semi empirical mass formula of Weizacker 1.5 Shell model - Shell model potential –1.5.1 Magic numbers - Valence nucleons 1.6 Beta decay - energy release 1.7 Fermi theory - experimental tests 1.7.1 Angular momentum and parity selection rules

Text Books

1. Introductory Nuclear Physics, K. S. Krane Wiley
2. Nuclear Physics, D. C. Tayal, Himalaya Publishing House
3. Nuclear Physics(2^{nd} Edition) , S N Ghoshal, S Chand & Company

Unit II

Nuclear Interactions, Fission and Fusion (18 hrs)

2.1 Nuclear forces, Characteristics of nuclear force 2.1.1 Spin dependence, charge independence, charge symmetry 2.2 Two body problem - Ground state of deuteron 2.3 Types of nuclear reactions and conservation laws 2.3.1 Compound-nucleus reactions - heavy ion reactions 2.4 Characteristics of fission - energy in fission 2.4.1 Fission and nuclear structure 2.5 Controlled fission reactions - Fission reactors 2.6 Fusion processes, Characteristics of fusion 2.7 Controlled fusion reactor, ITER.

Text Books

1. Introductory Nuclear Physics, K. S. Krane Wiley
2. Nuclear Physics, D. C. Tayal, Himalaya Publishing House
3. Nuclear Physics(2nd Edition) , S N Ghoshal, S Chand & Company

Unit III

Particle Physics (18 hrs)

3.1 Types of interactions between elementary particles 3.2 Hadrons and leptons - Masses, spin, parity and decay structure 3.3 Quark model-Confined quarks - coloured quarks, Gluons, Higg's Boson Gell-Mann- Nishijima formula 3.4 symmetries and conservation laws 3.4.1 C, P and T invariance 3.5 Applications of symmetry arguments to particle reactions 3.6 Parity non-conservation in weak interactions

3.7 Grand unified theories (Qualitative ideas), LHC (Elementary ideas).

Text Books

1. Introduction to Elementary Particle, D.J. Griffiths, Harper and Row,NY, (1987)
2. Nuclear Physics, D. C. Tayal, Himalaya Publishing House
3. Nuclear Physics(2nd Edition) , S N Ghoshal, S Chand & Company

Reference Books

1. Nuclear Physics, R.R. Roy and B.P. Nigam, New Age International, New Delhi,(1983).
2. The particle Hunters - Yuval Ne'eman & Yoram kirsh CUP, (1996)
3. Concepts of Nuclear Physics, B.L. Cohen, TMH, New Delhi, (1971).
4. Theory of Nuclear Structure, M.K. Pal, East-West, Chennai, (1982).
5. Atomic Nucleus, R.D. Evans, McGraw-Hill, New York.
6. Nuclear Physics, I. Kaplan, 2nd Edn, Narosa, New Delhi, (1989).

Advanced Reading

1. Introduction to Nuclear Physics, H.A. Enge, Addison Wesley, London, (1975).
2. Introductory Nuclear Physics, Y.R. Waghmare, Oxford-IBH, New Delhi, (1981).
3. Atomic and Nuclear Physics, Ghoshal,Vol. 2, S. Chand & Company
4. Fundamentals of Elementary Particle Physics, J.M. Longo, MGH,New York, (1971).
5. Nuclear and Particle Physics, W.E. Burcham and M. Jobes, Addison-Wesley, Tokyo, (1995).

PH020205: ELECTRONICS PRACTICALS

Credit-4 (180 hours)

(Minimum of 12 Experiments should be done)

1. RC coupled CE amplifier – two stages with feedback – frequency response and voltage gain
2. Differential amplifier – using transistors – constant current source – frequency response
3. Active filters – low pass and high pass – first and second orders – frequencyresponse and roll of rate
4. Band pass filter using single op-amp
5. Voltage controlled oscillator using transistors
6. Voltage regulation using op-amp with short circuit protection
7. UJT characteristics
8. Relaxation oscillator using UJT
9. Characteristics of SCR
10. RF amplifier- frequency response and band width
11. Op-amp monostable multivibrator, square wave generator
12. IC 555 monostable multivibrator and astable multivibrator
13. IC 555 pulse width modulation and linear RAMP generator
14. Voltage controlled oscillator using IC 555
15. Shift registers Binary sequence generator
16. Synchronous counters and divide by N counters
17. Op-amp mathematical operations
    a) Summing amplifier
    b) Differential amplifier
    c) Zero Cross Detector
    d) Op-amp as an integrator and differentiator.
18. Amplitude modulation using transistors
19. AM Modulator and Demodulator using MC1496
20. Precision rectifiers – measurement of rectifier efficiency at different frequencies
21. Op- amp triangular wave generator with specified amplitude
22. Op- amp sawtooth wave generator with specified amplitude

23. Analog to digital and digital to analog converter ADC0800 & DAC0800
24. RC phase shift Oscillator using op amp
25. Op-amp Wein bridge oscillator
26. Crystal Oscillator
27. Single stage CE amplifier design and study of frequency response.
28. Study of RC Phase shift Oscillator using transistors.
29. Study of Schmitt Trigger Circuits and calculation of Hysteresis voltage.
30. Emitter follower and Source follower circuits.
31. Frequency multiplier using PLL

SEMESTER – III

PH020301: STATISTICAL PHYSICS AND ASTROPHYSICS

Credit-4 (72 hours)

Objective of the course: The course is designed to give the students a firm understanding of statistical mechanics. The concept developed in classical system for various ensembles when applied to quantum systems have certain limitations, but classical results can be recovered from the quantum theories in the high temperature-low density limit. The theories deduced by Statistical Mechanics have been applied to Astro Physics. A fundamental study of Astro Physics along with structure and evolution of stars have been covered in this course.

Unit I

Quantum Statistical Mechanics and Ideal Gas Systems (18 hrs)

1.1 The postulates of Quantum statistical mechanics – in distinguishability of particles - exchange degeneracy 1.2 Density matrix - Ensembles in Quantum statistical mechanics - statistical distribution – The ideal gas in quantum mechanical micro canonical and other quantum mechanical ensemble 1.3 Partition functions and other thermodynamic quantities of monatomic and diatomic molecules 1.4 Thermodynamic behaviour of an ideal Fermi gas– Pauli Para magnetism 1.5 Thermodynamic behavior of a Bose gas – Bose Einstein condensation – 1.6 Theory of white dwarf stars.

Text books

1. Statistical Mechanics, Gupta, Kumar, Pragati Prakasan
2. Statistical mechanics, Kerson Huang, John Wiley and Sons

Unit II

The Canonical and Grand Canonical Ensemble Fluctuations and Phase Transitions (18 hrs)

2.1 Thermo dynamical relations in a canonical ensemble– energy fluctuations in the canonical ensemble:correspondence with micro canonical ensemble 2.2 Density and energy fluctuations in the grand canonical ensemble: correspondence with other ensembles.2.3 One dimensional random walk problem – Brownian motion and Random walk- 2.4.Fokker Planck equation Phase transitions – First and second order phase transition correlation functions 2.5 Bragg–Williams approximation – critical phenomena - critical exponents - scaling hypothesis2.6 Ising model and its solution for a linear chain –2.7 Equivalence of Ising model to other models - lattice gas and binary alloy- solution of one dimensional Ising model 2.8 Liquid Helium

Text books

1. Statistical mechanics, R..K. Pathria, Butterworth-Heinemann
2. Statistical Mechanics, B.K. Agarwal and M. Eisner, Wiley Eastern

UNIT III

Astrophysics (18hrs)

3.1 The sun-internal structure-solar atmosphere-sun spots-solar flares-prominences

3.2 celestial coordinate system-sun earth system –galactic system 3.3 Stellar spectrum - stellar types -Stellar magnitude sequence-Absolute magnitude and the distance modulus- Colour index of a star -Luminosities of a star 3.4 Measurement of distances and Absolute luminosities 3.5 measuring temperature- Application of Saha's Equation. 3.6 Virial theorem3.7 stellar energy -Thermonuclear reactions in stars, pp chains and CNO cycle-Solar Neutrino problem- subsequent thermonuclear reactions nucleosynthesis

Text books

1 Astrophysics: Stars and Galaxies, K D Abhyenkar, Universities Press.

2 Introduction to Astrophysics, Baidyanath Basu, PHI.

3 Textbook of astronomy an astrophysics with elements of cosmology, V.B.Bhatia, Narosa publishing house, 2001

UNIT IV

Structure and Evolution of Stars (18hrs)

4.1 Evolution of a star-Hertz Sprung Russell diagram4.2 star formation - life of a star - stellar structure -final stages of stellar evolution 4.3 Newtonian theory of stellar equilibrium4.4 White Dwarfs, Electron degeneracy and equation of States-Chandrasekhar Limit-Mass- Radius relation of WD4.5 Neutron Stars, Mass-Radius relations of NS-Pulsars, Magnetars, Gamma ray bursts4.6 Black holes, Collapse to a black hole, event horizon, singularity. 4.7 Qualitative discussions on galaxies, Nebulae, Quasars, Brown Dwarfs, Red giants, Nova, supernova.

Text books

1 Astrophysics: Stars and Galaxies, K D Abhyenkar, Universities Press.

2 Introduction to Astrophysics, Baidyanath Basu, PHI.

Reference Books:

1. Fundamentals of Statistical Mechanics, B. B. Laud, New Age International.

2. Elements of Statistical Mechanic, Kamal Singh, S P. Singh, S. Chand & Co.

3. Introduction to Statistical Mechanics, S.K. Sinha, Alpha Science International.

4. Statistical Mechanics, Tung Tsang, Rinton Press.

5. Introductory Statistical Mechanics, R. Bowley & M. Sanchez, 2nd Edn. Oxford University Press

6.The Structure of the Universe – J.V.Narlikar (OUP, 1978)

7.Fundamental Astronomy. H. Karttunen.P. Kröger.H. Oja.M. Poutanen .K. J. Donner (Eds.),Springer-Verlag Berlin Heidelberg New York

8.The Physical Universe. FrankShu. University Science Books

9.An Introduction to Modern Astrophysics. B.W. Carroll, D.A.Ostlie, Pearson

PH020302: NUMERICAL METHODS IN PHYSICS

Credit-4 (72 hours)

Objective of the course : Apply numerical methods to obtain approximate solutions to mathematical problems. Derive numerical methods for various mathematical operations and tasks, such as interpolation, curve fitting, differentiation, integration, the solution of system of equations, the solution of ordinary and partial differential equations and to learn how to apply numerical methods to a variety of physical problems.

Unit I

Interpolation (12 hrs)

1.1 Finite differences 1.1.1Forward differences - Backward differences – Central differences 1.1.2 Introduction to finite difference operators1.1.3 Detection of errors by use of difference tables1.1.4. Differences of a polynomial 1.2 Interpolation - Errors in Polynomial Interpolation 1.2.1 Newton's formulae for interpolation – forward and backward interpolation formula 1.2.2 Central difference interpolation formulae - Gauss central difference formulae - Stirlings formulae-Evretts formula 1.2.3 Interpolation with unevenly spaced points-Lagrange's interpolation formulae- Error in Lagrange's interpolation formulae - Hermite's interpolation formulae

Text Books

1. Introductory Methods of Numerical Analysis, S.S. Sastry, PHI Pvt. Ltd. .(Fifth Edition) Chapter – 3
2. Numerical methods for Scientists and Engineers – K Sankara Rao, PHI Learning Private Limited.(Third Edition) Chapter - 6
3. Numerical Methods in Engineering & Science – Dr. B S Grewal, Khanna Publishers (10^{th} Edition) Chapters – 6,7

Curve fitting (6 hrs)

1.3Least Squares Curve fitting procedures 1.3.1 Fitting a straight line 1.3.2 Linearization of Nonlinear laws - Curve fitting by polynomial.

Text Books

1. Introductory Methods of Numerical Analysis, S.S. Sastry, PHI Pvt. Ltd.(Fifth Edition) Chapter – 4
2. Numerical methods for Scientists and Engineers – K Sankara Rao, PHI Learning Private Limited.(Third Edition) Chapter - 5
3. Numerical Methods in Engineering & Science – Dr. B S Grewal, Khanna Publishers (10^{th} Edition) Chapter – 5

Unit II

Numerical Differentiation (6 hrs)

2.1 Numerical differentiation 2.1.1Differentiation for tabular and non-tabular functions 2.1.2 Errors in Numerical differentiation 2.1.3finding maxima and minima of a tabulated function

Numerical Integration (10 hrs)

2.2 Numerical integration 2.2.1 Trapezoidal rule – error associated 2.2.2 Simpson's 1/3 rule – error associated 2.2.3 Simpson's 3/8 rule –error associated 2.3 Romberg Integration 2.4 Gaussian Integration 2.5 Double Integration 2.6 Monte Carlo evaluation of integrals –Newton – cotes integration formula

Text Books

1. Introductory Methods of Numerical Analysis, S.S. Sastry, PHI Pvt. Ltd.(Fifth Edition) Chapter – 6
2. Numerical methods for Scientists and Engineers – K Sankara Rao, PHI Learning Private Limited.(Third Edition) Chapter - 7
3. Numerical Methods in Engineering & Science – Dr. B S Grewal, Khanna Publishers (10^{th} Edition) Chapter – 8

Unit III

Numerical Solution of Ordinary Differential Equations (10 hrs)

3.1 Euler method 3.2 modified Euler method and Runge - Kutta 4th order methods - adaptive step size R-K method 3.3 predictor - corrector methods - Milne's method, Adam - Mouton method.

Text Books

1. Introductory Methods of Numerical Analysis, S.S. Sastry, PHI Pvt. Ltd. .(Fifth Edition) Chapter – 8
2. Numerical methods for Scientists and Engineers – K Sankara Rao, PHI Learning Private Limited.(Third Edition) Chapter - 8
3. Numerical Methods in Engineering & Science – Dr. B S Grewal, Khanna Publishers (10^{th} Edition) Chapter – 10

Numerical Solution of System of Equations (10 hrs)

3.2 Gauss-Jordan elimination Method 3.3 Gauss-Seidel iteration method 3.4 Gauss elimination method 3.5 Gauss-Jordan method to find inverse of a matrix. 3.6 Power method and Jacobi's method to solve eigen value problems.

Text Books

1. Introductory Methods of Numerical Analysis, S.S. Sastry, PHI Pvt. Ltd.(Fifth Edition) Chapter –7
2. Numerical methods for Scientists and Engineers – K Sankara Rao, PHI Learning Private Limited.(Third Edition) Chapter - 3
3. Numerical Methods in Engineering & Science – Dr. B S Grewal, Khanna Publishers (10^{th} Edition) Chapter – 3

Unit IV

Numerical Solutions of partial differential equations (18 hrs)

4.1 Boundary value problem and initial value problem - Cauchy's and Dirichlet conditions – Classification of partial differential equation 4.2 Finite difference approximations to derivatives 4.3 Laplace equation 4.3.1 Iterative methods -Jacobi's method – Gauss Seidal method – Successive over relaxation- The ADI method

4.4 Parabolic equations – Heat conduction equation 4.4.1 Iterative methods for the solution of equations 4.5 Hyperbolic equations – Wave equations -Schmidt method – Crank – Nicolson method

Text Books

1. Introductory Methods of Numerical Analysis, S.S. Sastry, PHI Pvt. Ltd.(Fifth Edition) Chapter –9
2. Numerical methods for Scientists and Engineers – K Sankara Rao, PHI Learning Private Limited.(Third Edition) Chapter - 9

3. Numerical Methods in Engineering & Science – Dr. B S Grewal, Khanna Publishers (10th Edition) Chapter – 11

Reference Books:

1. Introductory Methods of Numerical Analysis, S.S. Sastry, PHI Pvt. Ltd.(Fifth Edition)
2. Numerical methods for Scientists and Engineers – K Sankara Rao, PHI Learning Private Limited.(Third Edition)
3. Numerical Methods in Engineering & Science – Dr. B S Grewal, Khanna Publishers (10th Edition)
4. An Introduction to Computational Physics, Tao Pang, Cambridge University Press
5. Numerical methods for scientific and Engineering computation M.KJain,S.R.K Iyengar, R.K. Jain, New Age International Publishers
6. Computer Oriented Numerical Methods, V. Rajaraman, PHI, 2004.
7. Numerical Methods, E. Balagurusami, Tata McGraw Hill, 2009.
8. Numerical Mathematical Analysis, J.B. Scarborough, 4th Edn, 1958
9. Mathematical Methods, G. Shanker Rao, K. Keshava Reddy, I.K. InternationalPublishing House, Pvt. Ltd.

PH020303: ADVANCED QUANTUM MECHANICS

Credit-4 (72 hours)

Objective of the course: After studying the course, the student will (i) understand the fundamentals of time dependent perturbation theory and different types of approximations used,(ii) understand the concepts of scattering and be able to apply them to various problems,(iii) the concepts of relativistic quantum mechanics and its applications,(iv) understand not only the concept of classical and quantum field theories but also be able to quantize scalar and vector fields.

Unit I

Time Dependent Perturbation Theory (12 hrs)

1.1 Time dependent potentials 1.1.1 Interaction picture -Comparison of pictures - Time evolution operator in interaction picture 1.2 Time dependent perturbation theory

- Dyson series – transition probability 1.2.1 Constant perturbation – Fermi's Golden rule 1.2.2 Harmonic perturbation - interaction with classical radiation field - Transition rates for absorption and emission of radiation1.2.3 Electric dipole approximation - Electric dipole selection rules1.3 Photo electric effect – Energy shift and decay width.

Text Book

1. Modern Quantum Mechanics, J.J. Sakurai, Revised Edition (Chapter 5)

Approximation Methods(4 hrs)

1.4 Sudden approximation-Sudden reversal of magnetic field 1.5 Adiabatic approximation -Adiabatic reversal of magnetic field.

Text Book

1. Quantum mechanics – V. K. Thankappan New Age Int. Pub 1996 (Chapter 8)

Unit II

Scattering (18 hrs)

2.1 Asymptotic equation for scattering 2.1.1 Scattering Amplitude and Differential Cross Section 2.2 The Born Approximation2.2.1 Yukawa potential- Rutherford Scattering2.3 Validity of the Born Approximation, Optical theorem 2.4 Method of Partial waves-Scattering by a perfectly rigid sphere2.5 Scattering by a square well potential - scattering length2.6 Ramsauer-Townsend effect, Resonance scattering-Breit-Wigner formula.

Text Books

1. A modern approach to Quantum Mechanics, Townsend.
2. Modern Quantum Mechanics, J.J. Sakurai, Revised Edition.

Unit III

Introduction to Relativistic Quantum Mechanics (18 hrs)

3.1 Klein-Gordon equation-plane wave solutions 3.1.1 Interpretation -Probability conservation 3.1.2 Covariant notation 3.2 Derivation of Dirac equation 3.2.1 conserved current representation - large and small components 3.3 Approximate Hamiltonian for electrostatic problem 3.4 Free particle at rest -plane wave solutions -

gamma matrices 3.5 Relativistic covariance of Dirac equation 3.6 Angular momentum as constant of motion.

Text Book

1. Advanced Quantum Mechanics, J.J. Sakurai, Pearson Education (Chapter 3)

Unit IV

Classical Field Theory (8 hrs)

4.1 Euler-Lagrange equation for fields 4.2 Hamiltonian formulation – functional derivatives 4.3 Conservation laws for classical field theory - Noether's theorem

Non-Relativistic Quantum Field Theory(12 hrs)

4.4 Quantization rules for Bose particles, Fermi particles - relativistic quantum field theory4.5 Quantization of neutral Klein Gordon field 4.6 Canonical quantization of Dirac field 4.6.1 Plane wave expansion of field operator 4.6.2 Positive definite Hamiltonian

Text Book

1. Field Quantization, W Greiner , J Reinhardt, Springer, (Chapter 2, 3,4 & 5)
2. Quantum mechanics - V.K. Thankappan, New Age Int. Publishers

Reference Books:

1. Quantum Field Theory, Lewis H. Ryder, Academic Publishers, Calcutta,1989
2. Quantum Field Theory, Claude Itzykson& Jean Bernard Zuber, MGH, 1986
3. Introduction to Quantum Field Theory, S.J. Chang, World Scientific, 1990
4. Quantum Field Theory, Franz Mandl& Graham. Shaw, Wiley 1990

PH020304: COMPUTATIONAL AND ELECTRONICS PRACTICALS

Credit-5 (180 hours)

(Minimum of 12 Experiments should be done)

(Experiments from 1 to 15 are C++ programs)

1. Motion of a spherical body in a viscous medium
2. Projectile motion and motion of a satellite
3. SHM – damped and forced oscillations
4. Formation of standing waves
5. Young's double slit – interference
6. Diffraction due to a grating
7. Polarisation and birefringence
8. Electric field due to a point charge and equi-potential surface
9. Motion in electric and magnetic fields – cyclotron
10. Solution of a differential equation – Runge kutta method
11. The variation of magnetic field with critical temperature in superconductivity
12. Finding the roots of a non-linear equation by bisection method
13. Solution of non linear differential equation - Bisection method
14. Numerical integration - rectangular method
15. Numerical integration - Simpson's rule
16. Microprocessor (use a PC or 8086-µp kit) – Find the largest and smallest of numbers in array of memory.
17. Microprocessor (use a PC or 8086-µp kit)– Sorting of data in ascending and descendingorder
18. Microprocessor (use a PC or 8086-µp kit)– Measurement of Multi channel analog voltageusing AC cards.
19. Microprocessor (use a PC or 8086-µp kit) – Conversion of Hexadecimal number to ASCII and vice versa.
20. Design and construct a RF oscillator using transistor. Measure the frequency and compare it with the designed value. Repeat the same for at least two capacitors.
21. Design and construct a pulse width modulator using IC 741.
22. Design and construct a full wave controlled rectifier using IC 2P4M.

23. Generation of Frequency modulation using IC555 timer. Confirm the modulation index and repeat the experiment for minimum three input signal voltages.
24. Design and generation of Inverting and difference amplifiers using OP AMP
25. Generation of low distortion sine wave using OP AMP.
26. Design and construct a 4-bit binary synchronous counter using JK flipflops also constructthe up counter/a down counter.
27. Design and construct a shift register using JK flipflops.
28. Design and construct a pulse amplitude modulator. Measure its output wave form.
29. To study Ripple Counter using Flip flops.
30. Design and setup half adder and full adder circuits and verify the truth tables (a) using X- OR and NAND gates (b) using NAND gates alone.
31. Design and construct Instrumentation amplifier using a transducer
32. Frequency modulation and demodulation using IC –CD4046.
33. FET: Study of static drain characteristics and calculations of various parameters
34. Study of Multiplexer and Demultiplexer IC.

SEMESTER – IV

PH020401: ATOMIC AND MOLECULAR SPECTROSCOPY

Credit-4 (90 hours)

Objective of the course: Objective of the course is to learn atomic, molecular and spin resonance spectroscopy. At the end of the course, the leaner will able to (i) describe the atomic spectra and change in behaviour of atom in external applied electric and magnetic field (ii) explain rotational, vibrational, electronic and Raman spectra of molecules (iii) describe electron spin and nuclear magnetic resonance spectroscopy and their applications**.**

Unit I

Atomic Spectra (18 hrs)

1.1 Vector atom model-electron spin- Stern-Gerlach experiment 1.2 LS and jj coupling schemes-spectroscopic terms-Pauli's exclusion principle1.3Spin-orbit interaction-interaction energy-interaction energy in LS and jj coupling schemes 1.4 Selection rule-Hund's rule-Lande interval rule 1.5 Normal and anomalous Zeeman

effect -Paschen-Back effect 1.6 Stark effect in one electron systems-hyperfine structure-width of spectral lines.

Text Books

1. Atomic and Molecular Spectra: Laser – Raj Kumar
2. Spectroscopy (Vol. 2 & 3), B.P. Straughan & S. Walker, Science paperbacks 1976

Unit II

Resonance Spectroscopy (18 hrs)

2.1 ESR-Theory- Relaxation process- g factor- Experimental setup -Hyperfine structure applications 2.2 NMR- Theory -Relaxation process-Experimental technique-Chemical shift- Spin-spin coupling-applications. 2.3 Mössbauer effect-Theory-Experimental technique- Chemical isomer shift magnetic hyperfine interactions- Electric quadrupole interaction-applications

Text Book

1. Fundamentals of molecular spectroscopy – Colin N Banwell and Elaine M .McCash

Unit III

Microwave Spectroscopy (18 hrs)

3.1 Classification of molecules- Rotational spectra of rigid diatomic moleculesExample of $CO_2$3.2 Isotopic effect-intensity of rotational lines- Non rigid rotator- Example of HF 3.3 Linear polyatomic molecules-symmetric top molecules
3.4 Microwave spectrometer-information derived from rotational spectra. 3.5 Infrared Spectroscopy -Vibrational energy of anharmonic oscillator -Diatomic vibrating rotator- Morse curve –IR spectra – Spectral transitions and selection rule 3.6. Breakdown of Born - Openheimer approximation - vibrational spectra of polyatomic molecules3.7 Normal modes of vibration of H_2O and CO_2 - overtones and combinations - Influence of rotation on the spectra of linear and symmetric top molecules 3.8 IR spectroscopic analysis - FT-IR spectroscopy

Text Book

1. Fundamentals of molecular spectroscopy – Colin N Banwell and Elaine M .McCash

Unit IV

Raman Spectroscopy (18hrs)

4.1 Raman effect- theory 4.2 Rotational Raman spectra-linear molecules-symmetric top molecules 4.3 Vibrational Raman spectra-rotational fine structure 4.4 Raman activity-mutual exclusion principle 4.5 Structure determination using Raman and IR spectroscopy 4.5.1 Laser Raman spectrometer-Techniques and instrumentation Near Infra red FT Raman spectroscopy 4.6 Hyper Raman Effect-classical treatment and experimental techniques 4.7Stimulated ,Inverse, coherent Antistokes and Photoacoustic Raman scattering.

Unit V

Electronic Spectroscopy (18hrs)

5.1 Electronic spectra of diatomic molecules- progressions and sequences 5.2 Frank Condon principle- rotational fine structure of electronic vibration spectra 5.3 Fortrat parabola - dissociation- pre dissociation 5.4 Fluorescence and phosphorescence - Photoelectron spectroscopy-principle instrumentation 5.5 Informations from Photoelectron spectra- Auger electron spectroscopy-X Ray Fluorescence.

Text Book

1. Molecular structure and spectroscopy, G. Aruldhas, PHI.

Reference Books:

1. Introduction of Atomic Spectra, H.E. White, Mc Graw Hill
2. Raman Spectroscopy, D.A. Long, Mc Graw Hill international, 1977
3. Introduction to Molecular Spectroscopy, G.M. Barrow, Mc Graw Hill
4. Molecular Spectra and Molecular Structure, Vol. 1, 2 & 3. G. Herzberg, Van Nostard, London.
5. Elements of Spectroscopy, Gupta, Kumar & Sharma, Pragathi Prakshan
6. The Infra Red Spectra of Complex Molecules, L.J. Bellamy, Chapman & Hall.Vol. 1 & 2.
7. Laser Spectroscopy techniques and applications, E.R. Menzel, CRC Press, India.

ELECTIVES

BUNCH-A: MATERIAL SCIENCE-I SPECIALIZATION

PH840301: THIN FILM SCIENCE AND CRYSTAL GROWTH TECHNIQUES

Credit-3 (54 hours)

Objective of the course: At the end of this course student will be able to : i) Have the basic knowledge about the physics behind thin film and crystal growth mechanism ii) Have the understanding of vacuum techniques used for thin film growth iii) Have the knowledge about characterization methods and application of thin films iv) Have the basic theory of crystal growth v) Have the understanding of a variety of crystal growth mechanism vi) Have the understanding of thin film and crystal growth preparation techniques

UNIT I

Thin Film (18 hrs)

1.1 Nucleationof thin films – Langmuir theory of condensation 1.2 Theories of nucleation – Liquid like coalescence and growth process – Epitaxial growth

1.2 Vacuum pumps and gauges– Exhaust pumps-rotary oil pump-molecular pump-diffusion pumps-Pirani gauge-penning gauge 1.4 Thickness measurement – optical methods-thickness monitor method 1.5 Properties of thin films- Morphological and structural properties-electrical and optical and properties 1.6 Applications of thin films- thin film as protective coating-thin film photovoltaic cells-thin film batteries-discrete resistive components

Text books

1. Thin film phenomena, K.L Chopra, McGraw Hill, New York

2. Thin film fundamentals, A. Goswami, New Age International

UNIT II

Crystal Growth from Melt and Solution Growth (20 hrs)

2.1 Growth techniques- from the melt - the Bridgmann technique – crystal pulling

2.2 Czocharalski method- experimental set up - controlling parameters advantages and disadvantages. 2.3 Convection in melts – liquid solid interface shape - crystal growth by zone melting 2.4 Verneuil's flame fusion technique. Low temperature solution growth 2.5 Methods of crystallization - slow cooling, solvent evaporation, temperature gradientmethods

Text book

1. P. SanthanaRagavan and P. Ramasamy, Crystal Growth Processes and Methods, KRU Publications, Kumbakonam (2001)

UNIT III

Deposition Techniques (16 hrs)

3.1 Physical vapour deposition – Resistive heating-flash evaporation-arc evaporation-exploding wire technique-electrode beam heating 3.2 Chemical vapour deposition (CVD)- pyrolysis, hydrogen reduction mechanism, polymerization3.3 Cathodic sputtering-glow discharge sputtering, low pressure sputtering, AC and Dc Magnetron sputtering3.4 Sol Gel method- Dip coating -Spin coating method3.5 Pulse laser deposition technique- hydrothermal growth.

Text books

1. Thin film phenomena, K.L Chopra, McGraw Hill, New York
2. Vacuum deposition of Thin films, L. Holland, Chapman Hall, London

Reference Books:

1.J.C. Brice, Crystal Growth Processes, John Wiley and Sons, New York (1986)
2.Handbook of thin film Technology, L.I Maissel and R Glang, McGraw Hill
3. Thinfilm deposition: Principles and practice-Donald.L. Smith
4. Materialscience of thinfilms-Milton Ohring
5. Optical Properties of Thin Films, O. S. Heaven, Dover Publications
6. Crystallography for Solid State Physics: Verma & Shrivastava

PH840402: NANOSCIENCE AND NANOTECHNOLOGY

Credit-3 (90 Hours)

Objective of the course: On successful completion of the course the students will be able to understand the synthesis and properties of the nanoparticles, Distinguish the functionality of nanomaterial and their structural characteristics, Have an idea about nano electronics, Nanomagnetiam and different carbon based nanostructures .

Unit I

Introduction to Nanoscience& Synthesis of Nanomaterials (18 hrs)

1.1Definition of nanotechnology, Current technologies and problem, Nano the Beginning 1.2 Nano and energetics, Nano and implication 1.3 General issues of concern of Synthesis of Nanomaterial 1.4 Synthetic methods: the common issue of concern 1.5 Variety in nanomaterials, Microemulsion based methods for nanomaterial 1.6 Solvothermal synthesis 1.7synthesis using support, using biology 1.8 Inert gas condensation.

Text book

1.A textbook of nanoscience and nanotechnology, T. Pradeep, Tata McGraw-Hill Education.

Unit II

Theoretical understanding and PropertiesofIndividualNanoparticles (18 hrs)

2.1Quantum mechanics of low dimensional systems 2.2 Exciton confinement in quantum dots 2.3 Quantum mechanics of confined nanoclusters 2.4 Band Gap engineering and optical response 2.5 Metal Nanoclusters :Magicnumbers , Geometric Structure, Electronic Structure, Reactivity, Fluctuations, Magnetic Clusters Bulk to Nanotransition2.6 Semiconducting Nanoparticles: Optical Properties, Photofragmentation , Coulombic Explosion 2.7 Rare Gas and Molecular Clusters: Inert-Gas Clusters, Superfluid Clusters

Text books

1. Introduction to Nanotechnology - Charles P. Poole Jr. and Franks. J. Qwens
2. A textbook of nanoscience and nanotechnology, T. Pradeep, Tata McGraw-Hill Education.

Unit III

Structural Characterization of Nanomaterials(18 hrs)

3.1 Scanning Electron Microscopy (SEM) 3.2 Transmission Electron Microscopy (TEM), Environmental TEM, Scanning Transmission electron Microscopy (STEM), 3.3 In situ nano measurements, EELS 3.4 Electron Diffraction as Tool 3.5 Scanning Tunnelling Microscopy (STM) 3.6 Atomic Force Microscopy 3.7 Confocal Microscopy, Scanning near field optical microscopy (SNOM). 3.8 X-ray diffraction (XRD), Small angle X-ray scattering (SAXS)

Text book

1. A textbook of nanoscience and nanotechnology, T. Pradeep, Tata McGraw-Hill Education.

Unit-IV

Carbon Nano structures& Special Nanomaterials(18 hrs)

4.1. Carbon fullerenes, Fullerene-derived crystals, Carbon nanotubes 4.2. Micro and Mesoporous Materials:Ordered mesoporous structures, Random mesoporous structures, Crystallinemicroporous materials: zeolites 4.3Core-Shell Structures: Metal-oxide structures, Metal-polymer structures, Oxide-polymer structures 4.4 Organic-Inorganic Hybrids: Class I hybrids, Class I1 hybrids 4.5. Intercalation Compounds 4.6 Nanocomposites and Nanograined Materials.

Text book

1. Nanostructures and Nanomaterials - Synthesis, Properties and Applications – Guozhong Cao, Imperial college press

Unit V

Molecular electronics, Nanolithography, Nanomagnetiam (18 hrs)

5.1 Molecules and experimental advance 5.2 Mechanism of molecular transport and advanced application 5.3 Lithography Concepts and definition 5.4 Photolithography,

scanning probe lithography, soft lithography 5.5 Nano manipulation5.6 Basics of magnetisam, magnetic nanostructures 5.7 Magnetisam of nanosized materials
5.8 Application of nanomagnetic materials

Text book

1.A textbook of nanoscience and nanotechnology, T. Pradeep, Tata McGraw-Hill Education.

Reference Books: .

1. Introduction to nanoscience and nanotechnology. Chris Binns,. John Wiley & Sons
2. Basic Principles of Nanotechnology, By Wesley C. Sanders, CRC Press
3. Textbook of nanoscience and nanotechnology. B. S. Murty, Springer
4. Handbook of microscopy for nanotechnology. Nan Yao, Lin Wang Zhong, Kluwer academic publishers.
5. Nano: the essentials.T. Pradeep, Tata McGraw-Hill Education.
6. Fundamentals of nanotechnology, G. L Hornyak, H. F. Tibbals, J. Dutta, & , J. J Moore. CRC press.
7. Introduction to Nanoscience, Gabor L. Hornyak, Joydeep Dutta, H.F. Tibbals, Anil Rao, CRC Press
8. Handbook of Nano Physics Nanoparticles and Quantum Dots Klaus D Sattler CRC Press Taylor and Francis Group

PH840403: MATERIALS SCIENCE AND ENGINEERING

Credit - 3(90 Hours)

Objective of the course: The course is primarily designed for Material science students. Therefore, focus of the course is on structural materials. The course is hoping to address both theoretical and practical aspects of materials science and engineering. To serve this purpose, the course is divided into five different units. a) Bonding in materials, b) imperfections and diffusion mechanism c) Polymer structure, d) Mechanical properties and e) different Types and Applications of Materials.

Unit I

Atomic Structure and Interatomic Bonding in materials (18 hrs)

1.1 Historical Perspective of Materials Science 1.2 Classification of Materials - Fundamental Concepts of Electrons in Atoms -The Periodic Table 1.3 Atomic Bonding In Solids : Bonding Forces and Energies 1.4 Primary Interatomic Bonds: Ionic Bonding, Covalent Bonding, Metallic Bonding 1.5 Secondary Bonding or Van der Waals Bonding 1.6 Molecules- Crystal Structures: Fundamental Concepts, Unit Cells 1.7 Metallic Crystal Structures.

Text book

1. Fundamentals of Materials Science and Engineering: An Interactive e.Text, 5th Edition by William D. Callister and William D. Callister Jr. Wiley

Unit II

Imperfections and Diffusion in solids(18 hrs)

2.1 Point Defects in Metals - Point Defects in Ceramics 2.2 Impurities in Solids

2.3 Specification of Composition 2.4 Dislocations—Linear Defects -Interfacial Defects 2.5 Grain size Determination 2.6 Diffusion Mechanisms- Steady-State Diffusion , Nonsteady-State Diffusion 2.7 Factors That Influence Diffusion

Text book

1. Fundamentals of Materials Science and Engineering: An Interactive e.Text, 5th Edition by William D. Callister and William D. Callister Jr. Wiley

Unit III

Polymer Structures (18 hrs)

3.1 Hydrocarbon Molecules -Polymer Molecules -The Chemistry of Polymer Molecules 3.2 Molecular Weight, Shape and Structure 3.3 Molecular Configurations 3.4 Thermoplastic and Thermosetting Polymers- Copolymers 3.5 Polymer Crystallinity -Polymer Crystals

Text book

1. Fundamentals of Materials Science and Engineering: An Interactive e.Text, 5th Edition by William D. Callister and William D. Callister Jr. Wiley

Unit IV

Mechanical Properties (18 hrs)

4.1 Concepts of Stress and Strain 4.2 Elastic Deformation: Stress–Strain Behavior, Anelasticity 4.3 Elastic Properties of Materials 4.4 Mechanical behavior of metals: Tensile Properties, True Stress and Strain -Compressive, Shear and Torsional deformation 4.5Mechanical behavior of ceramics: Flexural Strength, Elastic Behavior 4.6Mechanical behavior of Polymers: Stress–Strain Behavior, Macroscopic Deformation – Hardness and other mechanical property considerations - Tear strength and hardness of polymers 4.7 Property variability and design/safety factors

Text book

1. Fundamentals of Materials Science and Engineering: An Interactive e.Text, 5th Edition by William D. Callister and William D. Callister Jr. Wiley

UnitV

Types and Applications of Materials (18 hrs)

5.1 Ferrous Alloys 5.2 Nonferrous Alloys 5.3 Types of ceramics: Glasses,Glass–Ceramics, Clay Products 5.4Refractories, Abrasives, Cements 5.5 Advanced Ceramics, Diamond and Graphite5.6 Types of polymers: Plastics, Elastomers, Fibers,Miscellaneous Applications5.7 Recycling issues in materials science and engineering

Text book

1. Fundamentals of Materials Science and Engineering: An Interactive e.Text, 5th Edition by William D. Callister and William D. Callister Jr. Wiley

References Books:

1. An Introduction to Materials Engineering and Science for Chemical and Materials Engineers: Brian S. Mitchell, Wiley
2. Materials Science and Engineering an Introduction, W. D. Callister, Jr., John, Wiley
3. Materials Science and Engineering A First Course 5 ed., V. Raghavan, Prentice Hall of India Pvt. Ltd.
4. Materials: Introduction and Applications, Witold Brostow and Haley E. Hagg Lobland, Wiley
5. Material science and Processses, A.K Hajara Choudhury, Indian Book Distributing Co

PH840404: MATERIAL SCIENCE PRACTICALS

Credit-5 (180 hours)

(Minimum of 12 Experiments should be done)

Section A

GENERAL MATERIAL SCIENCE EXPERIMENTS

1. Study the resistivity of a single crystal by four probe method at constant deviation of temperature and find the energy gap of the material.
2. Compare the capacitance of a ceramic and a polymer capacitance with temperature. Show that the dielectric constant of the ferroelectric material used in the ceramic capacitor follows Curie-Weiss law.
3. Study the variation of voltage with respect to temperature for a semiconducting material and determine the bandgap energy
4. Using hall effect set up, determine (a) Hall coefficient (b) Mobility of charge carriers (c) Carrier concentration.
5. Observe Zeeman effect and measure the shift of atomic energy levels in an external magnetic field.
6. Determine the absolute Seebeck co-efficient of copper and constantan as a function of temperature.
7. Study the para to ferroelectric transition in barium titanate and determine the Curie temperature.
8. Determine the young's modulus of a metal using strain gauge apparatus.
9. Study the variation in electrical conductivity with temperature of NaCl / KCl and determine the vacancy migration energy and formation energy of vacancy pairs.
10. Measure the absolute Seebeck coefficient of n-type and p-type Bismuth telluride.
11. Determine the Fermi energy and Fermi temperature of copper using CF bridge by measuring its temperature coefficient of resistance.
12. Ultrasonic Interferometer – ultrasonic velocity in liquids
13. Ultrasonic Interferometer – Young’s modulus and elastic constant of solids

Section B

ADVANCED MATERIALS EXPERIMENTS

1. Study the dependence of Hall coefficient on temperature and nature of majority charge carriers using Hall effect set-up.
2. Determine the Lande g-factor of electron using an ESR spectrometer
3. Determination of lattice constant of a cubic crystal with accuracy and indexing the Bragg reflections in a powder X-ray photograph of a crystal.
4. Determine the dipole moment of an organic molecule using a cylindrical capacitor.
5. Crystal growth-Slow evaporation technique- Determination of saturation coefficient and linear density
6. Synthesis of nano particle by Sol-gel method
7. Preparation of glassy materials using Solgel technique
8. Thin film fabrication using dip coating technique and its thickness measurements
9. Preparation of nano colloids by varying PH scale using chemical synthesis
10. Morphological analysis of nano particles using simulation technique and Sherrer equation
11. Electrical conductivity of electrolytes using conductivity meter and its PH measurements
12. Study the dielectric measurements of a material as a function of frequency using LCR Q-Meter.
13. Compare the optical absorption spectrum of a direct and an indirect bandgap semiconductor specimen using simulation technique and estimate the bandgap in each case.

Section C

OPTICS AND LASER PHYSICS EXPERIMENTS

1. Study the photo conductivity characteristics of a semiconducting material with the variation in light intensity.
2. Study the beam profile and determine the spot size of diode laser.
3. Verify Malu's law of polarization using laser.
4. Measure the coefficient of linear expansion of a solid by Fizeau's interferometer configuration.
5. Determination of the distance between the grooves of a Compact and Digital

versatile Disk using laser beam.

6. Compare the optical absorption spectrum of a direct and an indirect bandgap semiconductor specimen and estimate the bandgap in each case.
7. Determination of wavelength of an unknown light source using a compact disk.
8. Measurement of absorption coefficient of a given material using laser light.
9. Determination of Numerical aperture of an optical fibre
10. Determination of least count of the given meter scale using laser.
11. Determination particle size of given sample using a laser beam.
12. Determination of characteristics of a solar cell.
13. To study the photoelectric effect and determination of Plank's constant using LED.

BUNCH-B: MATERIAL SCIENCE-II SPECIALIZATION

PH850301: OPTOELECTRONICS

Credit -3 (54 Hours)

Objective of the course: The course is an introduction to the fundamentals of optoelectronics and principals of the optoelectronics devices. This course gives the students to acquire knowledge in the field of fibre optics technology. This course also provides the background in optoelectronics helps students to meet the demand of growing semiconductor optoelectronic industry and prepares them to advance study and research in the semiconductor optics and optoelectronic devices.

Unit I

Light emitting diode and Fibre Optics (18 hrs)

1.1Direct and indirect bandgap semiconductors, pn junction under forward and reverse bias 1.2 light emitting diodes, principle, device structures 1.3 LED materials, heterojunction high intensity LEDs 1.4 double heterostructure, LED characteristics and LEDs for optical fiber communications, surface and edge emitting LEDs. 1.5 Symmetric planar dielectric slab waveguide, waveguide condition, single and multimode waveguides 1.6 TE and TM modes, modal and waveguide dispersion in the planar waveguide, dispersion diagram, intermodal dispersion, intramodal dispersion, dispersion in single mode fibers, material dispersion, waveguide dispersion1.7 chromatic dispersion, profile and polarization dispersion, dispersion

flattened fibers, bit rate and dispersion1.8 optical and electrical bandwidth, graded index optical fiber 1.9 light absorption and scattering 1.10 attenuation in optical fibers.

Text books

1. Optoelectronics and Photonics: Principles and Practices, S.O. Kasap, Pearson, (2009)
2. Fiber optics and Optoelectronics, R.P. Khare, Oxford University Press, (2004),

Unit II

Laser principles, Photodetectors and photovoltaics (20 hrs)

2.1Laser oscillation conditions, diode laser principles, heterostructure laser diode 2.2 Double heterostructure, stripe geometry, buried heterostructure, gain and index guiding, laser diode characteristics, laser diode equation 2.3 Single frequency solid state lasers,distributed feedback, quantum well lasers, vertical cavity surface emitting laser, optical laser amplifiers. 2.4 Principle of p-n junction photodiode 2.5 Ramo‘s theorem and external photocurrent 2.6 Absorption coefficient and photodiode materials, quantum efficiency and responsivity 2.7 PIN-photodiode, avalanche photodiode, phototransistor, photoconductive detectors and photoconductive gain 2.8 Noise in photo-detectors, noise in avalanche photodiode, solar energy spectrum 2.9 Photovoltaic device principles I-V characteristics, series resistance and equivalent circuit, temperature effects 2.10 Solar cell materials, device and efficiencies

Text books

1. Optoelectronics and Photonics: Principles and Practices, S.O. Kasap, Pearson, (2009)
2. Laser fundamentals, William T. Silfvast, CUP 2nd Edn. (2009)

Unit III

Optoelectronic modulators and Non-linear optics (16 hrs)

3.1Optical polarization, birefringence 3.2 retardation plates, electro-optic modulators 3.3Pockels effect, longitudinal and transverse electro-optic modulators 3.4 Kerr effect, Magneto-optic effect 3.5 Acousto-optic effect, Raman Nath and Bragg-types. 3.6 Polarization response of materials to light 3.7 Harmonic generation, second harmonic generation 3.8 phase matching, third harmonic generation 3.9 Optical mixing, sum and difference frequencies 3.10 Parametric generation of light, self focusing of intense light beams.

Text books

1.Optoelectronics and Photonics: Principles and Practices, S.O. Kasap, Pearson, (2009)

2.Optoelectronics: an Introduction, J. Wilson and J.F.B. Hawkes, PHI, (2000)

3. Lasers and non-linear optics, B. B. Laud, New Age Pub (2011).

Reference Books:

1. Semiconductor optoelectronic devices: Pallab Bhattacharya, Pearson(2008)

2. Optoelectronics: An introduction to materials and devices, Jasprit Singh, McGraw Hill International Edn., (1996).

3. Optical waves in crystals: Propagation and Control of Laser Radiation, A. Yariv and P. Yeh, John Wiley and Sons Pub. (2003)

PH850402: SEMICONDUCTOR DEVICES

Credit-3 (90 Hours)

Objective of the course: Objectives of this subject ensures the students to expand their knowledge in semiconductor physics and provide a foundation for further advanced studies. After completing the course the student will (1) understand the fundamental concepts of charge carriers transport phenomenon in semiconductors (2) Understand the concepts of p-n junction (3) Understand the mode of operations of bipolar transistors (4) Understand the features of Metal-semiconductor and semiconductor hetero-junctions (5) This course also provides the perceptives ofIntegrated Circuit Fabrication and Characteristics

Unit I

Carrier transport phenomena (18 hrs)

1.1 Carrier transport phenomena - carrier drift 1.2Drift current density - mobility effects- conductivity1.3 Velocity saturation - carrier diffusion- diffusion current density- total current density 1.4 Nonequilibrium excess carriers in semiconductors 1.5Semiconductor in equilibrium 1.6 Excess carrier generation and recombination-characteristics of excess carriers 1.6 Continuity equation 1.7Ambipolar transport 1.8Dielectric relaxation time constant- quasi Fermi energy levels 1.9 Excess carrier life time-surface effects.

Text book

1. Semiconductor Physics and Devices, Donald A. Neamen, McGraw Hill

Unit II

PN junction(18 hrs)

2.1 Basic structure of a p-n junction 2.2Built in potential- electric field 2.3 Space charge widths 2.4 Forward and reverse biasing 2.5 Junction capacitance- one sided junctions 2.6 p-n junction current- ideal current voltage relationship 2.7 Boundary conditions, minority carrier distribution 2.8Ideal p-n junction current, temperature effects, short diode 2.9Generation-recombination currents-reverse bias generation current 2.10 forward bias recombination current- total forward bias current-junction breakdown.

Text book

1. Semiconductor Physics and Devices, Donald A. Neamen, McGraw Hill

Unit III

Metal-semiconductor and semiconductor hetero-junctions(18 hrs)

3.1 Metal-semiconductor - Schottky barrier diode - qualitative characteristics – ideal junction properties 3.2 Current voltage relationship, Comparison with junction diode 3.3 Metal semiconductor ohmic contact 3.4 Ideal non rectifying barriers – tunneling barrier – specific contact resistances 3.5 Semiconductorhetero-junctions – hetero-junction materials – energy band diagram –Twodimensional electron gas 3.6 Equilibrium electrostatics

Text book

1. Semiconductor Physics and Devices, Donald A. Neamen, McGraw Hill

Unit IV

Bipolar transistor(18 hrs)

4.1 Bipolar transistor action-basic principle of operation 4.2 Simplified transistor current relations 4.3 Modes of operation- amplification with bipolar transistors 4.4 Minority carrier distribution4.5 Forward active mode- low frequency common-base current gain 4.6 Contributing factors, non-ideal effects-high injection 4.7 current crowding- breakdown voltage 4.8 Transistor equivalent circuit models- Elbers-Moll

model-frequency limitations- time delay factors 4.9 Transistor cutoff frequency-large signal switching-switching characteristics.

Text books

1. Solid state electronic devices, Streetman and Banerjee, PHI (2010).
2. Physics of Semiconductor Devices, Michael Shur, PHI (2002).
3. Introduction to Semiconductor materials and Devices, M.S. Tyagi, John Wiley and Sons (2000)

Unit V

Integrated Circuit Fabrication and Characteristics (18 hrs)

5.1 Integrated circuit technology – basic monolithic IC – epitaxial growth –marking and etching 5.2 Diffusion of impurities – transistor for monolithic circuit 5.3.Monolithic diodes – integrated resisters, capacitors and inductors5.4 monolithic circuit layout - additional isolation methods -MSI, LSI, VLSI– the metal semiconductor contact.

Text book

1. Integrated Electronics-Analogue and Digital Circuits and Systems, J Millmann and C CHalkias, TMGH

Reference Books:

1. 0000 to 8085 Introduction to Microprocessors for Engineers and Scientists.- P.K. Gosh & P.R. Sridhar, PHI
2. Advanced microprocessors and peripherals, A.K. Ray & K.M. Burchandi –TMH.
3. Microprocessor and microcontroller, R. Theagarajan- SCITECH Publications India Pvt. Ltd.
4. Microprocessor and Peripherals, S.P. Chowdhury& S. Chowdhury- SCITECH Publications
5. Operating system Principles, Abraham Silberschatz& Peter Baer Galvin & Greg Gagne, John Wiley
6. Solid state electronic devices, Streetman and Banerjee, PHI (2010).
7. Physics of Semiconductor Devices, Michael Shur, PHI (2002).
8. Introduction to Semiconductor materials and Devices, M.S. Tyagi, John Wiley and Sons (2000)

PH850403: CERAMICS AND BIOMATERIALS

Credit - 3 (90 Hours)

UNIT I

Ceramics (18 hrs)

1.1 Introduction to ceramic materials, 1.2 Structure of oxide and nonoxide ceramics, 1.3 Review of defects and diffusion in ionic solids, 1.4 Ionic conductivity. 1.5 Linear dielectrics, 1.6 Frequency dependence of polarization and associated mechanisms, Impedance spectroscopy, 1.7 Breakdown mechanisms, 1.8 Material design for dielectric constants, 1.9 Dielectric materials for microwave, 1.10 thin film capacitor

Text Books

1. Ceramic Materials - Science and Engineering , C. Barry Carter, M. Grant Norton, SpringerScience & Business Media
2. Principles of Electronic Ceramics, L.L. Hench and J. K. West, Wiley

Unit II

Ferroelectric Ceramics (18 hrs)

2.1 Non-linear dielectrics, 2.2 Structural origin of non-linear behaviour, 2.3 Ferroelectrics and Piezoelectrics, 2. 4 Thermodynamic formulation of ferroelectrics, 2.5 Domains, Applications of ferroelectric bulk and thin films, 2.6 Microstructure - property relationships, Applications of piezoelectric materials in transducers, 2.7 electrochemical filters and positioning devices. 2.8 Electro-optic ceramics: Optical phenomena - birefringence, 2.9 linear and quadratic electro-optic effects (Pockels and Kerr)

Text Book

1. Ceramic Materials - Science and Engineering , C. Barry Carter, M. Grant Norton, Springer Science & Business Media

Unit III

Magnetic ceramics (18 hrs)

3.1 Magnetic ceramics and their applications in power transformers, filters, microwave ferrites, recording media, etc. 3.2 New high permeability materials, 3.3 Novel recording media, 3.4 Giant and collosal magneto-resistance, 3.5 Magneto-

electronics. 3.6 High temperature super- conductors: Review of superconductivity and their applications to high field magnets, 3.7 Josephson junction.

Text Book

1. Magnetic Ceramics, Raul Valenzuela, Cambridge University Press

Unit IV

Biomaterial (18 hrs)

4.1 Atomic description of biomolecules: DNA, RNA, and proteins; 4.2 forces and energetic in living systems: cells; 4.3 Statistical physics in biology: energy and entropy in complex biomolecules, 4.4 molecular machines; Molecular modeling of biological problems: Brownian motion and diffusion, 4.5 protein folding, enzyme reaction; 4.6 Biomechanics: statics and human anatomy, 4.7 mechanics of motion.

Text Books

1. Nelson P., Biological Physics: Energy, Information, Life, Freeman.
2. Dill Ken and Bromberg Sarina, Molecular Driving Forces: Statistical thermodynamics in Biology, Chemistry, Physics and Nanoscience, Garland Science.

Unit V

Analysis Techniques (18 hrs)

5.1 Quantitative measurement techniques to investigate biological problems: 5.2. Nuclear magnetic resonance spectroscopy: working, application 5.3 Raman spectroscopy, 5.4 ultrafast spectroscopy, 5.5 magnetic resonance imaging, 5.6 optical microscopy, 5.7 Transmission electron microscopy

Text Books

1. Lodish H. et al., Molecular Cell Biology, Freeman.
2. Alberts B. et. al., Molecular Biology of the Cell,Garland Science.

References Books:

1. Nonstoichiometry, diffusion and electrical conductivity in binary metal oxides, Per Kofstad, Wiley
2. Nonstoichiometric Oxides, O. Toft Sorensen, Academic Press

3. Electroceramics: Materials, Properties, Applications, A. J. Moulson, J. M. Herbert, Wiley
4. Transition Metal Oxides, C.N.R. Rao and B. Raveau, Wiley-VCH
5. Basic Solid State Chemistry, A.R. West, Wiley
6. Structure and Properties of Inorganic Solids, F.S. Galasso, Pergamon Press
7. A textbook of nanoscience and nanotechnology, T. Pradeep, Tata McGraw-Hill Education
8. Fundamentals of Materials Science and Engineering: An Interactive e.Text, 5th Edition by William D. Callister and William D. Callister Jr. Wiley

PH850404: ADVANCED MATERIAL SCIENCE PRACTICALS

Credit-5 (180 hours)

(Minimum of 12 Experiments should be done)

1. Determine the dielectric constant of a non-polar liquid using a cylindrical capacitor.
2. Measure the electrical and thermal conductivity of copper and determine the Lorentz number.
3. Crystal growth – Slow evaporation technique – determination of saturation coefficient and linear density.
4. Synthesis of nano particle by Sol-gel method
5. Preparation of glassy materials using Solgel technique
6. Thin film fabrication using dip coating technique and its thickness measurements
7. Morphological analysis of nano particles using simulation technique and Sherrer equation
8. XRD – Crystal structure determination Cubic/ Hexagonal
9. XRD – Determination of Crystal size and lattice strain
10. Electrical conductivity of electrolytes using conductivity meter and its PH measurements
11. Study the photo conductivity characteristics of a semiconducting material with the variation in light intensity.
12. Determine the dipole moment of an organic molecule using a cylindrical capacitor.
13. Using hall effect set up, determine (a) Hall coefficient (b) Mobility of charge

carriers (c) Carrier concentration.

14. Calibrate a thermocouple as a temperature sensor.
15. Study the beam profile and determine the spot size of diode laser.
16. Determine the absolute Seebeck co-efficient of copper and constantan as a function of temperature.
17. Determine the Lande g-factor of electron using an ESR spectrometer.
18. Determine the magnetic susceptibility of a paramagnetic solution by Quincke's method and hence prove that water is diamagnetic.
19. Verify Malu's law of polarization using a He-Ne laser.
20. Measure the coefficient of linear expansion of a solid by Fizeau's interferometer configuration.
21. Determination of track width and pit width for a CD/DVD using laser beam.
22. Measure the absolute Seebeck coefficient of n-type and p-type Bismuth telluride.
23. Study the photo conductivity characteristics of a semiconducting material with the variation in light intensity.
24. Study the dependence of Hall coefficient on temperature and nature of majority charge carriers using Hall effect set-up.
25. Determine the average wavelength of sodium D lines and the thickness of a glass slide using a Michelson Interferometer.
26. Determine the band gap energy of germanium using a reverse biased p-n junction diode.
27. Determine the drift mobility of carriers in a semiconductor specimen using Haynes-Shockley experiment.
28. Determine the minority carrier life time of a semiconductor specimen using photoconductive decay method.
29. Determine the dielectric constant of a sheet by using it as a parallel plate capacitor in an oscillator.
30. Determine the dielectric constant of ADP/ KDP crystal using electro-optic effect.
31. Study the resistivity of a single crystal by four probe method at constant deviation of temperature and find the energy gap of the material.
32. Compare the optical absorption spectrum of a direct and an indirect bandgap semiconductor specimen and estimate the bandgap in each case.
33. Determination of lattice constant of a cubic crystal with accuracy and indexing

the Bragg reflections in a powder X-ray photograph of a crystal.

34. Study the I-V characteristics, I-P characteristics, modulation bandwidth and output spectrum of an LED.
35. Determination of characteristics of a solar cell.
36. To study the photoelectric effect and determination of Plank's constant using LED.
37. Ultrasonic Interferometer – ultrasonic velocity in liquids
38. Study the dielectric property of a thin film using LCR Q-Meter.
39. Study the structural and melting transition in KNO_3 using a differential thermal analyzer

4.3 M.Sc. PHYSICS - MATERIAL SCIENCE

MODEL QUESTION PAPERS

MAHATMA GANDHI UNIVERSITY

PG-CSS PHYSICS MODEL QUESTION PAPER

First Semester

Faculty of Science

Physics- Material Science

PH020101: APPLIED MATHEMATICS FOR PHYSICS- I

(2019 admission onwards)

Time: 3 Hours Maximum Weight: 30

Part A

*Answer any **eight** questions.*

Each question carries 1 weight.

1. Define matric tensor.
2. Distinguish between contravariant and covariant tensor.
3. State Stokes theorem.
4. Show that for Hermitian matrices A & B, which obeys AB – BA = i C, C is also hermitian.
5. Show that $\nabla X(\nabla X \vec{A}) = \nabla (\nabla . \vec{A}) - \nabla^2 \vec{A}$
6. Calculate the work done when a force F = 3xy i – y^2 moves a particle in the xy – plane from (0, 0) to (1, 2) along the parabola y = $2x^2$.
7. Express $\nabla \phi$ in orthogonal curvilinear coordinates.
8. Write a note on inner product space.
9. Prove that Christoffel symbol of first kind is not a tensor.
10. Show that in Euclidian space the Geodesics create straight line.

(8 x 1 = 8)

Part B

*Answer any **six** questions.*

Each question carries 2 weights.

11. Obtain the Recurrence relation for Lauguerre polynomials:

$(n+1)\, L_{n+1}(x) = (2n+1-x)\, L_n(x) - n\, L_{n-1}(x)$

12. Show that rotation of co-ordinate is orthogonal transformation.

13. Diagonolize matrix

$$A = \begin{pmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{pmatrix}$$

14. Show that any inner product of the tensors $A^{p}{}_{r}\ B_{t}^{qs}$ is a tensor of rank 3.

15. Show that eigen values of hermitian matrix are real and its eigen vectors corresponding to two distinct eigen values are orthogonal.

16. Explain Poisson distribution with one example.

17. Prove the orthogonality relation for Bessel function

$\int_0^1 x J_n(\alpha x) J_n(\beta x) dx = 0$

18. Prove the relations (a) $H_n(-x) = (-1)^n H_n(x)$ (b) $H_n'(x) = 2nH_{n-1}(x)$

(6 x 2 = 12)

Part C

*Answer any **two** questions.*

Each question carries 5 weights.

19. Find $\nabla \cdot \vec{A}$ and $\nabla \times \vec{A}$ in orthogonal curvilinear coordinates.

20. Obtain generating function for Laguerre function and find the value of:$mJ_{1/2}(x)$ and $J_{+3/2}(x)$

21. Find the inverse of

$$A = \begin{pmatrix} 2 & 2 & 1 \\ 1 & 3 & 2 \\ 1 & 1 & 3 \end{pmatrix}$$

22. Write the mathematical form of generalized covariant derivative of a tensor of arbitrary rank? Derive the expression for j^{th} covariant derivative of a tensor?

(2 x 5 = 10)

MAHATMA GANDHI UNIVERSITY

PG-CSS PHYSICS MODEL QUESTION PAPER

First Semester

Faculty of Science

Physics- Material Science

PH020102: BASIC QUANTUM MECHANICS

Time : 3 Hours. Maximum Weight: 30

Part A

*Answer any **eight** questions.*

Each question carries 1 weight.

1. Write a note on Dirac's bra and ket notation.
2. Mention any two properties of inner product.
3. What is zero point energy of harmonic oscillator? Explain it with the help ofuncertainty principle.
4. What are the basic quantum numbers that designatethe states of hydrogen atom? Give the allowed values of these quantum numbers.
5. What is time evolution operator? Give its properties.
6. Observables are Hermitian operators. Why?
7. Why J_+ and J_- are called raising and lowering operator?
8. What are Pauli spin matrices? Explain their properties.
9. Explain the condition for validity of WKB approximation.
10. Distinguish between Schrodinger picture and Heisenberg picture.

(8 x 1 = 8)

Part B

*Answer any **six** questions.*

Each question carries 2 weights.

11. Discuss the Zeeman effect.
12. Derive the general uncertainty relationship.
13. Explain the variation principle for determining the ground state energy of a system.

14. State and explain Ehrenfest's theorem.
15. If L= r x p, prove that[Lx, Ly] = iħLz.
16. Derive matrices for the operators J^2, J_z, J_x and J_y for j= 3/2.
17. Explain Schrodinger and Heisenburg pictures in quantum mechanics
18. Explain Stern-Gerlach experiment.

(6 x 2 = 12)

Part C

*Answer any **two** questions.*

Each question carries 5 weights.

19. Comment on position and momentum space wave functions. Also prove that Gaussian wave packet is a minimum uncertainity wave packet.
20. Solve the problem of linear harmonic oscillator using creation and annihilation operators.
21. Obtain the matrix elements of J^2 and J_z in a representation in which J^2 and J_z are diagonal.
22. Derive an expression for transmission coefficients through a potential barrier.

(2 x 5 = 10)

MAHATMA GANDHI UNIVERSITY

PG-CSS PHYSICS MODEL QUESTION PAPER

First Semester

Faculty of Science

Physics- Material Science

PH020103: CONDENSED MATTER PHYSICS

(2019 admission onwards)

Time: 3 Hours. Maximum Weight: 30

Part A

*Answer any **eight** questions.*

Each question carries 1 weight.

1. What are ferroelectric crystals? Name any two components that exhibit ferroelectricity.
2. What are ferroelectric domains?
3. Differentiate Type1 and Type2 superconductors.
4. Differentiate diamagnetic and paramagnetic materials.
5. What is Hall Effect?
6. Explain the isotope effect in Super Conductivity.
7. Distinguish between acoustic and optical phonons.
8. Explain the effective mass of electron.
9. Explain Bloch theorem.
10. Explain harmonic approximation in lattice vibrations.

(8 x 1 = 8)

Part B

*Answer any **six** questions.*

Each question carries 2 weights

11. (a) For argon gas, N= $10^{19}cm^{-3}$, Z= 18 and r= 10^{-8}cm. Calculate the electronic polarization for an applied field of 10 KV/cm. (b) Silicon has the dielectric constant 12, and edge length of the conventional cubic cell of Silicon lattice is 5.43A^0. Calculate the electronic polarisability of Silicon atoms.

12. Show that the intermediate state consists of regions of normal and superconducting metal.

13. Show that how the London equations lead to the Meissner effect and the flux penetration through thin films of superconductors.

14. Discuss the normal and umklap process.

15. Explain the inelastic scattering of neutrons by phonons.

16. A two –dimensional hexagonal lattice spacing a = 3 A^0 , and one electron per unit cell. If the electrons are considered free within the two – dimentional plane, what is the Fermi energy $\mathbf{E_F}$ (Provide a numerical value in eV).

17. Derive an expression for the density of available electron states

18. Explain Wiedemann Franz law.

(6 x 2 = 12)

Part C

*Answer any **two** questions.*

Each question carries 5 weights.

19. What is single particle tunneling. Derive an expression for AC and DC Josephson effects.

20. Distinguish between diamagnetism and paramagnetism. Derive Langevin's diamagnetic equation.

21. Discuss Debye model of lattice heat capacity. Derive an expression for it.

22. What is Fermi surface? Discuss the construction of Fermi surfaces.

(2 x 5 =10)

MAHATMA GANDHI UNIVERSITY

PG-CSS PHYSICS MODEL QUESTION PAPER

First Semester

Faculty of Science

Physics- Material Science

PH020104: CLASSICAL MECHANICS AND RELATIVITY

Time: 3 Hours Maximum Weight: 30

Part A

*Answer any **eight** questions.*

Each question carries 1 weight.

1. State the Hamiltonian conservation theorem.
2. State and explain the least action principle.
3. Derive the relationship between Poisson bracket and Lagrange bracket.
4. How does the short wavelength limit of Schroedinger equation leads to Hamilton-Jacobi equation?
5. Discuss the nature of Coriolis' force.
6. What are the advantages of Hamiltonian formalism over Lagrangian formalism?
7. State the Kepler's laws of planetary motion.
8. Outline the principle of equivalence.
9. What is meant by a linear system and a non linear system?
10. What is Lyapunov exponent? What is its significance?

(8×1=8)

Part B

*Answer any **six** questions.*

Each question carries 2 weights.

11. Using Hamilton's equations, show that the angular momentum is conserved in a central force problem.
12. Using Poisson brackets, check whether the transformation defined by

    q = $\sqrt{2P}sinQ$

    p = $\sqrt{2P}cosQ$ is canonical.

13. Prove that the rotational kinetic energy is conserved in the torque free motion of a

rigid body.

14. For a diatomic molecule consisting of masses m1and m2 connected by a spring of force constant k vibrating along the line joining the masses, determine the normal frequencies and normal co-ordinates.

15. Solve the differential equation of a linear harmonic oscillator $\frac{d^2x}{dt^2} + \omega_o^2 x = 0$ by quadrature method.

16. Solve the problem of Harmonic oscillator by Hamilton-Jacobi method.

17.Obtain the Lagrangian for a charged particle moving in an electromagnetic field

18. Obtain the lagrangian equation for a spherical pendulum.

(6×2=12)

Part C

*Answer any **two** questions.*

Each question carries 5 weights.

19. What is Hamilton's principle? Obtain Lagrange's equations from Hamilton's principle using the calculus of variation.

20. Obtain the Lagrange's equations for small oscillations of a system of two coupled oscillators in the neighborhood of stable equilibrium.Obtain the normal modes and the normal co-ordinates. .

21. Discuss the precessional motion with and without nutation of a spinning symmetrical top under gravity.

22. Derive Einstein's field equations. (ii).Write a note on gravitational red shift.

(5×2=10)

MAHATMA GANDHI UNIVERSITY

PG-CSS PHYSICS MODEL QUESTION PAPER

Second Semester

Faculty of Science

Physics- Material Science

PH020201: APPLIED MATHEMATICS FOR PHYSICS – II

(2019 admission onwards)

Time: 3 Hours Maximum Weight: 30

Part A

*Answer any **eight** questions.*

Each question carries 1 weight.

1. If $f(z) = \sin z$, show that $f^*(z) = f(z^*)$ for complex z.
2. Check whether $f(z) = i^z$ is analytic.
3. Explain cyclic group with example.
4. Prove that inverse of any element of group is unique.
5. Write down two partial differential equations and their relevance in physics.
6. Write short note on the different boundary conditions employed to solve differential equations.
7. Obtain the Laplace transform of $f(x) = x^n$
8. Define the Fourier transform of a function $f(x)$. What is the Fourier transform of its first derivative?
9. What is meant by Earth's Nutation?
10. Explain SU (3) flavor symmetry and SU(3) colour symmetry.

(8 x 1 = 8)

Part B

*Answer any **six** questions.*

Each question carries 2 weights.

11. Evaluate $\int_C \frac{2z-1}{z(z+1)(z+3)}dz$, where C is $|Z| = 2$ using Residue Theorem.

12. Obtain the Laurent expansion of the function $f(z)$ about $z = z_0$.

13. Show that the Fourier transform of a Gaussian function is another Gaussian.

14. Prove that the set of all matrices $\begin{pmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{pmatrix}$ for $0 \leq \theta \leq 2\pi$ form a Lie group.

15. State and prove convolution theorem of Laplace transforms.

16. Separate the partial differential equation $\nabla^2 \psi(\rho, \phi, z) + k^2 \psi(\rho, \phi, z) = 0$ in to three ordinary differential equations.

17. Obtain the momentum representation of a wave function $\psi(x) = \sqrt{a}\ \exp(-x^2/2a^2)$

18. Obtain a general solution of Laplace equation in circular cylindrical co-ordinates.

(6 x 2 = 12)

Part C

*Answer any **two** questions.*

Each question carries 5 weights.

19. State and prove Cauchy's integral theorem. Deduce Cauchy's integral formula from it.

20. State Schur's lemmas and prove the great Orthogonality theorem.

21. Solve the differential equation for the electric charge in a series LCR circuit using Laplace transform.

22. Solve Poisson's Equation using Green's function.

(2 x 5 = 10)

MAHATMA GANDHI UNIVERSITY

PG-CSS PHYSICS MODEL QUESTION PAPER

Second Semester

Faculty of Science

Physics- Material Science

PH020202: ELECTRODYNAMICS AND ELECTROMAGNETIC WAVES

(2019 admission onwards)

Time: 3 Hours Maximum Weight: 30

Part A

*Answer any **eight** questions.*

Each question carries 1 weight.

1. Write a short note on Maxwell's stress tensor.
2. State and explain second uniqueness theorem.
3. Why TEM wave cannot propagate through a wave guide?
4. Show that the four dimensional divergence of current density 4- vector is divergenceless.
5. Discuss the significance of Jefimenko's Equations.
6. What is meant by gauge transformation?
7. Write a short note on radiation reaction.
8. What is meant by dispersion in dielectrics?
9. Define proper velocity and proper time.
10. Obtain the expression for momentum of monochromatic plain waves.

(8 x 1 = 8)

Part B

*Answer any **six** questions.*

Each question carries 2 weights.

11. From Maxwell's equations obtain wave equation for an electromagnetic field. Identify the velocity of propagation.
12. Prove that dipole moment is independent of choice of origin if total charge of the system is zero.
13. For a TM wave between parallel plate, find the expression for cut off frequency.

14. A pion at rest decays into a muon and a neutrino. Find the energy of outgoing muon interms of 2 masses, m_π and m_μ ,(assume m_ν=0).
15. Obtain an expression for the fields of a moving point charge.
16. Show that $E^2 - c^2B^2$is relativistically invariant.
17. Show that when a uniform plane wave propagates in a good conductor, the magnetic field lags electric field by 45°.
18. Prove that R + T = 1 for a wave incident normally on a boundary separating two media.

(6 x 2 = 12)

Part C

*Answer any **two** questions.*

Each question carries 5 weights.

19. What is Poynting vector? Show that for a lossless medium, the total power flowing into a closed surface equal to the rate of increase of electric and magnetic energies in the closed volume.
20. Reformulate Maxwell's equations using relativistic tensor notation of fields.
21. Explain electric dipole radiation.
22. Explain the propagation TE waves in rectangular waveguide.

(2 x 5 = 10)

MAHATMA GANDHI UNIVERSITY

PG-CSS PHYSICS MODEL QUESTION PAPER

Second Semester

Faculty of Science

Physics- Material Science

PH020203:ADVANCED ELECTRONICS AND COMMUNICATION

(2019 admission onwards)

Time: 3 Hours Maximum Weight: 30

Part A

*Answer any **eight** questions.*

Each question carries 1 weight.

1. Do we get a voltage follower with inverting amplifier? Explain.
2. Explain slew rate.
3. Explain the working of zero crossing detectors.
4. Distinguish between FET and JFET.
5. Explain the performance of a summing amplifier.
6. Discuss balanced modulator.
7. Explain the fundamental principle of VCO with a diagram.
8. Give the effect of variation in power supply voltage on offset voltage.
9. What determines peaking frequency in the peaking amplifier?
10. Explain the frequency response of an op-amp.

(8 x 1 = 8)

Part B

*Answer any **six** questions.*

Each question carries 2 weights.

11. Draw and explain the operation of a triangular wave generator.
12. Calculate the exact voltage gain of a negative voltage series feedback OP-AMP circuit from the following data. Open loop voltage gain = 1000, feedback resistor, R_F= 22K, and series resistor R_1= 1K.

13. The CMRR of an OP-AMP is ratedat 80db.If its common mode gain is measured as 0.5, calculate the o/p corresponding to a differential input of 10μV.
14. What are the different types of pulse modulation? Explain with waveforms, how it is derived from PWM.
15. Explain how sinusoidal waves are generated in an OP-AMP Wien bridge oscillator circuit.
16. Briefly explain the working of an integrator.
17. Briefly explain voltage series feedback in op-amps.
18. What are the applications of IC565PLL

(6 x 2 = 12)

Part C

*Answer any **two** questions.*

Each question carries 5 weights.

19. What is frequency modulation? Explain FM generation and detection.
20. Draw the two differential amplifier configurations based on the no of Op-Amps used. Calculate the voltage gain, input resistance, output resistance of a differential amplifier using any of the two configurations.
21. Discuss closed loop frequency response of an Op-Amp and briefly explain circuit stability.
22. Explain the action of a low – pass first order Butterworth filter.How it is converted into a second order filter? Draw the frequency response curves.

(2 x 5 = 10)

MAHATMA GANDHI UNIVERSITY

PG-CSS PHYSICS MODEL QUESTION PAPER

Second Semester

Faculty of Science

Physics- Material Science

PH020204: ADVANCED NUCLEAR PHYSICS

(2019 admission onwards)

Time: 3 Hours Maximum Weight: 30

Part A

*Answer any **eight** questions.*

Each question carries 1 weight.

1. What are quarks? Name the different flavours of quarks.
2. Distinguish between leptons and hadrons.
3. The binding energy per nucleon is low at low mass numbers and high mass numbers. Explain.
4. Explain the ground state of deuteron. Plot the wave function for the deuteron ground state taken as an S-state.
5. Express the Gell-mann-Nishijima formula.
6. What are isomeric transitions?
7. Explain Q value of nuclear reaction.
8. Give the selection rule for forbidden decays.
9. What are power reactors?
10. What are magic numbers? What are singly and doubly magic nuclei. List magic numbers below 100.

(8 x 1 = 8)

Part B

*Answer any **six** questions.*

Each question carries 2 weights.

11. The ground state of $_{55}Cs^{137}$ 7/2+ decays with a half life 33 years,92% by β emission to an excited state of $_{56}Ba^{137}$(which in turn decays by γ emission with half life 2.6 minutes to theground state Ba^{137})and 8%by β emission directly the ground

state. Following quantities were measured ·$(K.E)_{\beta}$max(92%)=0.51MeV (K.E)β max(8%)=1.17MeVWhat is the degree of forbiddenness of each transition?

12. How many α and β particles are emitted when $_{92}U^{238}$decay to Lead ($_{82}$ Pb^{206}).

13. ^{7}Li (Z=3) and ^{7} Be(Z=4) have the atomic masses 7.016005 and7.016929u. Which of then shows β activity and of what type? Calculate Q for it.

14. Find the energy release of two $_{1}H^{2}$ nuclei can fuse together to form $_{2}He^{4}$ nucleus. The binding energy per nucleon of H^{2} and He^{4} is 1.1Mev and 7.0 respectively.

15. Show that nuclear density of $_{1}H^{1}$ is about 1014 times greater than atomic density assume the atom have the radius of the first Bohr model.

16. A reactor is developing energy at the rate of 1500KW.How many atoms of U^{235} undergo fission per second? How many Kg of U^{235} would be used in 1000 hours of operation assuming that on an average energy of 200MeV is released per fission.

17. Describe the angular momentum and parity of the nuclei.

18. Explain the magnetic dipole moment and electric quadrupole moment of the nuclei..

(6 x 2 = 12)

Part C

*Answer any **two** questions.*

Each question carries 5 weights.

19. Describe Fermi theory of β decay. Calculate the energy release in β decay process.

20. Explain electric quadrapole moment for an ellipsoidal charge distribution.

21. Describe quark model of elementary particles.

22. What is the evidence for shell structure of the nucleus? Sketching the main assumptions, explain the shell model of the nucleus.

(2 x 5 = 10)

MAHATMA GANDHI UNIVERSITY

PG-CSS PHYSICS MODEL QUESTION PAPER

Third Semester

Faculty of Science

Physics- Material Science

PH020301: STATISTICAL PHYSICS AND ASTROPHYSICS

(2019 admission onwards)

Time : 3 Hours. Maximum Weight : 30

Part A

*Answer any **eight** questions.*

Each question carries 1weight.

1. In terms of density matrix state the conditions for statistical equilibrium.
2. What are statistical ensembles? Give their classification with suitable examples.
3. What is meant by Ising model?
4. Discuss Pauli's theory of paramagnetism.
5. State Wiener Khintchine theorm.
6. Define partition function in canonical ensemble.
7. Write a brief note on Quasars.
8. Explain Chandrasekhar Limit.
9. What are Magnetars?
10. What is meant by colour index of a star?

(8x1 = 8)

Part B

*Answer any **six** questions.*

Each question carries 2 weights.

11. What is Fermi gas? Explain the thermodynamic behavior of an ideal Fermi system.
12. The molar mass of lithium is 0.00694 and its density is $0.53x10^{3}kg/m^{3}$.Caluculate the Fermi energy and Fermi temperature of the electrons.
13. Derive grand partition function. How can you obtain the various thermodynamic quantities from it?

14. Discuss on density and energy fluctuations in the grand canonical ensemble.
15. Discuss the phenomenon of Bose Einstein condensation in momentum space and hence explain the properties of liquid He-II.
16. Explain the two main processes behind the energy generation in stars.
17. Explain Virial theorem.
18. Define luminosity of a star. Derive the relationship between the luminosity and absolute magnitude. Derive relation between entropy and canonical partition function.

(6x2 = 12)

Part C

*Answer any **two** questions.*
Each question carries 5 weights

19. What is Bragg William approximation. How energy equation of Ising model is expressed in this approximation
20. Explain the thermodynamics of an ideal gas in canonical ensemble
21. Explain Saha's equation of thermal ionization and its applications.
22. ExplainHertz Sprung Russell diagram.

(2 x 5 =10)

MAHATMA GANDHI UNIVERSITY
PG-CSS PHYSICS MODEL QUESTION PAPER
Third Semester
Faculty of Science
Physics- Material Science
PH020302: NUMERICAL METHODS IN PHYSICS
(2019 admission onwards)

Time: 3 Hours Maximum Weight: 30

Part A

*Answer any **eight** questions.*

Each question carries 1 weight.

1. Discuss the uses of Lagrange's interpolation formula.
2. What do you mean by truncation error?
3. Why Trapezoidal rule is called so?
4. Explain Gauss – Seidel method for solution of Laplace equation.
5. What do you mean by marching methods for the solution of ordinary differential equations?
6. What is the basic idea behind predictor-corrector methods?
7. How will you find the inverse of a matrix by Gauss – Jordan method?
8. Obtain finite difference approximation to derivatives.
9. Show that divided differences are symmetrical in their arguments.
10. Write a note on Milne's method. (8 x 1 = 8)

Part B

*Answer any **six** questions.*

Each question carries 2 weights.

11. Using Romberg's method, compute I=$\int_0^1 \frac{1}{1+x} dx$ correct to 3 decimal places.
12. Given $\frac{dy}{dx} = y - x$, with *y(0)=2*. Find *y(0.1) and y(0.2)*correct to 4 decimal places.
13. The following data gives the melting point of an alloy of lead and zinc

% of lead in the alloy	40	50	60	70	80
Temperature in ^oC	201	206	225	251	276

Find the melting point of the alloy containing 48% of lead using Newton's forward Interpolation formula

14. Find the Lagrange's interpolation polynomial of degree 2 approximating the function y=ln(x) defined by the following table of values. Hence find the value of ln(2.7).

15. Solve the differential equation $(1+x)\frac{dy}{dx} + y = 0$ with $y(0) = 2$ for $x =$ 1.5 to $x = 2.5$ using fourth order Runge – Kutta method with $h = 0.25$.

16. Solve the following system of equations by Gauss elimination method

$$10x + y + z = 12$$
$$x + 10y + z = 12$$
$$x + y + 10z = 12$$

17. Solve one dimensional heat equation

$$U_t = U_{xx}$$

with the conditions $U(x,0) = x^2 - 4x, 0 \le x \le 4, U(0,t) = 0, U(4,t) = 0$ using Schmidt formula.

18. Find the equation of least square that fit a line y= a_0+a_1x for the following data.

X	5	10	15	20	25
Y	16	19	23	26	30

(6 x 2 = 12)

Part C

*Answer any **two** questions.*
Each question carries 5 weights.

19. Explain the method of least square curve fitting. How can you fit a straight line and an exponential function to given data points.

20. Describe Milne's method. Given

$$y' = 1 + y^2$$

with *y(0)=0*. Find *y(0.8) and y(1.0).*

21. Explain numerical double integration. Use trapezoidal rule to evaluate the double integral

$\int_{-2}^{2}\int_{0}^{4}(x^2 - xy + y^2)dx\,dy.$

22. Solve by Crank – Nicolson method

$$\boldsymbol{u_t = 2u_{xx}}$$

subject to conditions $u(x,0) = sin\pi x, 0 \le x \le 1$ and $u(0,t) = 0$, $u(1,t) = 0$, t > 0. With h= 1/4 and k=1/16, compute (1 /2, 1/ 8).

(2 x 5 = 10)

MAHATMA GANDHI UNIVERSITY
PG-CSS PHYSICS MODEL QUESTION PAPER
Third Semester
Faculty of Sciences
Physics – Material Science
PH020303: ADVANCED QUANTUM MECHANICS
(2019 admission onwards)

Time: 3 Hours Maximum Weight: 30

Part A

*Answer any **eight** questions.*

Each question carries 1 weight.

1. What is Noether's theorem and its consequences?
2. Write down the properties of Dirac matrices Υ.
3. Discus bilinear co variants in Dirac's theory.
4. Discuss the probability conservation and its importance in relativistic quantum mechanics.
5. What is the resonance scattering? Give an example.
6. Define scattering length. How it is related to zero energy cross section?
7. Discuss Ramsaur-Townsend effect.
8. What are the short comings of Klein-Gordon equation?
9. Describe Fermi's golden rule.
10. Distinguish between interaction picture and Schrodinger picture.

(8 x 1 = 8)

Part B

*Answer any **six** questions.*
Each question carries 2 weights.

11. What is non relativistic limit of Dirac equation? Explain the various terms.
12. In relativistic quantum mechanics, derive the approximate Hamiltonian for an electrostatic problem.
13. Discuss the bound state problem of deuteron.
14. Obtain the relation between scattering amplitude and differential cross section.
15. Discuss sudden and adiabatic approximation with an example.
16. Establish the formula for expanding plane wave in terms of partial waves.
17. Explain Electric Dipole Approximation.
18. Explain Optical Theorem.

(6 x 2 = 12)

Part C

*Answer any **two** questions.*

Each question carries 5 weights.

19. What is transition probability? Obtain an expression for total transition probability in case of constant perturbation.
20. Derive the expression for scattering amplitude using Born approximation.
21. Derive the nonrelativistic limit of Dirac equation.
22. Derive the second quantization of the free electromagnetic field.

(2 x 5 = 10)

MAHATMA GANDHI UNIVERSITY

PG-CSS PHYSICS MODEL QUESTION PAPER

Fourth Semester

Faculty of Science

Physics- Material Science

PH020401: ATOMIC AND MOLECULAR SPECTROSCOPY

(2019 admission onwards)

Time: 3 Hours Maximum Weight:30

Part A

*Answer any **eight** questions.*

Each question carries 1 weight.

1. What is the importance of Lande g factor?
2. How hyper fine structure is obtained in atomic spectra?
3. The intensity of J =0 →J=1 is often not the most intense rotational line. Why?
4. What are Fortrat parabolae?
5. Briefly explain the hot bands in IR spectra.
6. Explain inverse Raman scattering.
7. Intense light sources are needed for the observation of nonlinear Raman effects. Why?
8. Explain Frank-Condon Principle.

9. What is the significance of Bloch equations in NMR spectroscopy?
10. How s-electron density is related to chemical isomer shift?

(8×1=8)

Part B

*Answer any **six** questions.*

Each question carries 2 weights.

11. Calculate the Doppler velocity corresponding to the natural line width of the γ-ray emission line from 23.9 keV excited state of ^{119}Sn nucleus having a half life of 1.9×10^{-8}s.
12. Discuss the theory of stark effect in one electron system.
13. The moment of inertia of the CO molecule is 1.46×10^{-46} Kgm^2. Calculate the energy and angular velocity in the lowest rotational energy level of the CO molecule.
14. The Raman line associated with a vibrational mode which is both Raman and Infrared active is found at 4600A^0 when excited by light of wavelength 4358A^0. Calculate the wavelength of the corresponding infrared band.
15. Define chemical shift with example. Distinguish between δ and τ chemical shift.
16. The limit of continuum absorption for iodine occurs at 499.5 nm. What is the energy of dissociation of iodine into one normal and one excited atom? Calculate the dissociation energy of iodine molecule into normal atoms, if the lowest excitation energy is 0.94 eV.
17. Describe the theory of ESR and explain the origin of hyperfine structure with one example?
18. Define chemical shift with example. Distinguish between δ and τ chemical shift.

(6×2=12)

Part C

*Answer any **two** questions.*

Each question carries 5 weights.

19. Explain the theory of anomalous Zeeman effect. Discuss under what condition

    Zeeman effect changes to Paschen- back effect

20. Discuss rotational spectra of a non-rigid rotator.
21. What are the informations one can get from a vibrational analysis of an electronic vibration spectra. Explain it with Deslandres table.
22. Describe the spin –spin and spin –lattice relaxation processes with theory.

(5×2=10)

Bunch A: Material Science - I

MAHATMA GANDHI UNIVERSITY

PG-CSS PHYSICS MODEL QUESTION PAPER

Third Semester

Faculty of Science

Physics- Material Science

PH840301: THIN FILM SCIENCE AND CRYSTAL GROWTH TECHNIQUES

(2019 admission onwards)

Time: 3 Hours MaximumWeight:30

Part A

*Answer any e**ight** questions.*

Each question carries 1 weight.

1. What is Nucleation? Write different types of nucleation.
2. Write a note on Epitaxy.
3. Explain the principle of diffusion pump.
4. Explain Zone melting in crystal growth process.
5. What are the merits of Bridgeman technique?
6. Explain the working of Gaede’s rotary oil pump.
7. Write different optical methods for thin film thickness measurements.

8. Explain different techniques for thinfilm growth under chemical vapor deposition.
9. Explain the criteria for vapor transport mechanism.
10. Give the principle of Pulsed Laser deposition.

(8x1= 8)

Part B

*Answer any **six** questions.*

Each question carries 2 weights.

11. What is Pirani gauge? Explain its construction and working.
12. Discuss the spectrometric method of measuring the thickness of a film.
13. Explain Verneuil's flame fusion technique.
14. Write about the growth of ADP crystals.
15. Explain the Langmuir theory for Physical vapor deposition technique.
16. Differentiate between flash evaporation and arc evaporation techniques.
17. Calculate the thickness of Silicon dioxide thin film having film reflectance of 4 maxima and minima; refractive index 2 uses a photometric method? (Given the wave length of light is 1μm)
18. Explain the working of piezoelectric thickness monitor arrangement

(6x 2 = 12)

Part C

*Answer any **two** questions.*

Each question carries 5 weights.

19. Explain the morphological, structural and optical properties of thin films.
20. Explain Czocharalski method for crystal growth technique.
21. Discuss different sputtering methods for deposition of thin films.
22. Discuss the hydrothermal growth of crystals.

(2 x 5 = 10)

MAHATMA GANDHI UNIVERSITY

PG-CSS PHYSICS MODEL QUESTION PAPER

Fourth Semester

Faculty of Science

Physics- Material Science

PH840402: NANOSCIENCE AND NANOTECHNOLOGY

(2019 admission onwards)

Time: 3 Hours Maximum Weight:30

Part A

*Answer any **eight** questions.*

Each question carries 1 weight.

1. List out four challenges faced by Nanotechnology.
2. What is the likely impact of nanotechnology?
3. Describe the optical properties of Semiconducting Nanoparticles.
4. What areMetalnanoclusters?
5. Explain the concept of environmental TEM.
6. What is a Scanning transmission electron microscopy?
7. Briefly explain fullerenes and fullerene-derived crystals.
8. What is the significance of Nano manipulation?
9. Explain the Mechanism of scanning probe lithography.
10. Write a note on magnetic nanostructures.

(8×1=8)

Part B

*Answer any **six** questions.*

Each question carries 2 weights.

11. What are the general issues of concern of synthesis of Nanomaterial?
12. With suitable diagram explain the processes Solvothermal synthesis of nanoparticles.
13. Explain the process of exciton confinement in quantum dots.
14. Describe the mechanism of band gap engineering and optical response.
15. How can the electron diffraction pattern be indexed?

16. Explain the working of Scanning probe lithography and also mention its advantages.
17. Explain the properties of ordered mesoporous structures and random mesoporous structures.
18. Describe the Lithography Concepts of nanotechnology and its application.

(6×2=12)

Part C

*Answer any **two** questions.*

Each question carries 5 weights.

19. Explain the Quantum mechanics of low dimensional systems and confined nanoclusters.
20. Discuss the structure, principle, and working of Scanning Electron Microscopy (SEM).
21. Explain the properties of metal-polymer nanocomposite structures.
22. Describe the Mechanism of molecular transport and its advanced application.

(5×2=10)

MAHATMA GANDHI UNIVERSITY

PG-CSS PHYSICS MODEL QUESTION PAPER

Fourth Semester

Faculty of Science

Physics- Material Science

PH840403: MATERIALS SCIENCE AND ENGINEERING

(2019 admission onwards)

Time: 3 Hours Maximum Weight:30

Part A

*Answer any **eight** questions.*

Each question carries 1 weight.

1. Distinguish between ceramics and polymers.
2. What is a Burgers vector?
3. What is the difference between atomic mass and atomic weight?
4. What is meant by self-diffusion?

5. Write the difference between isotropy and anisotropy
6. What is isomerism?
7. What is the difference between Frenkel defect and schottky defect?
8. What is modulus of elasticity?
9. What are refractories?
10. What is graphite?

(8 x 1 = 8)

Part B

*Answer any **six** questions.*

Each question carries 2 weights.

11. Copper has an atomic radius of 0.128 nm (1.28A°), an FCC crystal structure, and an atomic weight of 63.5 g/mol. Compute its theoretical density.
12. Briefly explain the different structures of polymer molecule.
13. Distinguish between Thermoplastic and Thermosetting Polymers.
14. Calculate the equilibrium number of vacancies per cubic meter for copper at1000^{0}C. The energy for vacancy formation is 0.9 eV/atom; the atomic weight and density (at 1000^{0}C) for copper are 63.5 g/mol and 8.40 g/cm3, respectively.
15. Explain the mechanical behaviour of ceramic materials.
16. Compute the strain-hardening exponent n in Equation 7.19 for an alloy in which a true stress of 415 MPa (60,000 psi) produces a true strain of 0.10;assume a value of 1035 MPa (150,000 psi) for K.
17. Distinguish between ferrous and nonferrous alloys.
18. Explain tear strength and hardness of polymers.

(6 x 2 = 12)

Part C

*Answer any **two** questions.*

Each question carries 5 weights.

19. Explain the different types of bonding in materials.
20. Briefly explain the various defects in solids.
21. Discuss the various diffusion mechanisms. What are the factors affecting it?
22. Briefly explain the mechanical behavior of metals.

(2 x 5 = 10)

Bunch B: Material Science - II

MAHATMA GANDHI UNIVERSITY

PG-CSS PHYSICS MODEL QUESTION PAPER

Third Semester

Faculty of Science

Physics- Material Science

PH850301: Optoelctronics

(2019 admission onwards)

Time: 3 Hours Maximum Weight:30

Part A

*Answer any **eight** questions.*

Each question carries 1 weight.

1. Explain Acousto optic effect.
2. Explain Pockel effect.
3. What is meant by Bit rate?
4. Differentiate Surface and Edge emitting LEDs.
5. Explain Laser diode equation.
6. Explain Photo voltaic characteristics.
7. Explain Normalised index difference.
8. Explain V Number of an optical fiber.
9. Explain Dispersion flattened fibres.
10. Explain Ramo's theorem.

(8×1=8)

Part B

*Answer any **six** questions.*

Each question carries 2 weights.

11. A step index fiber has a core diameter of 100μm and a refractive index of 1.480. The cladding has a refractive index of 1.460. calculate numerical aperture, acceptance angle and V number.
12. Calculate the maximum length of an optical fiber whose input power is 1mW and produces an output power of 1 nW with an attenuation coefficient of 0.4 dB km^{-1}.

13. What is the conductivity of an n type Si crystal that has been doped uniformly with 10^{16} cm^{-3} phosphorus atoms if the drift mobility of electrons is about 1350 $cm^2V^{-1}s^{-1}$.
14. A typical low power 5mW He Ne Laser operates at a dc voltage of 2000 V and carries a current of 7 mA. What is the efficiency of the Laser?
15. A Si pin photodiode has an active light receiving area of diameter 0.4 mm. When radiation of wavelength 700nm and intensity 0.1 mW cm^{-1} is incident it generates a photocurrent of 56.6 nA. What is the responsivity and QE of the photodiode at 700 nm?
16. Calculate the slope efficiency of a laser diode operating at 1300 nm, if its external quantum efficiency is 0.1.
17. Estimate the minimum detectable power of a PIN diode whose responsivity and dark current are 0.5 A/W and 1 nA respectively.
18. A GaAs LED has an effective recombination region of width 0.1 μm. If it is operated at a current density of 2 x 10^7 Am^{-2} estimate the modulation bandwidth that can be expected?

(6×2=12)

Part C

*Answer any **two** questions.*

Each question carries 5 weights.

19. Write a short note on Quantum well lasers and Optical Laser amplifiers.
20. Explain dispersion in single mode fibers.
21. Explain the detection process in Photo conductive detection.
22. Explain the principle and working of Electro optic modulator.

(5×2=10)

MAHATMA GANDHI UNIVERSITY

PG-CSS PHYSICS MODEL QUESTION PAPER

Fourth Semester

Faculty of Science

Physics- Material Science

PH850402: SEMICONDUCTOR DEVICES

(2019 admission onwards)

Time: 3 Hours Maximum Weight:30

Part A

*Answer any **eight** questions.*

Each question carries 1 weight.

1. Write the equation for the total drift current density.
2. State the definition of the quasi-Fermi level for electrons.
3. What is two dimensional electron gas? Explain.
4. Write the characteristics of heterojunction materials.
5. Sketch the electron and hole currents through a forward-biased pn junction diode.
6. What is the cutoff frequency of a bipolar transistor?
7. Obtain the IC technology for resistor formation
8. What is the relation between barrier height, work function and semiconductor electron affinity?
9. Describe the response of a bipolar transistor when it is switching between saturationand cutoff.
10. Write a short note on epitaxial growth.

(8 x 1 = 8)

Part B

*Answer any **six** questions.*

Each question carries 2 weights.

11. What is meant by a short diode?
12. Explain emitter current crowding of bipolar transistor.
13. A uniformly doped n-type silicon epitaxial layer of 0.5Ω-cm resistivity is subjected to boron diffusion with constant surface concentration of 5 x10 ^{18}cm^{-}

^{3}. It is desired to for a p-n junction at a depth of 2.7μm. At what temperature should this diffusion be carried out if it is to be completed in 2hr?

14. Compare the forward-biased current-voltagc characteristic of a Schottky barrier diode tothat of pn junction diode.
15. Sketch the cross section of a diode pair integrated circuit using collector – base region if (a) the cathode is common and (b) the anode is common.
16. Consider n-type *Ge* doped with $N_d=10^{16}$ cm^{-3} and P-type *GaAs* doped with $N_a=10^{16}$ cm^{-3}. Let $n_i=2.4$ $x10^{13}cm^{-3}$ for *Ge* at T=300 K. Determine the difference between two conduction band energies (ΔE_c), difference between two valence band energies (ΔE_v) and the total built in potential barrier V_{bi} for an *n-Ge* to *p-GaAs* hereojunction using the electron affinity rule.
17. Consider a contact between tungsten and n-type silicon doped to $N_d=10^{16}$ cm^{-3} at T=300K. Calculate the theoretical barrier height, built in potential barrier and a maximum electric field in a metal semiconductor diode for zero applied bias. Given, the metal work function for tungsten=4.55V and the electron affinity for silicon is 4.01V.
18. Write a note on Large Scale and Medium Scale Integration.

(6 x 2 = 12)

Part C

*Answer any **two** questions.*

Each question carries 5 weights.

19. Derive the Ambipolar Transport Equation.
20. Explain Ebers-Moll Model of bipolar transistor.
21. Bring out the energy band diagram of hetro junction material and discuss the two dimentional electron gas.
22. Discuss in detail the fabrication of an integrated circuit.

(2 x 5 = 10)

MAHATMA GANDHI UNIVERSITY
PG-CSS PHYSICS MODEL QUESTION PAPER
Fourth Semester
Faculty of Science
Physics- Material Science

PH850403: CERAMICS AND BIO MATERIALS

(2019 admission onwards)

Time: 3 Hours Maximum Weight:30

Part A

*Answer any e**ight** questions.*
Each question carries 1 weight.

1. Explain the structure of a non-oxide ceramics.
2. What is the mechanism behind diffusion in ionic solids?
3. Write down the difference between Ferroelectrics and Piezoelectric
4. What are the significances of Electro-optic ceramics
5. What do you mean by Giant magneto-resistance
6. What are important feature of Magnetic ceramics
7. Explain the principle of protein folding,
8. Write down the major difference in DNA and RNA
9. What are the application of Raman spectroscopy in bioscience
10. Describe the phoneme of magnetic resonance imaging

(8x1= 8)

Part B

*Answer any **six** questions.*

Each question carries 2 weights.

11. Write a note on ionic conductivity in ceramics.
12. Explain the use of Dielectric materials for microwave application.
13. Describe the Thermodynamic formulation of ferroelectrics.
14. Discuss the principle of superconductivity and their applications to high field magnets.
15. What is a Magneto-electronic materials and explain its characteristics?
16. Explain the structure of DNA with neat diagram.
17. Write a note on energy and entropy in complex biomolecules.
18. Explain the working of Transmission electron microscope with a schematic diagram

(6x 2 = 12)

Part C

*Answer any **two** questions.*

Each question carries 5 weights.

19. Explain the frequency dependence of polarization and associated mechanism in electronic ceramics.
20. Describe the Microstructure - property relationships, Applications of piezoelectric materials in transducers
21. Write an essay on molecular modeling of biological problems
22. Explain the principle and working of Nuclear magnetic resonance spectroscopy in Bio materials.

(2 x 5 = 10)

CHAPTER-V
MODEL QUESTION PAPERS

M.Sc PHYSICS DEGREE C.S.S EXAMINATION

1 Semester

Faculty of Science

PH010101 – MATHEMATICAL METHODS IN PHYSICS – I

(2019 Admissions Onwards)

Time : 3 Hrs **Max Weight : 30**

SECTION – A
(Answer Any Eight Questions. Each Question Carries a Weight of 1)

1. State and Prove Gauss' divergence theorm
2. What is similarly transformation? How does it affect the eigen values and eigen vectors of a matrix?
3. State and prove Cayley – Hamiltorn Theorem for square matrices
4. Explain the central limit theorem.
5. Show the Kronecker delta is a mixed tensor of rank 2.
6. State the theorem relating line and surface integrals.
7. What are orthogonal curviliniear co-ordinates?
8. Show that the eigenvalues of Hermitian matrix are orthogonal to each other
9. Explain contra variant and covariant tensors
10. What are Christoffels 3 index symbols? (8 x 1 = 8)

SECTION – B

(Answer Any Six Questions. Each Question Carries a Weight of 2)

11. Solve the system of equations

    $x+y+3z=6$

    $2x+3y-4z=6$

    $3x+2y+7z=0$

12. Show that contraction reduces the rank of a tensor by 2?

13. Discuss the properties of Dirac delta function
14. Discuss Schwartz in equality
15. Define Christoffels symbols of first and second kind
16. Show that in Cartesian co-ordinate system contra variant covariant components of a vector are identical.
17. Discuss the features of linear vector space.
18. Explain Associate Tensors?

(6 x 2 = 12)

SECTION – C

(Answer Any Two Questions. Each Question Carries a Weight of 5)

19. Define general orthogoanal curvilinear co-ordinates and obtain various differential operators in terms of orthogoanal curvilinear co-ordinates
20. Outline the characteristics of Binominal, Poisson and Gaussion distributions
21. What are unitary and Hermitian matrices? State and prove their properties
22. Bringout the transformation laws of Christoffels symbols.

(2 x 5 = 10)

MODEL QUESTION PAPER
M.Sc. DEGRE (PGCSS0EXAMINATION
FIRST SEMESTER
FACULTY OF SCIENCE
Branch II: Physics(A) Pure Physics

PH010102 – CLASSICAL MECHANICS

Time: 3 hours Maximum Weight: 30

PART A

(Answer any **EIGHT** questions. Each question carries **1** weight)

1. Discuss the effect of holonomic constraints on the number of degrees of freedom of a system.
2. What is dissipation function? Give its physical significance.
3. State Noether's theorem.
4. Explain how the Hamiltonian of a system can be generated from its Lagrangian using Legendre transformation.
5. Distinguish between stable equilibrium and unstable equilibrium.
6. Write down the fundamental Poisson brackets.
7. What are the first integrals of a conservative central potential?
8. Explain centrifugal potential in the context of a central force field.
9. Define principal moments of inertia of a rigid body.
10. Explain Thomas precession.

(8 X 1 = 8)

PART B

(Answer any **SIX** questions. Each question carries **2** weight)

11. A bead is sliding on a wire in a uniformly rotating wire in a force free region. The wire is straight and the axis of rotation of the wire is perpendicular to the wire. Obtain the equation of motion of the bead.

12. Derive Hamilton's equations of motion from modified Hamilton's principle.

13. A simple pendulum has a bob of mass $m$with another mass m' at the moving support. Mass m' moves on a horizontal line in the vertical plane containing the bob of the pendulum. Find the normal frequencies and normal modes of vibrations.

14. Show that the transformation $Q = \sqrt{2q}\cos p$, $P = \sqrt{2q}\sin p$ is canonical.

15. Solve the problem of simple harmonic oscillator in one dimension by making use of a canonical transformation.

16. State and prove Poisson's theorem regarding Poisson brackets.

17. A particle falls freely from a height h at a place with latitude λ. Find the deflection due to Coriolis force.

18. Explain the physical significance of Hamilton's principal function.

(6 X 2 = 12)

PART C

(Answer any **TWO** questions. Each question carries 5 weight)

19. Derive Lgrange's equations of motion from Hamilton's principle.

20. Discuss the normal modes and normal coordinates of the free vibrations of CO_2 molecule.

21. Derive Euler's equation for rigid body motion. Apply it to work out the torque free motion of a symmetric top.

22. Describe how action-angle variable can be used to obtain the frequencies of a periodic system without finding a complete solution to the motion of the system. Apply this method to the linear harmonic oscillator problem.

(2 X 5= 10)

MODEL QUESTION PAPER
M.Sc. DEGRE (PGCSS0EXAMINATION
SECOND SEMESTER
FACULTY OF SCIENCE
Branch II: Physics(A) Pure Physics

PH010202 – QUANTUM MECHANICS-I

Time: 3 hours Maximum Weight: 30

PART A

(Answer any **EIGHT** questions. Each question carries **1** weight)

1. Discuss the concept of kets and bras.
2. Show that the outer product of a ket and bra is an operator.
3. What is meant by a Hermitian operator?
4. Define time evolution operator
5. What are energy eigenkets? Why are they called stationary states?
6. State and explain the Ehrenfest's theorem.
7. Give the fundamental commutation relations for angular momentum operators.
8. Write down the rotation operator for a spin half system.
9. Give the matrix elements of J_x and J_y in $|jm\rangle$ basis.
10. Express the L_z operator in spherical polar coordinate system.

(8 X 1 = 8)

PART B

(Answer any **SIX** questions. Each question carries **2** weight)

11. Obtain the matrices representing the three components of spin operator in S_z basis.

12. Show that (a) a change of basis can be accomplished by a unitary transformation. (b)Unitary equivalent observables have identical spectra.

13. Express infinitesimal translation operator in terms of momentum operator. Hence deduce the commutation relation between position and momentum operators.

14. Show that the wavefunctions in momentum space and position space are Fourier transforms of each other.

15. Solve the Schrodinger equation for the time evolution operator for a system with a time independent Hamiltonian.

16. The lifetime of hydrogen in the 2p state to decay to the 1s ground state is 1.6 ns. Calculate the spread in energy of this excited state . Also estimate the linewidth of the emitted spectral line in angstroms.

17. Calculate the commutation relations between all the three pairs of Pauli spin matrices.

18. Calculate the Clebsch-Gordon coefficients associated with the addition of two angular momenta j_1 =1/2 ; $j_2 = 1/2$.

(6 X 2 = 12)

PART C

(Answer any **TWO** questions. Each question carries 5 weight)

19. State and prove the generalized uncertainty principle.

20. Obtain the energy eigenvalues and energy eigenkets of a simple harmonic oscillator using operator method.

21. Using ladder operators, solve the eigenvalue problem for angular momentum operators.

22. Starting from the Schrodinger equation for a spherically symmetric potential, obtain the energy eigenvalues and the eigenfunctions of the hydrogen atom. Discuss the degeneracy of the energy levels of the hydrogen atom.

(2 X 5= 10)

M Sc (Physics) Degree (C.S.S) Examination,

First Semester

Faculty of Science

Course Code- **PH010103: ELECTRODYNAMICS**

(2019 admissions onwards)

Time: Threehours Max. Weight: 30

Section- A

(Answer any **eight** questions. Each question carries a weight of 1)

1. What are the static and dynamic Maxwells equations?
2. What is meant by Maxwells stress tensor? Explain its significance.
3. Why TEM waves can not be transmitted through hollow waveguides?
4. Explain the term characteristic impedance.
5. What is skin depth? How it is related to the attenuation constant?
6. Distinguish between phase velocity and group velocity
7. What is meant by electric dipole radiation?
8. What is a four vector? Give the components of momentum four vector.
9. Explain proper time and proper velocity.
10. What is meant by radiative reaction?

(8 x 1 = 8)

Section B

(Answer any**six** questions. Each question carries a weight of 2)

11. Verify that the Poynting vector is invariant under the transformation $\mathbf{E'} = \mathbf{E}\cos\Phi + \mathbf{B}\sin\Phi$ and $\mathbf{B'} = -\mathbf{E}\sin\Phi + \mathbf{B}\cos\Phi$. Give the physical significance of the transformation if $\Phi = \boldsymbol{\pi}/2$
12. Evaluate the magnitude of the current density **J** in a region where the vector potential is given by $\mathbf{A} = x^2\mathbf{j} - 2xy\mathbf{k}$, where **j** and **k** are unit vectors.

13. Show that $\mathbf{E}^2$-$\mathbf{B}^2$ is Lorentz scalar.
14. Show that **E.B** is relativistically invariant.
15. The lowest frequency of an electromagnetic field is a rectangular waveguide is fixed at 3 MHz. What should be the dimension of the waveguide for its propagation?
16. Show that the power radiated from a magnetic dipole varies as the fourth power of the frequency.
17. Explain Gauss law in dielectric medium
18. For a TE in a rectangular wave guide, show that TE_{10} is the dominant modern

(6 x 2 = 12)

Section C

(Answer any **two** questions. Each question carries a weight of 5.)

19. Derive the laws of conservation of energy and momentum in electrodynamics and show that the electromagnetic fields carry energy and momentum
20. Discuss the reflection and transmission of the electromagnetic waves at oblique incidence and obtain the Snell's law.
21. Discuss the propagation of TM waves in rectangular wave guide and obtain an expression for the cutoff frequency
22. Explain retarded potentials. Find the expressions for Lienard-Wiechert potentials.

(2 x 5 = 10)

M.Sc. PHYSICS Degree (C.S.S.) Examination

First Semester

Faculty of Science

PH010104 ELECTRONICS

(2019 admission onwards)

Time: 3hrs

Max.Weight:30

Section A

(Answer any *eight*questions. Each question carriers a weight of 1)

1. Why op-amp called operational amplifier?
2. Using aneat schematic diagram explain how op-amp canbe used asa voltage follower.
3. Discuss current to voltage converter.
4. What are the three methods of compensation?
5. Define slew rate?
6. What is an instrumentation amplifier? Give two applications.
7. What is the principle of phase discriminator?
8. What is a sample and hold circuit? Why is it needed?
9. What is an all pass filter? Where and why is it needed?
10. Write short note on stereo FM reception. (8 x 1 =8)

Section B

(Answer any *sixquestions*. Each question carries a weight of 2)

11. A 5mv, 1 KHz sinusoidal signal is applied to the input of an OP-AMP integrator for which R=100KΩ and c = 1μF. Find the output voltage.
12. Design a Weinbridge oscillator for a frequency of 900Hz.
13. The o/p voltages of a certain OP-AMP circuit changes by 20V in 4μS.What is its Slew rate?
14. Design a second order low pass filter at a high cut off frequency of 1 KHz.
15. Differentiate between inverting and non-inverting amplifiers.
16. With the help of diagram bring out the theory of phase-shift oscillator.
17. Discuss an integrator circuit using Op-Amp.
18. What is the Butterworth response? Explain (6 x 2 =12)

Section C

(Answer any *two*questions. Each question carries a weight of 5)

19. Define a filter? How are filters classified? Explain first order low pass butter worth filter. Discuss its frequency response.
20. With neat circuit diagrams explain the principle and operation of a Square wave generator and a triangular wave generator.
21. What is a comparator? Explain its working. Discuss with theory the working of IC 555 as an astable multivibrator.
22. Compare and contrast voltage to frequency and frequency to voltage converters.

(2x 5 =10)

MODEL QUESTION PAPER
M.SC DEGREE C.S.S EXAMINATION
Semester II
Faculty of Science
PH010201 – MATHEMATICAL METHODS IN PHYSICS – II
(2019 Admissions Onwards)

Time : 3 Hrs **Max Weight : 30**

SECTION – A
(Answer Any Eight Questions. Each Question Carries a Weight of 1)

1. What are analytic functions? Explain.
2. State Cauchy residue theorem.
3. Expand In (1+z) in a Taylor series about z = 0
4. What is infinite Fourier sine and cosine transforms?
5. What is meant inverse Laplace transforms?
6. Show that $P_n(1) = 1$ and $P_n(-1) = (-1)^n$
7. Study the heat equation
8. Show that $H_{2n}(0) = \frac{(-1)^n(2^n)_!}{n!}$
9. Obtain Laplace and Poisson's equations in Cartesian co-ordinates.
10. Write Helmholtz equation. Give any one application (8 x 1 = 8)

SECTION – B

(Answer Any Six Questions. Each Question Carries a Weight of 2)

11. Show that the real and imaginary parts of the function log *z* satisfy the Cauchy-Riemann equations when z is not zero.
12. Find the residues of f(z) = $\frac{ze^{iz}}{z^4+a^4}$ at its poles.
13. State and prove the convolution theorem.
14. Obtain the Laplace transform of a periodic function with period T.
15. Explain the method of separation of variables
16. Get the general proof of symmetry property of Green's function.
17. Prove that $\beta\left(\frac{1}{2}, \frac{1}{2}\right) = \pi$
18. Show that $\lceil m \lceil n = \lceil (m+n)\ \beta\ (m,n)$ when m>0, n>0 (6 x 2 = 12)

SECTION – C

(Answer Any Two Questions. Each Question Carries a Weight of 5)

19. State and prove Taylors theorem for a complex function.
20. Discuss the properties of Fourier transform.
21. Bring out Green's function and apply it to scattering problem
22. Define Legendre polynomials and prove their orthogonality condition

(2 x 5 = 10)

QP Code: ·····

M.Sc DEGREE(C.S.S.) EXAMINATION NOVEMBER 2019

Second Semester

Faculty of Science

PH010203 – STATISTICAL MECHANICS

(2019 admission onwards)

Time: Three hours Maximum Weight : 30

Section A(Answer any **eight** questions. Each carries weight of 1)

1. Explain the thermodynamic and statistical definitions of entropy.
2. How density of states is related to energy for a 2-D system?
3. Explain Gibb's paradox.
4. Obtain the partition function for a system of harmonic oscillators.
5. "The ensemble average of any physical quantity f is identical to the value one expects to obtain on making an appropriate measurement on the given system". Justify this statement.
6. Plot F-D distribution function at $T = 0$ K and $T > 0$ K.
7. What is meant by chemical potential?
8. Explain Fermi temperature and Fermi energy.
9. Discuss the phase separation in mixtures.
10. What is a maxwell construction for van der Waals isotherms?

Section B (Answer any **six** questions. Each question carries weight of 2,)

11. Making use of the fact that the entropy S(N,V,E) of a thermodynamic system is an extensive quantity, show that, $N\left(\frac{\partial S}{\partial N}\right)_{V,E} + V\left(\frac{\partial S}{\partial V}\right)_{N,E} + E\left(\frac{\partial S}{\partial E}\right)_{V,N} = S$
12. For an extreme relativisitic gas, the single-particle energy states is given by $\epsilon(n_x, n_y, n_z) = \frac{hc}{2L}\left(n_x^2 + n_y^2 + n_z^2\right)^{1/2}$, show that, $C_p/C_v = 4/3$.
13. Consider a rigid lattice of distinguishable spin 1/2 atoms in a magnetic field. The spins have two states, with energies $-\mu_0 B$ and $-\mu_0 B$ for spin up and down respectively. The system is at a temperature T. Obtain the heat capacity C_v and schematically plot it as a function of T.
14. Show that chemical potential is the Gibbs free energy per particle($\mu = G/N$).
15. Obtain the density matrix for a system of free particles.
16. Show that the entropy of a system in the grand canonical ensemble can be written as $S = -k\sum_{r,s} P_{r,s} ln P_{r,s}$, where $P_{r,s} = \frac{e^{-\alpha N_r - \beta E_s}}{\sum_{r,s} e^{-\alpha N_r - \beta E_s}}$
17. Derive Clapeyron equation by assuming the Gibbs potential or the chemical potential is same at the phase boundary.
18. Atomic weight of Lithium is $6.94u$ and density $0.53gm/cm^3$. Calculate Fermi energy and Fermi temperature of electrons.

Part C (answer any**two** questions. Each question carries weight of 5,)

19. Derive Liouville's theorem and explain its consequences.
20. Obtain the canonical partition function for system in contact with a thermal reservoir at temperature T.
21. Discuss the density and energy fluctuations in Grand canonical ensemble.
22. Explain the thermodynamic behaviour of an ideal Bose gas.

M.Sc.PHYSICS Degree (C.S.S) Examination

Second Semester

Faculty of Science

PH010204 CONDENSED MATTER PHYSICS

(2019 admissions onwards)

Time: Three hours Max.Weight:30

Section –A

(Answer any Eight questions. Each question carries a weight of 1)

1. What is the difference between optical and acoustic mode?
2. Define density of states.
3. Briefly discuss thermal conductivity of metals.
4. Define phonon momentum.
5. Define the axis vectors of a reciprocal lattice interms of primitive cell lattice vectors.
6. What is a Brillouin zone? Give its construction.
7. Discuss about the different kinds of symmetry shown by crystals.
8. Discuss the phenomenon of antiferro magnetism.
9. How does adiabatic demagnetization produce cooling.
10. Obtain the expression for Lorentz number on the basis of quantum theory

(1x8=8)

Section –B

(Answer any SIX questions. Each question carries a weight of 2)

11. Calculate the glancing angle on the plane (110) of a cube rock salt ($a=2.81A^o$) corresponding to second order diffraction maximum for the X-rays of wavelength $0.71A^o$.
12. Give three differences between dislocations in sc and fcc lattices. Compare both these with dislocations in the bcc lattice.

13. The thermal conductivity of aluminum at 20^{o}C is 210Wm^{-1}K^{-1}. Calculate the electrical resistivity of aluminum at this temperature. The Lorentz number of Aluminum is 2.02x10^{-8}Ωm.

14. The Fermi energy of copper is 7eV. Calculate (a) the Fermi momentum of electron in copper (b) the de Brogile wavelength of the lectron and (c) the Fermi velocity.

15. Prove the in one diamensional diatomic lattice both acoustic and optical brances in dispersion curve mmet the zone boundary normally.

16. Draw temperature dependence of susceptibility of all types of magnetic materials. Comment on them

17. A para magnetic has 10^{28}atoms/m^{3}.. The magnetic moment of each atom is 1.8x10^{-23}Am$^{2.}$ Calculate the paramagnetic susceptibility at 300K. What would be the dipole moment of a bar of this material 0.1m lonf and 1 sq cm cross-section placed in the field of 8x10^{4}A/m.

18. If in a one diamensional lattice, x= M/m<<1, prve that the square of the widths of the optical and acoustic brances are in the ratio x:4

(6x2=12)

Section –C

(Answer any two questions. Each question carries a weight of 5)

19. Explain the Ewald construction. Discuss how reciprocal lattice concept is useful in

X-ray diffraction studies.

20. Discuss Debye model of lattice heat capacity. Derive an expression for it.

21. Discuss Weiss theory of ferro magnetism. Mention its merits and demerits

22. Explain the vibrations of crystal with monoatomic basis. Obtain dispersion relation and discuss first brillouin zone, long wave length limit and phase and group velocities. **(2x5=10)**

MODEL QUESTION PAPER
M.Sc. DEGRE (PGCSS0EXAMINATION
THIRD SEMESTER
FACULTY OF SCIENCE
Branch II: Physics(A) Pure Physics

PH010301 – QUANTUM MECHANICS-II

Time: 3 hours Maximum Weight: 30

PART A

(Answer any **EIGHT** questions. Each question carries **1** weight)

1. Discuss the validity of the WKB method.
2. Give the Bohr-Sommerfeld quantization rule for a potential well.
3. Using WKB, method, obtain the tunneling probability in alpha decay.
4. What is meant by the interaction picture?
5. Give the expression for energy shift in time dependent perturbation.
6. Distinguish between bosons and fermions.
7. Write down the solution of the Klein-Gordon equation for a neutral spin 0 particle.
8. Express the Klein-Gordon equation in the Schrodinger form.
9. What is meant by *zitterbewegung*?
10. Explain how the stability of vacuum is assured in Dirac's theory.

(8 X 1 = 8)

PART B

(Answer any **SIX** questions. Each question carries **2** weight)

11. A particle of charge q that undergoes a simple harmonic is subjected to a constant electric field along the x-direction. Find the first order correction in energy of the particle.

12. Using variational method, estimate the ground state energy of a particle moving under a delta function potential.

13. A particle, which is initially in the ground state of an infinite potential well with walls at x=0 and x=L. It is subjected to a potential $V(t) = V(0)\, e^{-t/\tau}$. Calculate to first order the probability of transition from the ground state to the first excited state. The energies and energy eigenfunctions of the infinite potential well are given by $E_n = \frac{n^2\pi^2\hbar^2}{2mL^2}$; $\psi_n = \sqrt{\frac{2}{L}}\sin\left(\frac{n\pi x}{L}\right)$; $n =$ 1,2,3 ...

14. Discuss electric dipole approximation.

15. Obtain the relation connecting differential cross section and scattering amplitude

16. Using the Born approximation, calculate the differential cross section for the scattering of an alpha particle of energy 8 MeV from a gold nucleus. Atomic number of helium=2; atomic number of gold=79. Scattering angle = 60^0.

17. Obtain the continuity equation for the Klein-Gordon equation.

18. Prove the anti-commutation relations among Dirac matrices (alpha matrices and beta matrix).

(6 X 2 = 12)

PART C

(Answer any **TWO** questions. Each question carries 5 weight)

19. Develop the degenerate perturbation theory for stationary states and apply it to the first order Stark effect in hydrogen.

20. Derive the expression for total transition probability in case of constant perturbation and obtain Fermi's golden rule.

21. Discuss the partial wave analysis and apply it to the problem of hard sphere scattering.

22. Obtain the non-relativistic limit of the Dirac equation and hence deduce the spin of the Dirac particle.

(2 X 5= 10)

MODEL QUESTION PAPER
M.Sc DEGREE (PGCSS)EXAMINATION
Third Semester
Faculty of Science
Branch II : Physics (A) Pure Physics
PH010302 - Computational Physics
(2019 Admission onward)

Time : Three Hours Maximum Weight 30

Part A
(Answer any Eight Questions. Each question carries 1 weight)

1) What do we understand by the term "First difference of a function y" in case of interpolation? How do we represent it symbolically ? Give one example also.
2) Define cubic spline function and explain its properties
3) A function y= *f*(x) is tabulated below. Calculate the slope of the function when x =1.4 using Newton's forward difference formula.

x	1.1	1.2	1.4	1.6	1.8	2	2.2
y	2.2783	3.3.3201	4.0552	4.9530	6.0496	7.3891	9.0250

4) Write down the equation we use to integrate a function using Simpson's 3/8 rule and explain each term used.
5) Using Euler method calculate the value of y at t=0.1 in five steps. Given $\frac{dN}{dt}=.5N$ with initial conditions N=10 at t=0.
6) Solve the the following system of equations, x+2y+3=0 ,2x+y=3 using Gauss-Jordan elimination method.
7) Find the inverse of a matrix A= $\begin{bmatrix}2 & 3\\4 & 5\end{bmatrix}$ using Gauss-Jordan method
8) Using power method calculate Eigen value and eign matrix of A= $\begin{bmatrix}2 & 3 & 3\\3 & 3 & 2\\3 & 2 & 3\end{bmatrix}$
9) Write in short note on how do we obtain Schmidt two level explicit formula
10) Explain what is meant by Buffoon's needle problem

(8X1=8)

Part B
(Answer any Six Questions. Each question carries 2 weight)

11) Water jet from an inclined hose is observed and the height of the water jet h, and horizontal distances x from the tip of the hose are tabulated as shown below. Assuming water follows a parabolic path, fit an appropriate curve and hence calculate the velocity with which water comes out.

x in meter	.1	.15	.2	.25	.3	.35	.4
h in meter	.075	.09375	.1	.09380	.0749	.04375	0

12) By using method of least squares, find the relation of the form $y=ax^b$ to the data tabulated below:

x	2	3	4	5
y	27.8	62.1	110	161

13. The following data gives the melting point of an alloy of lead and zinc where T is the temperature in ^{0}C and P is the percentage of lead in the alloy. Find the melting point of the alloy containing 75% of lead using Newton's interpolation method.

P	60	70	80	90
T	226	250	276	304

14. A river is 100meters wide. Depth, d, at various distances,x, from one bank of the river is tabulated as shown below. With the help of Simpson's 1/3 rule ,calculate the volume of water flowing through the river in one hour when velocity of water flow is 3m/s .

X in meter	0	10	20	30	40	50	60	70	80	90	100
d in meter	0	5	8	9	10	12	9	7	5	2	0

15. Use 4th order R-K method to solve $\frac{dy^2}{dx^2}=x\frac{dy}{dx}+y^2$ Given y(0)=1 , and $\left.\frac{dy}{dx}\right|_{at\ x=0}=2$ Take h=0.2 and find y and y' at x=0.2

16. Find all eigen values and the corresponding eigen vectors of the matrix $\begin{bmatrix} 1 & \sqrt{2} & 2 \\ \sqrt{2} & 3 & \sqrt{2} \\ 2 & \sqrt{2} & 1 \end{bmatrix}$ by Jacobi's method

17. Solve the equation $y'=x^3+y$, with initial condition y(0)=1 to compute y(.02) using Euler's modified formula with h=0.01.

18. Write a short note on using Mote Carlo method for evaluation of integrals.

(6X2=12)

Part C

(Answer any Two Questions. Each question carries 5 weight)

19. Starting from basics deduce Newton's Divided Difference interpolation formula.

20. Obtain the generalised trapezoidal rule of the form.

$\int f(x)=\frac{h}{2} y_0+y_n+2(y_1+y_2+y_3+...+y_{n-1})+E_n$ through geometrical approach . Write the expression for the error term E_n .

21. Explain why the concept of stability is important in selecting the step size while trying to solve differential equations numerically using Euler's method.
22. Use Crank-Nicholson method to find the numerical solution of the following parabolic partial differential equation after one time step; Tt=Txx; with 0<x<1 ; subjected to the initial condition T(x,0)=1 ,with 0<x<1 and boundary condition T(0,t)=T(1,t)=0 with t>=0. Compute the solution by taking Δt= 1/32.

(2X5=12)

MODEL QUESTION PAPER
M.Sc. DEGRE (PGCSS0EXAMINATION
THIRD SEMESTER
FACULTY OF SCIENCE
Branch II: Physics(A) Pure Physics

PH010303 – ATOMIC AND MOLECULAR PHYSICS

Time: 3 hours Maximum Weight: 30

PART A

(Answer any **EIGHT** questions. Each question carries **1** weight)

1. What is Paschen-Back effect?
2. Explain hyperfine structure in atomic spectral lines?
3. What is the information derivable from the rotational spectrum of a molecule?
4. Explain what is meant by Morse potential.
5. Differentiate between skeletal vibrations and group frequencies.
6. How does the polarizability of a molecule influence its Raman activity?
7. Explain stimulated Raman effect.
8. Distinguish between progressions and sequences.
9. What is meant by chemical shift in NMR spectrum?
10. Explain Fermi contact interaction.

(8 X 1 = 8)

PART B

(Answer any **SIX** questions. Each question carries **2** weight)

11. The term symbol for an atomic state is $^2P_{3/2}$. What are the values of L,S and J for this state? Calculate the Lande' g-factor for this state. What type of Zeeman effect this atom will give?

12.. Derive all possible terms arising out of the combination of an s-electron with a p-electron in LS coupling scheme. Also calculate the separation between singlet state and triplet states.

13.Explain collision broadening and Doppler broadening

14. The rotational constant of $^1H^{35}Cl$ is observed to be $10.5909cm^{-1}$. Determine the value of B for $^1H^{37}Cl$ and $^2D^{35}Cl$.

15. When H_2 molecule is irradiated with 435.8nm line, the Raman Stoke's vibrational line appear at 18551.05 cm^{-1}. Find the wavenumber of the ant-Stoke's line, the force constant and zero point energy. Atomic weight of hydrogen= 1.008.Avagadro number is 6.023×10^{23} . Obtain the relation connecting differential cross section and scattering amplitude

16. The band origin of a transition in a molecule is observed at 19,378 cm^{-1} . The rotational fine structure indicates that the rotational constants in excited and ground states are 17527 cm^{-1} and 16326 cm^{-1} respectively. Estimate the position of the band head. Which state has larger internuclear distance?

17. Electron spin resonance is observed for atomic hydrogen with an instrument operating at 9.5 GHz. If the g value for the electron in the hydrogen atom is 2.0026, what is the magnetic field applied?

18. Calculate the recoil velocity of a free Mossbauer nucleus of mass $1.67 \times 10^{-25}\ kg.$, when emitting a gamma ray of wavelength 0.1 nm. What is the Doppler shift of the gamma ray to an outside observer?

(6 X 2 = 12)

PART C

(Answer any **TWO** questions. Each question carries 5 weight)

19. Discuss the fine structure of one electron atoms and derive an expression for the fine structure splitting in hydrogen like atoms.

20. Describe the spectrum of a diatomic vibrating rotator assuming Born-Oppenheimer approximation. Discuss the changes in the spectrum when this approximation breaks down

21. Describe how the molecular structure is determined using Raman and IR spectroscopies.

22. Explain the relaxation processes in nuclei and obtain the Bloch equations for the components of nuclear magnetization.

(2 X 5= 10)

M Sc (Physics) Degree (C.S.S) Examination,

Fourth Semester

Faculty of Science

Course Code- **PH010401 NUCLEAR AND PARTICLE PHYSICS**

(2019 admissions onwards)

Time: Three hours Max. Weight: 30

Section- A

(Answer any **eight** questions. Each question carries a weight of 1)

1. Compare nuclear scattering with optical diffraction.
2. What is meant by isotopic shift? How it is useful in isotope separation.
3. Explain the term electric quadrupole moment.
4. How can you explain the continuous spectrum of β decay?
5. Differentiate between direct reaction and compound nucleus reactions.
6. What is meant by reaction cross section?
7. Why a proton cannot decay except at GUT energies?
8. Explain the role of Higg's mechanism in symmetry breaking of electro-weak interaction
9. Explain 'r process' and 's process'
10. .What are the advantages of carbon dating using accelerator mass spectroscopy technique?

(8 x 1 = 8)

Section B

(Answer any**six** questions. Each question carries a weight of 2)

11. Briefly explain the nuclear force as an exchange force mediated by mesons.
12. Explain the properties of deuteron
13. Explain forbidden β decay
14. A free neutron decays into a proton by the emission of β^- particles of maximum kinetic energy 0.782MeV.If the rest mass of the electron and neutron are 0.0005486u and 1.008665u respectively, find the mass of proton.(1u=931.478MeV)

15. A tritium gas target is bombarded with a beam of monoenergetic protons of kinetic energy 3 MeV to produce He^3 and neutron. What is the kinetic energy of the neutrons emitted at 30^0 to the incident beam?(H^1=1.007276u,n^1=1.008665u,H^3=3.016056u and He^3=3.016030u)
16. Detail the classification of elementary particles.
17. With the help of conservation laws ,determine which of the following reactions are allowed through strong interactions. If they are forbidden, explain why?

    a) $p + p \rightarrow K^+ + \Sigma^+$?
    b) $\pi^- + p \rightarrow n + \gamma$
    c) $p \rightarrow e^+ + \gamma$
    d) $K^0 \rightarrow \pi^- + \pi^+$

18. .What is meant by positron emission tomography.How it can be used in brain scans?

(6 x 2 = 12)

Section C

(Answer any **two** questions. Each question carries a weight of 5.)

19. Describe shell model in nuclear physics. How is it successful in explaining parity, magnetic diple moment and quadrupole moment?
20. Explain coulomb scattering and derive differential cross section for elastic coulomb scattering.
21. Explain Quark model. What are the experimental evidences supporting quark model. What is meant by colored quarks and what is its significance?
22. Describe primordial nucleosynthesis

(2 x 5 = 10)

M Sc PHYSICS Degree (C.S.S) Examination

III Semester

Faculty of Science

PH800301 DIGITAL SIGNAL PROCESSING

(2019 admissions onwards)

Time: Three hours Max. Weight: 30

Section- A

(Answer any **eight** questions. Each question carries a weight of 1)

1. What you mean by signals? List the classifications of signals.
2. What are FIR and IIR systems?
3. Explain convolution sum.
4. Distinguish between DFT and DTFT.
5. What is decimation in Time? Explain.
6. Define Z-Transform.
7. What is meant by poles and zeros of the system function ?
8. Differentiate between FIR and IIR filter.
9. Obtain window technique.
10. what is direct form I structure of IIR system?

(8 x 1 = 8)

Section B

(Answer any **six** questions. Each question carries a weight of 2)

11. Describe the advantage limitations and applications of DSP.
12. Explain with examples the different types of operations on signals.
13. Calculate the DFT of the sequence x(n)={1,1,0,0}
14. Explain the computational merits of FFT.
15. Find the Z transform and ROC of the causal sequence x(n)={1,0,3,-1,2}
16. Explain the zeros and poles of system function. Explain the stability criterion related to system function
17. Explain the design of IIR filter using impulse invariance technique
18. Explain the Direct form II realization of digital filters

6 x 2 = 12)

Section C

(Answer any **two** questions. Each question carries a weight of 5.)

19. Describe the Classification of discrete time signals with examples.
20. Prove any six properties of DFT
21. Define the Z-transform.What is ROC? What are the properties of ROC?
22. Describe the different methods of realization of digital filters

(2 x 5 = 10)

M.Sc PHYSICS Degree (C.S.S) EXAMINATION

Fourth Semester

Faculty of Science

PH800402- MICROELECTRONICS AND SEMICONDUCTOR DEVICES

(2019 admission onwards)

Time: 3hrs Maximum Weight: 30

Part A

*Answer any **four** questions.*

Each question carries 2 weights.

1. How many clock cycles will be required by 8086 to access a 16 bit word located at an even address?
2. Explain the frequency measurement using microcontroller system.
3. What is two dimensional electron gas? Explain.
4. Write the characteristics of heterojunction materials.
5. Write a note on Cache memory.
6. What are the features of 8051 microcontroller?
7. Obtain the IC technology for resistor formation

(4 x 2 = 8)

Part B

*Answer any **four** questions.*

Each question carries 3 weights.

8. Explain the various addressing modes in 8086 processor.
9. Draw and explain the memory structure of 8085 processor.
10. A uniformly doped n-type silicon epitaxial layer of 0.5Ω-cm resistivity is subjected to boron diffusion with constant surface concentration of 5 x10 ^{18}

cm^{-3}. It is desired to for a p-n junction at a depth of 2.7μm. At what temperature should this diffusion be carried out if it is to be completed in 2hr?

11. Write a programme to sort an array of 6 numbers in ascending order using 8086.
12. How can an I/O pin can be both an input and output in 8051 microcontroller?
13. Consider n-type *Ge* doped with $N_d = 10^{16}$ cm^{-3} and P-type *GaAs* doped with $N_a = 10^{16}$ cm^{-3}. Let $n_i = 2.4 \times 10^{13} cm^{-3}$ for *Ge* at T=300 K. Determine the difference between two conduction band energies (ΔE_c), difference between two valence band energies (ΔE_v) and the total built in potential barrier V_{bi} for an *n-Ge* to *p-GaAs* hereojunction using the electron affinity rule.
14. Consider a contact between tungsten and n-type silicon doped to $N_d = 10^{16}$ cm^{-3} at T=300K. Calculate the theoretical barrier height, built in potential barrier and a maximum electric field in a metal semiconductor diode for zero applied bias. Given, the metal work function for tungsten=4.55V and the electron affinity for silicon is 4.01V.

(4 x 3 = 12)

Part C

*Answer any **two** questions.*

Each question carries 5 weights.

15. Draw and explain the timing diagram for memory read operation of 8085 processor
16. Draw the 8086 internal architecture and explain.
17. Discuss the instruction set of 8051 microcontroller with appropriate example.
18. Discuss in detail the fabrication of an integrated circuit.

(2 x 5 = 10)

M Sc (Physics). Degree (C.S.S) Examination

Fourth Semester

Faculty of Science

Course Code- PH800403-COMMUNICATION SYSTEMS

(2019 admissions onwards)

Time: Three hours Max. Weight: 30

Section- A

(Answer any **eight** questions. Each question carries a weight of 1)

1. Explain VSAT
2. What is CW Doppler radar
3. Explain GSM
4. State its merits and demerits of PAM
5. Explain the significance of Doppler frequency in RADAR communication
6. Explain total internal reflection
7. What do you mean by guard channel concept?
8. Explain the acceptance angle and numerical aperture for optic fiber.
9. Write a short note on GPS
10. Explain noise in digital data communication.

(8 x 1 = 8)

Section B

(Answer any **six** questions. Each question carries a weight of 2)

11. If a signal to interface ratio of 15 KB is required for satisfactory forward channel performance of a cellular system ,What is the frequency use factor and cluster size that should be used for maximum capacity if the path loss exponent is (a) n=4 (b) n=3 ? There are six co-channels in the first tier and all of them are at same distance from the mobile.
12. A silica optical fiber with a core diameter large enough to be considered by ray theory analysis has a core refractive index of 1.50 and a cladding refractive index of 1.47. Determine: (a) the critical angle at the core–cladding interface; (b) the NA for the fiber; (c) the acceptance angle in air for the fiber.

13. Explain the dispersion in fiber optic communication.

14. What are multiplexing techniques? Discuss in detail TDM and FDM.

15.How to improve coverage and capacity of a cellular system?

16. How to improve coverage and capacity of a cellular system?

17. Explain MTI radar.

18. Discuss about digital transmission techniques.

(**6 x 2 = 12**)

Section C

(Answer any **two** questions. Each question carries a weight of 5.)

19. Explain PCM. What do you mean by quantizing noise? Explain the generation and demodulation of PCM

20. Explain step index and graded index fibers with index profile diagram.

21. What are the multiple access techniques for wireless communication?

22. Derive radar range equation and discuss various target properties.

(**2 x 5 = 10)**

MSc PHYSICS DEGREE EXAMINATION

III SEMESTER
Faculty of Science

PH810301 SOLID STATE PHYSICS FOR MATERIALS

(2019 admissions onwards)

Time: 3 hours Max. Weight:30

Part A:(Answer any ***eight*** questions. Each question carries a weight of 1)

1. What is polytypism?
2. How do Van der Waals- London interaction evolve?
3. Distinguish between Frenkel and Wannierexcitons?
4. Explain edge dislocation.
5. Discuss the formation of stacking faults in fcc crystals.
6. What is Kirkendall effect?

7. Write a note on plasmons.
8. Explain the role of polarons in crystals.
9. What is polymorphism?
10. State Puling's rules.

(8x1=8)

Part B:(Answer any ***six*** questions. Each question carries a weight of 2)

11. Determine the fraction of atoms in a given solid with energy equal to or greater than 1.4eV at room temperature and 5 times room temperature.
12. Find the radius of the largest sphere that will fit into the void produced by the bcc packing of atoms of radius R.
13. Explain the importance of Born-Haber cycle.
14. Briefly discuss the phase diagram rules.
15. Discuss the role of phase diagram in zone refining of materials.
16. What is LST relation? Explain its importance.
17. What are the different types of diffusion mechanisms? Explain.
18. Assume that the potential energy of two particles in the field of each other is given by $U(R) = -\frac{A}{R} + \frac{B}{R^9}$, where A and B are constants. Show that the particles form a stable compound for $= \left(\frac{9B}{A}\right)^{1/8}$. prove that for stable configuration, the energy of attraction is 9 times the energy of repulsion. Also find the potential energy under stable configuration.

(6x2=12)

Part C:(Answer any ***two*** questions. Each question carries a weight of 5)

19. Explain Madelung energy and evaluate the Madelung constant for a one dimensional chain.
20. Discuss the origin of the quantization of spin waves.
21. What is dislocation and obtain the expression for the energy of dislocation.
22. What are Fick's laws? Obtain the solution for second Fick's law for the diffusion through a plane surface.

(2x5=10)

MSc PHYSICS DEGREE EXAMINATION

IV SEMESTER
Faculty of Science

PH810402 Science of Advanced Materials
(2019 admissions onwards)

Time: 3 hours Max. Weight:30

Part A:(Answer any ***eight*** questions. Each question carries a weight of 1)

1. What are refractories? List their features.
2. What are semimetals?
3. What do you mean by dielectric breakdown?
4. Mention the properties of Gaussian beams.
5. Distinguish between temporal and spatial coherence.
6. List the features of photonic crystals.
7. Compare SLED and ELED.
8. What is nucleation?
9. What the natures of thin films?
10. Write a note on cathodic sputtering.

(8x1=8)

Part B:(Answer any ***six*** questions. Each question carries a weight of 2)

11. Compare thermoplastic and thermosetting polymers.
12. The tensile strength of 2 PMMA materials are 50MPa and 150MPa. Their respective number average molecular weight in g/mol are 30,000 and 50,000. Estimate the tensile strength at a number average molecular weight of 40,000 g/mol.
13. Show that the photovoltage varies logarithmically with photocurrent.
14. Find the ratio of populations of the two states in a laser that produces a wavelength of 590nm at room temperature.
15. An acousto-optic cell of Raman Nath modulator contains water. A piezoelectric crystal generates an acoustic wave of frequency 5MHz in water. The velocity of the acoustic wave in water is 1500m/s and the thickness of the cell is 1cm. If a laser beam of 632nm is incident on the cell,calculate the angle between the first order diffracted beam and the direct beam.

16. Discuss the classification of liquid crystals.
17. Differentiate between type I and type II superconductors.
18. Explain Josephson tunnelling.

(6x2=12)

Part C:(Answer any ***two*** questions. Each question carries a weight of 5)

19. Discuss the mechanical properties of ceramics.
20. How does mode locking be different from Q-switching? How are they achieved?
21. Explain the solar cell principles and characteristics.
22. Analyse the electrodynamics of superconductors.

(2x5=10)

MSc PHYSICS DEGREE EXAMINATION

IV SEMESTER

Faculty of Science

PH810403 Nanostructures and Materials Characterisation

(2019 admissions onwards)

Time: 3 hours Max. Weight:30

Part A: (Answer any ***eight*** questions. Each question carries a weight of 1)

1. Write a note on quantum dots.
2. What are super lattices?
3. Explain self-assembly.
4. What are the advantages of nanosensors?
5. Why does graphene be important in nanoworld?
6. Distinguish between bathochromic and hypsochromic shifts.
7. What are the features of thermal lens spectroscopy?
8. State and explain Moseley's law.
9. Define amu and daltons.
10. Why are the applications of TGA more limited than those for DSC?

(8x1=8)

Part B:(Answer any ***six*** questions. Each question carries a weight of 2)

11. Discuss the various steps involve d in a CVD process.
12. Briefly explain the nanolithographic techniques.
13. Describe the features of giant and colossal magnetoresistance.

14. Discuss the size effects in nanostructures.
15. If the molar absorptivity of a complex is 12000 $lmol^{-1}cm^{-1}$ and the minimum detectable absorbance is 0.001, find the minimum molar concentration that can be detected for 1cm path length.
16. What are the advantages of Fourier transform spectrometry?
17. What is the short wavelength limit of the continuum produced by an X-ray tube having silver target and operated at 90kV?
18. An AFM cantilever has a spring constant 0.1N/m. Find its mass if oscillating frequency is 40kHz.

(6x2=12)

Part C: (Answer any ***two*** questions. Each question carries a weight of 5)

19. Discuss the theory of quantum leak.
20. Explain the properties and applications of nano ZnO and TiO_2.
21. (a) Explain how the photoluminescence power is related to concentration. (b) How does the fluorescence lifetime be calculated?
22. Analyse the functioning of TEM and how can you use TEM for quantitative analysis.

(2x5=10)

MAHATMA GANDHI UNIVERSITY, KOTTAYAM

CURRICULUM FOR UNDER GRADUATE PROGRAMMES IN

PHYSICS

UNDER CHOICE BASED CREDIT SYSTEM (UG CBCS) 2017

2017 ADMISSIONS ONWARDS

CONTENTS

1. ACKNOWLEDGEMENT 3
2. TITLE 4
3. AIMS AND OBJECTIVES OF THE PROGRAMME 4
4. COURSE DESIGN - B. Sc. PROGRAMMES IN PHYSICS 6
5. PROGRAMME STRUCTURE 6
6. MARKS DISTRIBUTION FOR PROJECT AND INDUSTRIAL VISIT 10
7. CONSOLIDATED SCHEME FOR I TO VI SEMESTERS 12
8. SYLLABUS CORE PHYSICS 31
9. COMPLEMENTARY PHYSICS FOR MATHEMATICS AND STATISTICS 81
10. COMPLEMENTARY PHYSICS FOR CHEMISTRY AND GEOLOGY 87
11. COMPLEMENTARY PHYSICS FOR B. Sc. ELECTRONICS (MODEL III) PROGRAMME 95
12. VOCATIONAL COURSES - MODEL II - APPLIED ELECTRONICS 98
13. VOCATIONAL COURSES - MODEL II - COMPLUTER APPLICATIONS 113
14. B. Sc. PHYSICS - MODEL III - ELECTRONIC EQUIPMENT MAINTENANCE 131
15. COMPUTER APPLICATION – COMPLIMENTARY COURSES FOR Model III 145

1. ACKNOWLEDGEMENT

There are many profound personalities whose relentless support and guidance made this syllabus restructuring 2017 a success. We take this opportunity to express our sincere appreciation to all those who were part of this endeavour for restructuring the syllabus of U G course in Physics under Mahatma Gandhi University, Kottayam.

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Special thanks are due to the representatives of the colleges affiliated to M. G. University, who have actively participated and contributed in the workshops. The enthusiasm and sincerity shown by the teachers from various colleges in the context of syllabus restructuring is highly appreciated.

Prepared by BOS and Faculty of Science,

Kottayam
02-05-2017

2. TITLE

B. Sc. PHYSICS PROGRAMME – Under Graduate Programmes under Choice Based Credit System, 2017 (**UG CBCS 2017**).

3. AIMS AND OBJECTIVES OF THE PROGRAMME

Aims:

The Board of Studies in Physics (UG) recognizes that curriculum, course content and assessment of scholastic achievement play complementary roles in shaping education. The committee is of the view that assessment should support and encourage the broad instructional goals such as basic knowledge of the discipline of Physics including phenomenology, theories and techniques, concepts and general principles. This should also support the ability to ask physical questions and to obtain solutions to physical questions by use of qualitative and quantitative reasoning and by experimental investigation. The important student attributes including appreciation of the physical world and the discipline of Physics, curiosity, creativity and reasoned skepticism and understanding links of Physics to other disciplines and to societal issues should gave encouragement. With this in mind, we aim to provide a firm foundation in every aspect of Physics and to explain a broad spectrum of modern trends in physics and to develop experimental, computational and mathematics skills ofstudents.

The programme also aims to develop the following abilities:

1. Read, understand and interpret physical information – verbal, mathematical and graphical.
2. Impart skills required to gather information from resources and use them.
3. To give need based education in physics of the highest quality at the undergraduate level.
4. Offer courses to the choice of the students.
5. Perform experiments and interpret the results of observation, including making an

assessment of experimental uncertainties.

6. Provide an intellectually stimulating environment to develop skills and enthusiasms of students to the best of their potential.
7. Use Information Communication Technology to gather knowledge at will.
8. Attract outstanding students from all backgrounds.

Objectives:

The syllabi are framed in such a way that it bridges the gap between the plus two and post graduate levels of Physics by providing amore complete and logical framework in almost all areas of basic Physics.

By the end of the first year (2nd semester), the students should have attained a common level in basic mechanics, a secure foundation in mathematics, Chemistry(otherwise specified), Languages and other relevant subjects to complement the core for their future courses and developed their experimental and data analysis skills through experiments at laboratories.

By the end of the second year(4thsemester), the students should have been introduced to powerful tools for tackling a wide range of topics in Optics, Laser, Fiber optics, Semiconductor devices and circuits. Along with Languages, they should have been familiar with additional relevant techniques in mathematics, Chemistry or Electronics/Computer application and developed their experimental and data analysis skills through a wide range of experiments through practical at laboratories.

By the end of the third year (6th semester)r, the students should have developed their understanding of core Physics by covering a range of topics in almost all areas of physics including Classical and Quantum Mechanics, Electricity and Electrodynamics, Relativity and spectroscopy, Thermal and Statistical Physics, Nuclear and Particle physics, Solid State Physics, Digital Electronics etc. along with one choice based courses, Open course and had experience of independent work such as projects; seminars etc. and thereby developing their experimental skills through a series of experiments which also illustrate major themes of the lecture courses.

4. COURSE DESIGN - B. Sc. PROGRAMMES IN PHYSICS

The U.G. programme in Physics must include (a) Common courses, (b) Core courses, (c) Complementary courses, (d) Choice based courses, (e) Open courses and (f) Project. No course shall carry more than 4 credits. The student shall select any one Open course in Semester 5 offered by the various Departments which offers the core courses or physical education department, depending on the availability of infrastructure facilities, in the institution. The number of Courses for the restructured programme should contain 12 compulsory core courses, 1 open course, 1 choice based course from the frontier area of the core courses, 6 core practicals, 1 project in the area of core, 8 complementary courses, 2 complementary practicals otherwise specified, from the relevant subjects for complementing the core of study. There should be 10 common courses, or otherwise specified, which includes the first and second language of study.

5. PROGRAMME STRUCTURE

Programme structure

Model- I B. Sc

A	Programme Duration	6 Semesters
B	Total Credits required for successful completion of the Programme	120
C	Credits required from Common Course I	22
D	Credits required from Common Course II	16
E	Credits required from Core course (including Project) and Complementarycourses	79
F	Open course	3
G	Minimum attendance required	75%

Model- II B. Sc

A	Programme Duration	6 Semesters
B	Total Credits required for successful completion of the Programme	120
C	Credits required from Common Course I	16
D	Credits required from Common Course II	8
E	Credits required from Core (including Project) + Complementary + Vocational Courses	93
F	Open course	3
G	Minimum attendance required	75%

Model- III B. Sc

A	Programme Duration	6 Semesters
B	Total Credits required for successful completion of the Programme	120
C	Credits required from Common Course I	8
D	Credits required from Core I + Core II + Complementary + Project	109
E	Open course	3
F	Minimum attendance required	75%

Courses:

There shall be three different types (models) of courses in Physics programme. The programme (Model I) consists of common courses with 38 credits, core, Choice based course, Open course & complementary courses with 82 credits. The programme (Vocational -Model II) consists of common courses with 24 credits, core, Choice based courses, Open course & complementary courses with 96 credits. The programme (Model III) consists of common courses with 8 credits, core, Choice based course, Open course & complementary courses with 112 credits.

The Physics core subject will be the same in all respect in Model-I, Model-II and Model-III. Therefore B.Sc. Physics programme in all these three models will be treated equally for considering higher education in Physics and for Physical Science B.Ed.

Scheme of Courses:

The different types of courses and its number are as the following:

Model- I		**Model- II**		**Model- III**	
Courses	**No.**	**Courses**	**No.**	**Courses**	**No.**
Common Courses	10	Common Courses	6	Common Courses	2
Core Courses	12	Core Courses	12	First Core Courses	12
Project	1	Project	1	Project	1
Core Practicals	6	Core Practicals	6	First Core Practicals	6
Open Course	1	Open Course	1	Open Course	1
Choice based Course	1	Choice based Course	1	Choice based Course	1
-		Vocational courses	8	Second Core Courses	8
		Vocational Practicals	3	Second Core Practicals	3
		-	-	OJT	2
Complementary Courses	8	Complementary Courses	4	Complementary Courses	8
Complementary Practicals	2	-		Complementary Practicals	2
Total	**41**	**Total**	**42**	**Total**	**46**

Course Code:

Every course is coded using an eight digit alpha numeric code that gives a brief description on the following details.

A. Subject Code (2 characters)

Composed of two characters, which gives a meaningful abbreviation of the subject to which the paper belongs to.

The abbreviations used here are PH – Physics, AE – Applied Electronics, CA – Computer Application, EM – Electronic Equipment Maintenance, and EL - Electronics

B. Semester to which course belongs to (1 digit)

Composed of single digit number which indicates the semester to which the paper belongs to (1to 6). In case of Practicals the number indicates the semester in which the exam in conducted.

C. Course type as per syllabus (2 characters)

Composed of two characters which give meaningful abbreviation of type of the course. The abbreviations used here are CM – Complementary Course, CB – Choice Based Core, CR – Core Course, OJ – On Job Training, PR – Project, OP – Open Course and VO – Vocational Course

D. Whether 'Theory' or 'Practical' or 'Other' (1 character)

Letter 'T' is used to denote Theory papers, the letter 'P' for Practical papers and the letter 'O' to denote other papers like Project, On Job Training, etc.

E. Serial number of the course in continuous series (2 digits)

Composed of two digits to indicate the paper's relative position in the programme. Eg. 01 indicates 1st paper, 05 indicates 5th paper, etc.

Sample Course Code

The Course code "PH1CRT01" indicates that the paper is
"Physics – 1st Semester – Core Course – Theory – 1st paper"

Courses with Credits:

Courses with Credits of different courses and scheme of examinations of the programme is the following

Courses	Model I		Model II		Model III	
	Credits	Total	Credits	Total	Credits	Total
Core Courses	47		47		47	
Open Course	3		3		3	
Choice Based Core	3		3		3	
Project	1		1		1	
Vocational Courses	Nil		28		Nil	
2nd Core Courses	Nil		Nil		30	
Total		**54**		**82**		**84**
Complementary Courses I	14		14		14	
Complementary Courses II	14		Nil		14	
Total		**28**		**14**		**28**
Common Courses	38		24		8	
Total		**38**		**24**		**8**
Grand Total		**120**		**120**		**120**

Scheme of Distribution of Instructional hours for Corecourses:

Semester	Model I		Model II		Model III	
	Theory	**Practical**	**Theory**	**Practical**	**Theory**	**Practical**
First semester	2	2	6	4	8	4
Second semester	2	2	6	4	6	4
Third semester	3	2	9	6	9	6
Fourth semester	3	2	9	6	9	6
Fifth semester	17	8	17	8	17	8
Sixth Semester	17	8	17	8	17	8

6. MARKS DISTRIBUTION FOR PROJECT AND INDUSTRIAL VISIT

All students are to do a **project in the area of core course.** This project can be done individually or in groups (not more than three students). The projects are to be identified and its work must be started during the V semester of the programme with the help of the supervising teacher. The report of the project in duplicate is to be submitted to the department at the sixth semester and are to be produced before the examiners appointed by the University. External Project evaluation and Viva / Presentation are compulsory for all subjects and will be conducted at the end of theprogramme.

An industrial visit is also included in the program. The entire student must visit an industry during 5thor 6thsemester and submit a report in duplicate along with the project report. This industrial visit and the report will be evaluated internally and externally along with the project evaluation.

a) Marks ofExternalExamination 80

Components of Evaluation (External)	**Marks**
Dissertation - Project (External)	45
Viva-Voce– Project(External)	27
Industrial Visit Report	5
Viva-Voce – Industrial Visit	3
Total	**80**

b) Marks of internal evaluation: 20(All the five components of the internal assessment are mandatory)

Components of Internal Evaluation	**Marks**
Punctuality	4
Experimentation/Data Collection	5
Knowledge	5
Report	4
Industrial Visit	2
Total	**20**

c) OJT Evaluation (Internal evaluation: 100 marks)

Components of Internal Evaluation	**Marks**
Punctuality	20
Knowledge	20
Experimentation	20
Report	25
Presentation & Viva Voce	15
Total	**100**

7. CONSOLIDATED SCHEME FOR I TO VI SEMESTERS

B. Sc. Physics Programme – (Model I)

Semester	Title of the Course		Hours/week	Credits	Total hrs	Marks	
						IA	EA
1	English (Common Course I) EN1CCT01 – Fine Tune Your English		5	4	90	20	80
	English (Common Course II) EN1CCTO2 – Pearls From the Deep		4	3	72	20	80
	Second Language I		4	4	72	20	80
	PH1CRT01 - Methodology and Perspectives of Physics		2	2	36	15	60
	Complementary I: Mathematics I		4	3	72	20	80
	Complementary II	Chemistry I or Electronics I	2	2	36	15	60
		Or Statistics I (No Practical)**	4	3	72	20	80
	Core Practical I: PH2CRP01 Mechanics and Properties of Matter		2	-	36	-	-
	Complementary II Practical I (Chemistry or Electronics)		2	-	36	-	-
2	English (Common Course III) EN2CCT03 – Issues that Matter		5	4	90	20	80
	English (Common Course IV) EN2CCTO4 – Savouring the Classics		4	3	72	20	80
	Second Language II		4	4	72	20	80
	PH2CRT02 – Mechanics and Properties of Matter		2	2	36	15	60
	Complementary I: Mathematics II		4	3	72	20	80
	Complementary II:	Chemistry II or Electronics II	2	2	36	15	60
		Or Statistics II**	4	3	72	20	80
	Core Practical I: PH2CRP01 Mechanics and Properties of Matter		2	2	36	10	40
	Complementary II Practical I (Chemistry or		2	2	36	10	40

	Electronics)						
3	**English (Common Course V) EN3CCTO5 – Literature and / as Identity**		**5**	**4**	**90**	**20**	**80**
	Second Language III		**5**	**4**	**90**	**20**	**80**
	PH3CRT03 – Optics, Laser and Fiber Optics		**3**	**3**	**54**	**15**	**60**
	Complementary I: Mathematics III		**5**	**4**	**90**	**20**	**80**
	Complementary II:	**Chemistry III or Electronics III**	**3**	**3**	**54**	**15**	**60**
		Or Statistics III**	**5**	**4**	**90**	**20**	**80**
	Core Practical II: PH4CRP02 Optics and Semiconductor Physics		**2**	**-**	**36**	**-**	**-**
	Complementary II Practical II (Chemistry or Electronics)		**2**	**-**	**36**	**-**	**-**
4	**English (Common Course VI) EN4CCTO6 - Illuminations**		**5**	**4**	**90**	**20**	**80**
	Second Language IV		**5**	**4**	**90**	**20**	**80**
	PH4CRT04- Semiconductor Physics		**3**	**3**	**54**	**15**	**60**
	Complementary I: Mathematics IV		**5**	**4**	**90**	**20**	**80**
	Complementary II:	**Chemistry IV or Electronics IV**	**3**	**3**	**54**	**15**	**60**
		Or Statistics IV**	**5**	**4**	**90**	**20**	**80**
	Core Practical II: PH4CRP02 Optics and Semiconductor Physics		**2**	**2**	**36**	**10**	**40**
	Complementary II Practical II (Chemistry or Electronics)		**2**	**2**	**36**	**10**	**40**
5	**PH5CRT05 – Electricity and Electrodynamics**		**3**	**3**	**54**	**15**	**60**
	PH5CRT06 – Classical and Quantum Mechanics		**3**	**3**	**54**	**15**	**60**
	PH5CRT07 –Digital Electronics and Programming		**3**	**3**	**54**	**15**	**60**
	PH5CRT08 – Environmental Physics and Human Rights		**4**	**4**	**72**	**15**	**60**
	PH5OPT0X* -Open Course		**4**	**3**	**72**	**20**	**80**
	Core Practical III: PH6CRP03 Electricity, Magnetism and Laser		**2**	**-**	**36**	**-**	**-**
	Core Practical IV: PH6CRP04 Digital Electronics		**2**	**-**	**36**	**-**	**-**
	Core Practical V: PH6CRP05 Thermal Physics, Spectroscopy and C++ programming		**2**	**-**	**36**	**-**	**-**
	Core Practical VI: PH6CRP06		**2**	**-**	**36**	**-**	**-**

	Acoustics, Photonics and Advanced Semiconductor Physics					
6	**PH6CRT09- Thermal and Statistical Physics**	**3**	**3**	**54**	**15**	**60**
	PH6CRT10 --Relativity and Spectroscopy	**4**	**3**	**72**	**15**	**60**
	PH6CRT11 – Nuclear, Particle and Astrophysics	**3**	**3**	**54**	**15**	**60**
	PH6CRT12- Solid State Physics	**4**	**3**	**72**	**15**	**60**
	PH6CBT0X *-Choice Based Course	**3**	**3**	**54**	**20**	**80**
	Core Practical III: PH6CRP03 Electricity, Magnetism and Laser	**2**	**2**	**36**	**10**	**40**
	Core Practical IV: PH6CRP04 Digital Electronics	**2**	**2**	**36**	**10**	**40**
	Core Practical V: PH6CRP05 Thermal Physics, Spectroscopy and C++ programming	**2**	**2**	**36**	**10**	**40**
	Core Practical VI: PH6CRP06 Acoustics, Photonics and Advanced Semiconductor Physics	**2**	**2**	**36**	**10**	**40**
	PH6PRO01 – Project and Industrial Visit	**-**	**1**	**-**	**20**	**80**

***- X Stands for 1, 2, 3, … depending upon Open course and Choice based course**

**** Complementary II : Statistics has only theory papers.**

Choice Based Course

Sl. No.	Paper Code	Semester	Paper Title
1	PH6CBT01	VI	IT
2	PH6CBT02	VI	Material Science
3	PH6CBT03	VI	Computational Physics
4	PH6CBT04	VI	Instrumentation
5	PH6CBT05	VI	Astronomy & Astrophysics

Open Course

Sl. No.	Paper Code	Semester	Paper Title
1	PH5OPT01	V	Our Universe
2	PH5OPT02	V	Physics in Daily Life
3	PH5OPT03	V	Computer Hardware and Networking

B.Sc. Physics Programme – (Model -II)

Vocational Subject 1: APPLIEDELECTRONICS

Semester	Title of the Course	Hrs\week	Credits	Total hrs/sem	Marks	
					IA	EA
1	English (Common Course I) EN1CCT01 – Fine Tune Your English	5	4	90	20	80
	Second Language I	5	4	90	20	80
	PH1CRT01 - Methodology and Perspectives of Physics	2	2	36	15	60
	Complementary I – Mathematics I	5	3	90	20	80
	AE1VOT01 Principle of Electronic Components	2	2	36	20	80
	AE1VOT02 - Electronics Application	2	2	36	15	60
	Core Practical 1: PH2CRP01 Mechanics and Properties of Matter	2	-	36	-	-
	Vocational Practical 1: AE2VOP01- Basic and Power Electronics	2	-	36	-	-
2	English (Common Course III) EN2CCT03 – Issues that Matter	5	4	90	20	80
	Second language II	5	4	90	20	80
	PH2CRT02 – Mechanics and Properties of Matter	2	2	36	15	60
	Complementary I – Mathematics II	5	3	90	20	80
	AE2VOT03 - Basics of power Electronics	2	2	36	20	80
	AE2VOT04 - Power Electronics	2	2	36	15	60
	Core Practical 1: PH2CRP01 Mechanics and Properties of Matter	2	2	36	10	40
	Vocational Practical 1: AE2VOP01- Basic and Power Electronics	2	2	36	10	40
	English (Common Course V) EN3CCTO5 – Literature and / as Identity	5	4	90	20	80
	PH3CRT03 – Optics, Laser and Fiber Optics	3	3	54	15	60

3	**Complementary I – Mathematics III**	**5**	**4**	**90**	**20**	**80**
	AE3VOT05 - Microprocessor and Interfacing Devices	**3**	**4**	**54**	**15**	**60**
	AE3VOT06 - Communication Electronics	**3**	**3**	**54**	**15**	**60**
	Core Practical II: PH4CRP02	**2**	**-**	**36**	**-**	**-**
	Vocational Practical II: AE4VOP02- Microprocessor and Linear Integrated Circuits	**2**	**-**	**36**	**-**	**-**
	Vocational Practical III: AE4VOP03- Microprocessor and Communication Electronics	**2**	**-**	**36**	**-**	**-**

4	**English (Common Course VI) EN4CCTO6 - Illuminations**	**5**	**4**	**90**	**20**	**80**
	PH4CRT04 - Semiconductor Physics	**3**	**3**	**54**	**15**	**60**
	Complementary I – Mathematics IV	**5**	**4**	**90**	**20**	**80**
	AE4VOT07-Linear Integrated Circuits	**3**	**4**	**54**	**15**	**60**
	AE4VOT08 - Applications of Microprocessors	**3**	**3**	**54**	**15**	**60**
	Core Practical II: PH4CRP02 Optics and Semiconductor Physics	**2**	**2**	**36**	**10**	**40**
	Vocational Practical II: AE4VOP02- Microprocessor and Linear Integrated Circuits	**2**	**2**	**36**	**10**	**40**
	Vocational Practical III: AE4VOP03- Microprocessor and Communication Electronics	**2**	**2**	**36**	**10**	**40**
5	**PH5CRT05 – Electricity and Electrodynamics**	**3**	**3**	**54**	**15**	**60**
	PH5CRT06 – Classical and Quantum Mechanics	**3**	**3**	**54**	**15**	**60**
	PH5CRT07 –Digital Electronics and Programming	**3**	**3**	**54**	**15**	**60**
	PH5CRT08 – Environmental Physics and Human Rights	**4**	**4**	**72**	**15**	**60**
	PH5OPT0X* -Open Course	**4**	**3**	**72**	**20**	**80**
	Core Practical III: PH6CRP03 Electricity, Magnetism and Laser	**2**	**-**	**36**	**-**	**-**
	Core Practical IV: PH6CRP04 Digital Electronics	**2**	**-**	**36**	**-**	**-**

	Core Practical V: PH6CRP05 Thermal Physics, Spectroscopy and C++ Programming	**2**	**-**	**36**	**-**	**-**
	Core Practical VI: PH6CRP06 Acoustics, Photonics and Advanced Semiconductor Physics	**2**	**-**	**36**	**-**	**-**
6	**PH6CRT09- Thermal and Statistical Physics**	**3**	**3**	**54**	**15**	**60**
	PH6CRT10 - --Relativity and Spectroscopy	**4**	**3**	**72**	**15**	**60**
	PH6CRT11 – – Nuclear, Particle and Astrophysics	**3**	**3**	**54**	**15**	**60**
	PH6CRT12- Solid State Physics	**4**	**3**	**72**	**15**	**60**
	PH6CBT0X*-Choice Based Course	**3**	**3**	**54**	**20**	**80**
	Core Practical III: PH6CRP03 Electricity, Magnetism and Laser	**2**	**2**	**36**	**10**	**40**
	Core Practical IV: PH6CRP04 Digital Electronics	**2**	**2**	**36**	**10**	**40**
	Core Practical V: PH6CRP05 Thermal Physics, Spectroscopy and C++ Programming	**2**	**2**	**36**	**10**	**40**
	Core Practical VI: PH6CRP06 Acoustics, Photonics and Advanced Semiconductor Physics	**2**	**2**	**36**	**10**	**40**
	PH6PRO01 – Project and Industrial Visit	**-**	**1**	**-**	**20**	**80**

***- X Stands for 1, 2, 3, … depending upon Open course and Choice based course**
Choice Based Course

Sl. No.	Paper Code	Semester	Paper Title
1	PH6CBT01	VI	IT
2	PH6CBT02	VI	Material Science
3	PH6CBT03	VI	Computational Physics
4	PH6CBT04	VI	Instrumentation
5	PH6CBT05	VI	Astronomy & Astrophysics

Open Course

Sl. No.	Paper Code	Semester	Paper Title
1	PH5OPT01	V	Our Universe
2	PH5OPT02	V	Physics in Daily Life
3	PH5OPT03	V	Computer Hardware and Networking

Vocational Subject 2: COMPUTER APPLICATION

Semester	Title of the Course	Hours\week	Credits	hrs/semester	marks	
					IA	EA
1	English (Common Course I) EN1CCT01 – Fine Tune Your English	5	4	90	20	80
	Second Language I	5	4	90	20	80
	PH1CRT01 – Methodology and Perspectives of Physics	2	2	36	15	60
	Complementary I – Mathematics I	5	3	90	20	80
	CA1VOT01 - Computer Fundamentals	2	2	36	20	80
	CA1VOT02 Computer Networks& Internet Technologies	2	2	36	15	60
	Core Practical I: PH2CRP01 Mechanics and Properties of Matter	2	-	36	-	-
	Vocational Practical I: CA2VOP01 Introduction to Computers & ANSI C Programming	2	-	36	-	-
2	English (Common Course III) EN2CCT03 – Issues that Matter	5	4	90	20	80
	Second Language II	5	4	90	20	80
	PH2CRT02 – Mechanics and Properties of Matter	2	2	36	15	60
	Complementary I – Mathematics II	5	3	90	20	80
	CA2VOT03 Word and Data processing Packages	2	2	36	20	80
	CA2VOT04 - Programming in ANSI C	2	2	36	15	60
	Core Practical I: PH2CRP01 Mechanics and Properties of Matter	2	2	36	10	40
	Vocational Practical 2: CA2VOP01 Introduction to Computers & ANSI C Programming	2	2	36	10	40

3	**English (Common Course V) EN3CCTO5 – Literature and *I* as Identity**	**5**	**4**	**90**	**20**	**80**
	PH3CRT03 – Optics, Laser and Fiber Optics	**3**	**3**	**54**	**15**	**60**
	Complementary I – Mathematics III	**5**	**4**	**90**	**20**	**80**
	CA3VOT05 Concepts of Object Oriented	**3**	**4**	**54**	**15**	**60**
	CA3VOT06 –Operating System	**3**	**3**	**54**	**15**	**60**
	Core Practical II: PH4CRP02 Optics and Semiconductor Physics	**2**	**-**	**36**	**-**	**-**
	Vocational Practical II: CA4VOP02 Data Processing Packages, Operating System and Visual Basic Programming	**2**	**-**	**36**	**-**	**-**
	Vocational Practical III: CA4VOP03 C++ Programming and Web Development	**2**	**-**	**36**	**-**	**-**

4	**English (Common Course VI) EN4CCTO6 - Illuminations**	**5**	**4**	**90**	**20**	**80**
	PH4CRT04 - Semiconductor Physics	**3**	**3**	**54**	**15**	**60**
	Complementary I – Mathematics IV	**5**	**4**	**90**	**20**	**80**
	CA4VOT07 - Visual Basic Programming	**3**	**4**	**54**	**15**	**60**
	CA4VOT08 Web Development and PHP Programming	**3**	**3**	**54**	**15**	**60**
	Core Practical II: PH4CRP02 Optics and Semiconductor Physics	**2**	**2**	**36**	**10**	**40**
	Vocational Practical II: CA4VOP02 Data Processing Packages, Operating System and Visual Basic Programming	**2**	**2**	**36**	**10**	**40**
	Vocational Practical III: CA4VOP03 C++ Programming and Web Development	**2**	**2**	**36**	**10**	**40**
5	**PH5CRT05 – Electricity and Electrodynamics**	**3**	**3**	**54**	**15**	**60**
	PH5CRT06 – Classical and Quantum Mechanics	**3**	**3**	**54**	**15**	**60**
	PH5CRT07 –Digital Electronics and Programming	**3**	**3**	**54**	**15**	**60**
	PH5CRT08 – Environmental Physics and Human Rights	**4**	**4**	**72**	**15**	**60**
	PH5OPT0X* -Open Course	**4**	**3**	**72**	**20**	**80**

	Core Practical III: PH6CRP03 Electricity, Magnetism and Laser	**2**	**-**	**36**	**-**	**-**
	Core Practical IV: PH6CRP04 Digital Electronics	**2**	**-**	**36**	**-**	**-**
	Core Practical V: PH6CRP05 Thermal Physics, Spectroscopy and C++ Programming	**2**	**-**	**36**	**-**	**-**
	Core Practical VI: PH6CRP06 Acoustics, Photonics and Advanced Semiconductor Physics	**2**	**-**	**36**	**-**	**-**
6	**PH6CRT09 Thermal and Statistical Physics**	**3**	**3**	**54**	**15**	**60**
	PH6CRT10 - Relativity and Spectroscopy	**4**	**3**	**72**	**15**	**60**
	PH6CRT11 – Nuclear, Particle and Astrophysics	**3**	**3**	**54**	**15**	**60**
	PH6CRT12- Solid State Physics	**4**	**3**	**72**	**15**	**60**
	PH6CBT0X *-Choice Based Course	**3**	**3**	**54**	**20**	**80**
	Core Practical III: PH6CRP03 Electricity, Magnetism and Laser	**2**	**2**	**36**	**10**	**40**
	Core Practical IV: PH6CRP04 Digital Electronics	**2**	**2**	**36**	**10**	**40**
	Core Practical V: PH6CRP05 Thermal Physics, Spectroscopy and C++ Programming	**2**	**2**	**36**	**10**	**40**
	Core Practical VI: PH6CRP06 Acoustics, Photonics and Advanced Semiconductor Physics	**2**	**2**	**36**	**10**	**40**
	PH6PRO01 – Project and Industrial Visit	**-**	**1**	**-**	**20**	**80**

***- X Stands for 1, 2, 3, … depending upon Open course and Choice based course**

Choice Based Course

Sl. No.	Paper Code	Semester	Paper Title
1	PH6CBT01	VI	IT
2	PH6CBT02	VI	Material Science
3	PH6CBT03	VI	Computational Physics
4	PH6CBT04	VI	Instrumentation
5	PH6CBT05	VI	Astronomy & Astrophysics

Open Course

Sl. No.	Paper Code	Semester	Paper Title
1	PH5OPT01	V	Our Universe
2	PH5OPT02	V	Physics in Daily Life
3	PH5OPT03	V	Computer Hardware and Networking

B. Sc. Physics (Model -III) Programme (2 Core Courses)

(1) ELECTRONIC EQUIPMENT MAINTENANCE

Semester	Title of the Course	Hours per week	No. Of Credits	Total hrs/semester	Marks	
					IA	EA
1	English I	5	4	90	20	80
	PH1CRT01 – Methodology and Perspectives of Physics	2	2	36	15	60
	PH1CRT21 - Principles of Electronics	3	2	54	20	80
	PH1CRT22 - Communication Engineering	3	2	54	15	60
	Complementary I: Mathematics I	4	3	72	20	80
	Complementary II : CA1CMT01 Computer Fundamentals	2	2	36	15	60
	Core 1 Practical I: PH2CRP01 Mechanics and Properties of Matter	2	-	36	-	-
	Core 2 Practical I: PH2CRP21	2	-	36	-	-
	Complementary II Practical I: CA2CMP01	2	-	36	-	-
2	English II	5	4	90	20	80
	PH2CRT02 – Mechanics and Properties of Matter	2	2	36	15	60
	PH2CRT23 - Power Electronics	3	2	54	20	80
	PH2CRT24 – Analogue Integrated Circuits	3	2	54	15	60
	Complementary I – Mathematics II	4	3	72	20	80
	Complementary II: CA2CMT02 Programming in C Language	2	3	36	15	60
	Core 1 Practical I: PH2CRP01 Mechanics and Properties of Matter	2	2	36	10	40
	Core 2 Practical I: PH2CRP21	2	2	36	10	40
	Complementary II Practical I: CA2CMP01	2	2	36	10	40
	PH2OJO01- On Job Training I	0	2	0	100	-

3	**PH3CRT03 – Optics, Laser and Fiber Optics**	**3**	**3**	**54**	**15**	**60**
	PH3CRT25 Microprocessor and its applications	**3**	**3**	**54**	**15**	**60**
	PH3CRT26- Network Theory	**3**	**3**	**54**	**15**	**60**
	Complementary I - Mathematics III	**5**	**4**	**90**	**20**	**80**
	Complementary II: CA3CMT03 Web Technology and Programming	**3**	**2**	**54**	**15**	**60**
	Core 1 Practical II: PH4CRP02 Optics and Semiconductor Physics	**2**	**-**	**36**	**-**	**-**
	Core 2 Practical II: PH4CRP22	**2**	**-**	**36**	**-**	**-**
	Core 2 Practical III: PH4CRP23	**2**	**-**	**36**	**-**	**-**
	Complementary II Practical II: CA4CMP02	**2**	**-**	**36**	**-**	**-**
4	**PH4CRT04 - Semiconductor Physics**	**3**	**3**	**54**	**15**	**60**
	PH4CRT27 - Trouble Shooting of Audio Equipments	**3**	**3**	**54**	**15**	**60**
	PH4CRT28 Trouble Shooting of Video Equipments	**3**	**3**	**54**	**15**	**60**
	Complementary I: Mathematics IV	**5**	**4**	**90**	**20**	**80**
	Complementary II: CA4CMT04 Visual Programming Techniques	**3**	**3**	**54**	**15**	**60**
	Core 1 Practical II: PH4CRP02 Optics and Semiconductor Physics	**2**	**2**	**36**	**10**	**40**
	Core 2 Practical II: PH4CRP22	**2**	**2**	**36**	**10**	**40**
	Core 2 Practical III: PH4CRP23	**2**	**2**	**36**	**10**	**40**
	Complementary II Practical II: CA4CMP02	**2**	**2**	**36**	**10**	**40**
	PH4OJ02: On Job Training II	**0**	**2**	**0**	**100**	**-**
	PH5CRT05 – Electricity and Electrodynamics	**3**	**3**	**54**	**15**	**60**
	PH5CRT06 –Classical and Quantum Mechanics	**3**	**3**	**54**	**15**	**60**
	PH5CRT07 –Digital Electronics and Programming	**3**	**3**	**54**	**15**	**60**
	PH5CRT08 – Environmental Physics and Human Rights	**4**	**4**	**72**	**15**	**60**
	PH5OPT0X* -Open Course	**4**	**3**	**72**	**20**	**80**

5	**Core 1 Practical III: PH6CRP03 Electricity, Magnetism and Laser**	**2**	**-**	**36**	**-**	**-**
	Core 1 Practical IV: PH6CRP04 Digital Electronics	**2**	**-**	**36**	**-**	**-**
	Core 1 Practical V: PH6CRP05 Thermal Physics, Spectroscopy and C++ Programming	**2**	**-**	**36**	**-**	**-**
	Core 1 Practical VI: PH6CRP06 Acoustics, Photonics and Advanced Semiconductor Physics	**2**	**-**	**36**	**-**	**-**

	PH6CRT09 Thermal and Statistical Physics	**3**	**3**	**54**	**15**	**60**
	PH6CRT10 - Relativity and Spectroscopy	**4**	**3**	**72**	**15**	**60**
	PH6CRT11 – – Nuclear, Particle and Astrophysics	**3**	**3**	**54**	**15**	**60**
	PH6CCRT12- Solid State Physics	**4**	**3**	**72**	**15**	**60**
	PH6CBT0X *-Choice Based Course	**3**	**3**	**54**	**20**	**80**
6	**Core 1 Practical III: PH6CRP03 Electricity, Magnetism and Laser**	**2**	**2**	**36**	**10**	**40**
	Core 1 Practical IV: PH6CRP04 Digital Electronics	**2**	**2**	**36**	**10**	**40**
	Core 1 Practical V: PH6CRP05 Thermal Physics, Spectroscopy and C++ Programming	**2**	**2**	**36**	**10**	**40**
	Core 1 Practical VI: PH6CRP06 Acoustics, Photonics and Advanced Semiconductor Physics	**2**	**2**	**36**	**10**	**40**
	PH6PRO01 – Project and Industrial Visit	**-**	**1**	**-**	**20**	**80**

***- X Stands for 1, 2, 3, … depending upon Open course and Choice based course**

Choice Based Course

Sl. No.	Paper Code	Semester	Paper Title
1	PH6CBT01	VI	IT
2	PH6CBT02	VI	Material Science
3	PH6CBT03	VI	Computational Physics
4	PH6CBT04	VI	Instrumentation
5	PH6CBT05	VI	Astronomy & Astrophysics

Open Course

Sl. No.	Paper Code	Semester	Paper Title
1	PH5OPT01	V	Our Universe
2	PH5OPT02	V	Physics in Daily Life
3	PH5OPT03	V	Computer Hardware and Networking

1. Complementary Physics for Mathematics and Statistics

Semester	Title of the Course	Hours per week	No. Of Credits	Total hrs/semester	Marks	
					IA	EA
1	**PH1CMT01: Properties of Matter & Error Analysis**	2	2	36	15	60
	PH2CMP01: Practical 1	2	-	36	-	-
2	**PH2CMT01: Mechanics and Astrophysics**	2	2	36	15	60
	PH2CMP01: Practical 1	2	2	36	10	40
3	**PH3CMT01: Modern Physics and Electronics**	3	3	54	15	60
	PH4CMP01: Practical 2	2	-	36	-	-
4	**PH4CMT01: Optics & Electricity**	3	3	54	15	60
	PH4CMP01: Practical 2	2	2	36	10	40

2. Complementary Physics for Chemistry and Geology

Semester	Title of the Course	Hours per week	No. Of Credits	Total hrs/semester	Marks	
					IA	EA
1	**PH1CMT02: Properties of Matter and Thermodynamics**	**2**	**2**	**36**	**15**	**60**
	PH2CMP02: Practical 1	**2**	**-**	**36**	**-**	**-**
2	**PH2CMT02: Mechanics and Superconductivity**	**2**	**2**	**36**	**15**	**60**
	PH2CMP02: Practical 1	**2**	**2**	**36**	**10**	**40**
3	**PH3CMT02: Modern Physics and Magnetism**	**3**	**3**	**54**	**15**	**60**
	PH4CMP02: Practical 2	**2**	**-**	**36**	**-**	**-**
4	**PH4CMT02: Optics and Solid State Physics**	**3**	**3**	**54**	**15**	**60**
	PH4CMP02: Practical 2	**2**	**2**	**36**	**10**	**40**

3. Complementary Physics for B.Sc. Electronics (Model III) Programme

Semester	Title of the Course	Hours per week	No. Of Credits	Total hrs/semester	Marks	
					IA	EA
1	**PH1CMT03: Solid State Physics**	**4**	**3**	**72**	**20**	**80**

8.SYLLABUS CORE PHYSICS

B.Sc. Physics Programme (Model – I, II &III)

Semester-I

Core Course: I **Credit – 2 (36 hours)**

PH1CRT01: METHODOLOGY AND PERSPECTIVES OF PHYSICS

Module I

Concepts and Development Physics: (8hours)

Development of physics in the last century and the birth of new scientific concepts with reference to s*cientific contributions of Galileo, Newton, Einstein, J J Thomson, Curies, Rayleigh, Max Plank, Heisenberg and Schrodinger* (qualitative understanding). Contributions of Indian physicists -*C V Raman, H J Babha, J C Bose, S N Bose, M Saha, S Chandrasekhar, Vikram Sarabhai,* (Topics in this part require qualitative study only)

References:

1. Feynman lectures of Physics
2. Concepts of Modern Physics: ArtherBeisser,
3. Modern Physics: Kenneth Krane
4. Modern Physics: R Murugeshan
5. https://www.nobelprize.org/nobel_prizes/physics/laureates/

Module II **(18 hours)**

Number systems- Decimal, hexadecimal and Binary.Conversions, Binary arithmetic addition, subtraction and multiplication. 1's and 2's complement subtraction –signed binary numbers. Signed binary arithmetic, BCD code, ASCII code, Significance of binary number system in digital electronics, microprocessors and in computers,

Introductory Vector Analysis - Applications of vectors in Physics. Differential and integral vector calculus: – The operator ∇- physical significance of Gradient, Divergence and Curl, Line integral, surface integral and volume integral of vectors

Co-ordinate systems:Cartesian Co-ordinate system, plane polar and spherical polar coordinates, cylindricalcoordinates (Basic ideas with examples in physics),

References:

6. Introduction to Electrodynamics, David J. Griffiths, Prentice Hall India Pvt. Ltd., Chapter 1
7. Mathematical Physics: Charlie Harper
8. University Physics, Roger A Freedman, Hugh D Young 14th edition
9. Digital electronics: Albert Paul Malvino
10. Digital logic and computer design – M. Morris Mano, PHI.

Module III

Experimental methods and error analysis (10 hrs)

Experimental methods, least count of instruments, Instruments for measuring mass- common balance; length-vernier, screw gauge, travelling microscope, and sonar; time- pendulum clock and atomic clock; angle- spectrometer and stellar parallax; current- ammeter and conversion of galvanometer to ammeter; voltage- voltmeter and conversion of galvanometer to voltmeter. Fundamental units. Precision and accuracy of measurements, source of error in measurements, necessity of estimating errors , types of errors, reading error of instrument, calibration error, random error, systematic error, significant digits, order of magnitude and rounding of numbers, rounding error, absolute and relative errors, Errors of computation- addition, subtraction, multiplication, division, error in power and roots, Propagation of errors, analysis of data, standard deviation, calculation of mean value.

References:

1. Text book: Advanced course in Practical Physics by D Chattopadhyay- Chapter-1
2. Practical Physics, G L Squires, Third edn. Cambridge University Press.

3. The theory of Errors in Physical Measurements- J C Pal- New Central Book Agency- 2010

Semester-II

Core Course: II **Credit – 2(36 hours)**

PH2CRT02: MECHANICS AND PROPERTIES OF MATTER

Module I

Wave motion **(4 hours)**

General equation of wave motion, plane progressive harmonic wave, energy density, intensity of a wave, superposition of waves, beats, transverse waves in stretched strings, modes.

Text Book: Mechanics by D.S. Mathur – Chapter 9.

Oscillations **(8 hours)**

Periodic motion, simple harmonic motion and harmonic oscillator, energy of a harmonic oscillator, examples of harmonic oscillator – simple and compound pendulum.Theory of Damped harmonic oscillator.Theory of forced oscillator, resonance, applications.

Text Book: Mechanics by D.S. Mathur – Chapter 7, 8.

Module -II

Rotational mechanics (7 Hours)

Angular velocity- angular acceleration- angular momentum- conservation- torque-moment of inertia- Parallel and perpendicular axes theorems - calculation of moment of inertia- (rod, ring, disc, cylinder, and sphere). Theory of flywheel.

Text Book: Mechanics by D.S. Mathur – Chapter 10.

Module III

Elasticity **(10 hours)**

Basic ideas on elasticity – Young's modulus, bulk modulus, rigidity modulus, Poisson's ratio, relations connecting various elastic constants.Work done per unit volume in a strain. Bending of beams, bending moment, flexural rigidity.Young's modulus – uniform and non-uniform bending, cantilever.I –section girders. Determination of rigidity modulus using Static and Dynamic methods.

Text Book: Mechanics by D.S. Mathur – Chapter 12, 13.

Hydrodynamics (7 hours)

Streamline and turbulent flows, coefficient of Viscosity – Determination of viscosity by Poiseuille's method. Equation of continuity, energy possessed by a liquid, Bernoulli's theorem.

Surface tension, surface energy, excess pressure in a liquid drop and bubble, factors affecting surface tension, applications.

Text Book: Mechanics by D.S. Mathur – Chapter 14.

Text books:

1. Mechanics by J.C. Upadhayaya, Ramprasad Pub.
2. Mechanics -D.S.Mathur, S.Chand.
3. Advanced course in Practical Physics by D Chattopadhyay, Central Book
4. Properties of Matter and Acoustics by Murugeshan and K. Sivaprasath, S. Chand

References:

1. Mechanics- Hans and Puri, TMH
2. Classical Mechanics by J.C. Upadhyaya, Himalaya Pub.
3. Classical Mechanics-Takwale and Puranik, TMH.
4. Classical mechanics- K.SankaraRao, PHI.
5. Properties of Matter by Mathur, S. Chand,
6. Mechanics by Somnath Datta, Pearson
7. Mechanics by H.D Young and R.A Freedman, Pearson.

Semester-III

Core Course: III **Credit – 3(54 hours)**

PH3CRT03: OPTICS, LASER AND FIBER OPTICS

Module I

Interference **(13 hours)**

Review of basic ideas of interference- Coherent waves-Optical path and phase change-superposition of waves-theory of interference-intensity distribution. Young's double slit experiment, Coherence-Conditions for interference.

Thin films-plane parallel film- interference due to reflected light-conditions for brightness and darkness-interference due to transmitted light- Haidinger fringes- interference in wedge shaped film- colours in thin films-Newton's rings-applications. Michelson interferometer- construction and working.

Text book: Optics by N.Subramanayam, Brijlal, M.N.Avadhanulu-Chapter 14 and 15.

Module II

Diffraction **(10 hours)**

Fresnel Diffraction – Huygens- Fresnel theory –zone plate –Difference between zone plate and convex lens. Comparison between interference and diffraction –diffraction pattern due to a straight edge, single silt. Fraunhoffer diffraction at a single slit, double slit,N slits, theory of plane transmission grating. Dispersive power and resolving power of grating.

Text book: Optics by N.Subramanayam, Brijlal, M.N.Avadhanulu-Chapter 17, 18 and 19.

Polarization **(12hours)**

Concept of polarization – plane of polarization- Types of polarized light-production of plane polarized light by reflection-refraction. Malu's law-Polarization by double refraction-calcite crystal. Anisotropic crystals-optic axis-Double refraction-Huygens explanation of double refraction. Retarders - Quarter wave plate and Half wave plate. Production and Detection of plane, elliptically and circularly polarized light-Optical Activity- specific rotation.

Text book: Optics by N.Subramanayam, Brijlal, M.N.Avadhanulu-Chapter 20.

Module III

Laser (10 hours)

Absorption and emission of light- Absorption- spontaneous emission and stimulated emission, Einstein relations, Population inversion- Active medium-Pumping, different pumping methods, Resonators – plane mirror and confocal resonators – Metastable state, Three level and Four level Laser systems. Ruby Laser, He-Ne laser, Semiconductor Laser, Laser beam Characteristics, coherence. Applications of Laser.

Text book: Optics by N.Subramanayam, Brijlal, M.N.Avadhanulu-Chapter 22 and 23.

Fiber Optics (9 hours)

Propagation of light in a fiber -acceptance angle, numerical aperture, V-number, single mode and multimode step index fiber –graded index fiber- attenuation- application of fiber-optical fiber communication – advantages.

Text book: Semiconductor physics and optoelectronics- V.Rajendran, J.Hemaletha and M.S.M.Gibson, Unit IV*-Chapter 1.*

References

1. Optics, E Hecht and AR Ganesan, Pearson
2. Optics, 3rd edition, AjoyGhatak, TMH
3. Optical Electronics, AjoyGhatak and K Thyagarajan, Cambridge
4. Optics and Atomic Physics, D P Khandelwal, Himalaya Pub. House
5. Optics, S K Srivastava, CBS Pub. N Delhi
6. A Text book of Optics, S L Kakani, K L Bhandari, S Chand.
7. Optics N.Subramanayam, Brijlal, M.N Avadhanulu S Chand.
8. Semiconductor optoelectronic devices: Pallab Bhattacharya, PHI 2009.
9. Lasers and Non linear Optics, BB Laud, New Age Int Pub. 2013
10. Laser Fundamentals, William T Silfvast, Cambridge Univ Press. 2012.
11. Optoelectronics an Introduction, J Wilson & JFB Hawkes, PHI 1999.
12. Fiber Optics and Optoelectronics, R P Khare, Oxford 2012..
13. Introduction to Optics, Frank L Pedrotti, Leno M Pedrotti& Leno S Pefrotti, Pearson 2014.
14. Optical fiber and fiber optic communication system (4th edition) Subir Kumar Sarkar, S Chand.

Semester-IV

Core Course: IV **Credit – 3 (54 hours)**

PH4CRT04: SEMICONDUCTOR PHYSICS

Module I

Semiconducting diodes and applications (14 hours)

PN Junction, Depletion layer, Barrier potential, Biasing- forward and reverse, Reverse breakdown, Junction capacitance and diffusion capacitance- PN Junction diode – V-I characteristics–Diode parameters, Diode current Equation, Diode testing, Ideal diode. Zener diode and its reverse characteristics.Thermistors.

Rectification - Half wave, Full wave, Centre tapped, Bridge rectifier circuits - Nature of rectified output, Efficiency & Ripple factor-Filter circuits – Inductor Filter, Capacitor Filter, LC Filter, π Filter-Regulated Power supplies - Zener diode voltage regulator- Voltage multipliers – Doubler & Tripler- Wave shaping circuits - Clipper-Positive, negative and biased – Clampers- Positive, negative and biased.

Text Book: Basic Electronics- B.L.Theraja Chapters 13,14,15,17

A Text Book of Applied Electronics- R.S.Sedha Chapters-11, 12, 19, 20, 33

Module II

Transistors Configurations and Feed back (12 hours)

Bipolar junction transistors, Transistor biasing, CB, CC, CE configurations and their characteristics- Active, saturation and cut-off regions. Current gain α, β, γ and their relationships. Leakage currents- Thermal runaway. DC operating point and AC and DC Load line, Q-Point.

Basic principles of feedback, positive & negative feedback, Advantages of negative feedback, negative feedback circuits – voltage series & shunt, current series & shunt.

Amplifiers and Oscillators (12 hours)

Need for biasing-Stabilization- Voltage divider bias. Single stage transistor Amplifiers-CE amplifier - amplification factors. Decibel system, Variations in Amplifier gain with frequency.

Oscillatory Circuits, LC oscillators – Hartley Oscillator, Colpit's Oscillator, RC oscillators - Phase shift Oscillator. Astable and monostable multivibrator (basic idea only)

Text Book: Basic Electronics-B.L.Theraja-Chapters 18, 19, 20, 22, 24, 25, 28, 29.

A Text Book of Applied Electronics-R.S.Sedha Chapters 14, 15, 22,24, 29, 31, 32

Module III

FET, Operational Amplifier & Modulation (16 hours)

FET -characteristics, FET- Parameters. Comparison between FET and BJT.

OP-amp- Symbol and terminals. Characteristics of ideal OP-amp, CMRR, Applications - inverting, Non-inverting, Unity follower and Summing amplifiers.

Types of modulation – AM, FM, Pulse modulation and Phase modulation (qualitative study only). Amplitude modulation- modulation index - Analysis of AM wave – Sidebands –bandwidth- AM Demodulation.

Text Book: Basic Electronics-B. L. Theraja - Chapters 26, 30, 31

A Text Book of Applied Electronics-R.S.Sedha-Chapter-16, 35

References:

1. Principles of electronics, VK Mehta, S Chand
2. Basic Electronics(7thEdition), Malvino and Bates, TMH
3. Electronics Fundamentals and Applications- D. Chattopadhyay and P.G.Rakshit, New Age International Publishers.
4. Electronics: Fundamentals of Analog circuits, Thomas L. Floyd, David Buchla, Prentice Hall
5. Electronic Devices and Circuit Theory, Robert Boylestad, Louis Nashelsky, Prentice Hall
6. Basic Electronics, Debashis De , Pearson 2010
7. Basic Electronics, Santiram Kal, PHI 2010

Semester-V

Core Course: V **Credit – 3 (54 hours)**

PH5CRT05: ELECTRICITY AND ELECTRODYNAMICS

Module I

Alternating Current and Network Theorems (15 hours)

EMF induced in a coil rotating in a magnetic field - AC applied to resistive, inductive and capacitance circuits - AC applied to LR and RC circuits - Analysis of LCR series circuits - LCR parallel resonant circuit – comparison - Power in ac circuits - Wattless current - choke coil - transformer on no load- skin effect.

Ideal voltage source and current source - Superposition theorem - Reciprocity theorem - Thevenin's theorem - Norton's theorem - Maximum power transfer theorem.

Text Book:Electricity and Magnetism, R. Murugeshan- Chapters 13, 30 and 18

Module II

Transient Current and Thermo electricity (8 hours)

Growth and decay of current in an LR circuit- Charging and discharging of a capacitor through a resistor - Growth and decay of charge in an LCR circuit.

Seebeck effect - Laws of thermo emf - Peltier effect- Thomson effect- Thermoelectric diagrams -Thermocouple (qualitative study) - Explanation of thermoelectric effects based on electron theory.

Text Book: Electricity and Magnetism, R. Murugeshan- Chapters 12, 8 and 32.

Module III

Electrostatics and Magnetostatics (20 hours)

Fundamental theorems of divergence and curl (physical concepts) - Electric field - Continuous charge distribution- Divergence and curl of electrostatic field- Gauss's law and applications: solid sphere, infinite wire, infinite plane sheet - Electric potential - Poisson's and Laplace's equations - Potential of a localized charge distribution – Electrostatic boundary conditions- work and energy in electrostatics – The work done to

move a charge – Energy of a point charge distribution and continuous charge distribution- Basic properties a conductor .

Lorentz Force law- Biot- Savart law- Divergence and curl of B- Applications of Amperes' law: long straight wire, infinite plane, solenoid – Comparison of electrostatics and magnetostatics- Magnetic vector potential – Magnetostatics boundary conditions

Electromagnetic induction- Faraday's law

Text Book:Introduction to Electrodynamics, David J Griffiths, Chapters 1, 2, 5 and 7

Module IV

Maxwell's Equations and Electromagnetic wave propagation (11 hours)

Maxwell's equations - Boundary conditions for free space - Continuity equations- Poynting's theorem

Wave equations (general idea on reflection at boundary and polarization) - Electromagnetic wave in vacuum - Wave equation for E and B - Monochromatic plane waves- Energy of electromagnetic waves

Text Book: Introduction to Electrodynamics, David J Griffiths-Chapters 7,8 and 9

References:

1. *Fundamentals of Magnetism and Electricity, D.N Vasudeva - S Chand*
2. *Principles of Electromagnetics, Mathew N.O Sadiku- 4th Ed. , Oxford*
3. *Electricity and Magnetism, KK Tewari- S Chand*
4. *Electricity and Electronics, Saxena, Arora and Prakash- Pragati Prakashan*
5. *Classical Electromagnetism, Jerrold Franklin- Pearson*
6. *Electromagnetic Fields and Waves, KD Prasad- Satya Prakashan*
7. *Field and wave Electromagnetics, David K Cheng- Pearson.*

Semester-V

Core Course:VI **Credit – 3 (54 hours)**

PH5CRT06: CLASSICAL AND QUANTUM MECHANICS

Module I

Lagrangian and Hamiltonian Formulations of Classical Mechanics (15 hours)

Constraints, degrees of freedom, generalized co-ordinates, principle of virtual work, D'Alembert's principle, Lagrange's equations(no derivation required), Application of Lagrangian (Linear Harmonic oscillator, Planetary motion and Simple Pendulum only), Hamilton's Canonical equations of motion, Advantages of Hamilton's method, Applications of Hamilton's method (Linear Harmonic oscillator and Simple pendulum only).Hamilton's Principle. Derivation of Lagrange's equation from Hamilton's Principle.

Text book: Classical Mechanics by J.C. Upadhyaya-Chapter 2 & 3.

Classical Mechanics by G. Aruldhas

Module II

Historical development and origin of quantum theory (12 hours)

Failure of classical physics- Black Body radiation-Planck's radiation law, Photoelectric effect-Einstein's explanation, Compton effect, Bohr's correspondence principle-Wave particle Dualism, Dual nature of matter- De Broglie hypothesis, Davisson-Germer Experiment, De Broglie waves, Wave packet, Group and phase velocities

Text Book: A Textbook of Quantum Mechanics- G Aruldhas-Chapter 1

General Formalism of Quantum Mechanics (12 hours)

Eigen functions and eigen values- Hermitian operator- Postulates of Quantum Mechanics- wave function, Operators, Expectation value, uncertainty relation (Position, momentum uncertainty).

Text Book: A Textbook of Quantum Mechanics- G Aruldhas-Chapter 3 and 8

Module III

Schrödinger equation and its applications (15 hours)

Time dependent Schrödinger equation- interpretation of wave function, Probability density, Probability current density, Ehrenfest theorem- Extension to three dimensions- Time independent Schrödinger equation- Stationary states- Admissibility conditions of wave function-general properties of one dimensional Schrödinger equation, particle in a box, orthogonality of wave function.

Text Book: A Textbook of Quantum Mechanics- G Aruldhas.

Text Book:

1. *Classical Mechanics by J.C. Upadhyaya. Himalaya Pub.*
2. *Concepts of Modern Physics- Arthur Beiser, TMH*

References:

1. *Concepts of Modern Physics- Arthur Beiser, TMH*
2. *A Textbook of Quantum Mechanics- G Aruldhas- (2nd Edition)- PHI*
3. *Classical Mechanics-Takwale and Puranik, TMH.*
4. *Classical mechanics- K.SankaraRao, PHI.*
5. *Introductory Quantum Mechanics- RI Liboff, Pearson*
6. *Quantum Physics- Gasiorowicz,John Wiely*
7. *Quantum Mechanics- Griffith, Pearson*

Semester-V

Core Course: VII **Credit-3 (54 hours)**

PH5CRT07: DIGITAL ELECTRONICS AND PROGRAMMING

Module I

Boolean algebra and logic gates **(9 hours)**

Basic gates NOT, OR, AND. Universal Logic Gates- NOR, NAND.XOR and XNOR Gates.Rules and Laws of Boolean algebra.Duality theorem -De Morgan's Theorems, analysis and simplification of logic circuits. Boolean equation and truth table - SOP and POS.Minterms and Maxterms. Standard SOP and Standard POS- Conversion between Standard SOP & Standard POS. Karnaugh Map (up to four variables). K map SOP minimization.

Module II

Combinational logic **(6 hours)**

Half Adder and Full Adder, Half and Full subtractor, 4-bit parallel Adder/Subtractor.Multiplexer, De-multiplexer, Encoder & Decoder.

Sequential logic **(13 hours)**

Flip-flops, RS, Clocked RS, Master Slave JK FF, DFF, T Flip-flop, Buffer registers- Shift register-SISO and SIPO, Counters- Binary ripple counter. D/A converters (Ladder type), A/D Converter (Counter type).

Module III

Programming in C++ **(26 hours)**

Basic C++ program structure –comments-data types-variable types-constants-operators(arithmetic, relational, logical and assignment operators)- if, if-else and else if, do while - case – loops(while, do-while, and for)-nested loops- arrays(Defining Arrays, Accessing Array Elements, Initializing Arrays)- basic ideas of functions(qualitative idea), object and classes. Programs using loops.

Text book: Object oriented programming in Turbo C++ - Robert Lafore (Galgotia Pub.)
Chapter 2, 3 and 7.

Text books:

1. *Digital fundamentals, Thomas L. Floyed (10th edition), Pearson*
2. *Digital principles and applications, Malvino, Leach and Saha (6th Edition) TMH*
3. *Digital electronics, S Salivahanan & S Arivazhagan VPH (2010)*
4. *Digital design, M Morris Mano, PHI*

References:

1. *Digital logic and computer design - M Morris Mano, PHI*
2. *Digital Electronics- William H Gothmann, PHI*
3. *Digital circuits and design- S Salivahanan and S Arivazhakan, PHI*
4. *Digital Electronics- Sedha, S Chand*
5. *Digital computer electronics- Malvino, Brown, TMH*
6. *Object oriented programming in Turbo C++ - Robert Lafore (Galgotia Pub.)*

Semester-V

Core Course: VIII **Credit-4 (72 hours)**

PH5CRT08: ENVIRONMENTAL PHYSICS AND HUMAN RIGHTS

Vision

The importance of environmental science and environmental studies cannot be disputed. The need for sustainable development is a key to the future of mankind. Continuing problems of pollution, solid waste disposal, degradation of environment, issues like economic productivity and national security, Global warming, the depletion of ozone layer and loss of biodiversity have made everyone aware of environmental issues. The United Nations Conference on Environment and Development held in Rio de Janerio in 1992 and World Summit on Sustainable Development at Johannesburg in 2002 have drawn the attention of people around the globe to the deteriorating condition of our environment. It is clear that no citizen of the earth can afford to be ignorant of environment issues.

India is rich in biodiversity which provides various resources for people. Only about 1.7 million living organisms have been described and named globally. Still many more remain to be identified and described. Attempts are made to conserve them in ex-situ and in-situ situations. Intellectual property rights (IPRs) have become important in a biodiversity-rich country like India to protect microbes, plants and animals that have useful genetic properties. Destruction of habitats, over-use of energy resource and environmental pollution has been found to be responsible for the loss of a large number of life-forms. It is feared that a large proportion of life on earth may get wiped out in the near future.

In spite of the deteriorating status of the environment, study of environment has so far not received adequate attention in our academic programme. Recognizing this, the Hon'ble Supreme Court directed the UGC to introduce a basic course on environment at every level in college education. Accordingly, the matter was considered by UGC and it was decided that a six months compulsory core module course in environmental studies may be prepared and compulsorily implemented in all the University/Colleges of India.

The syllabus of environmental studies includes five modules including human rights. The first two modules are purely environmental studies according to the UGC directions. The second two modules are strictly related with the core subject and fifth module is for human rights.

Objectives

- Environmental Education encourages students to research, investigate how and why things happen, and make their own decisions about complex environmental issues by developing and enhancing critical and creative thinking skills. It helps to foster a new generation of informed consumers, workers, as well as policy or decision makers.
- Environmental Education helps students to understand how their decisions and actions affect the environment, builds knowledge and skills necessary to address complex environmental issues, as well as ways we can take action to keep our environment healthy and sustainable for the future. It encourages character building, and develops positive attitudes and values.

- To develop the sense of awareness among the students about the environment and its various problems and to help the students in realizing the inter-relationship between man and environment and helps to protect the nature and natural resources.

- To help the students in acquiring the basic knowledge about environment and the social norms that provides unity with environmental characteristics and create positive attitude about the environment.

Module I (15 Hours)

Water Resources and Its Management (3 Hours)

Water resources: Use and over-utilization of surface and ground water, floods, drought, dams-benefits and problems. Water harvesting-Importance of rain water harvesting in Kerala.

Remote sensing (3 Hours)

Remote sensing-principles, spectral reflectance of earth's surface features, Remote sensing satellites and sensors, aerial photography, Applications of Remote Sensing in environmental monitoring and assessment.

Environmental Pollution (9 Hours)

Environment and human health; Environmental pollution- Primary and secondary pollutants; Air pollution- Sources, Effects and Control/Treatment methods; Acid Rain; Ozone layer depletion; Green house gases; Global warming - Climatic effects; Water pollution- Sources, Effects and Control/Treatment methods; Groundwater pollution; Marine pollution; Soil pollution; Noise pollution- Sources and measurement indices of noise pollution, Noise exposure level and standards, Noise control measures, Impact of noise on human health, ; Environmental pollution due to environmental disasters; Consumerism and waste products; E-waste-an emerging environmental threat. Disaster management: floods, earthquake, cyclone and landslides.

Module II (12 Hours)

Waste Management (8Hours)

Waste minimization and resource conservation:- Source reduction, Recycling, Value-added products; Waste minimization promotional methods- awareness generation, control methods and economic benefits; Benefits of waste minimization; Management of solid wastes- Municipal solid wastes, Hazardous solid waste-characteristics and management of HSW, Waste treatment and disposal methods- physical, biological and chemical process.

Environment Impact Assessment and Control (4 Hours)

Basic ideas of environment impact assessment; Environment ethics; Environmental laws and constitutional provisions to control pollutions in India-The general acts; Air (prevention and control

of pollution) act; Water (prevention and control of pollution) act; Wild life protection act; Forest conservation act; Environment protection acts.

Module III (13 Hours)

Non-renewable and Renewable Energy Sources (13 Hours)

Non-renewable energy sources:-Coal, Oil, Natural gas; Nuclear fission energy; Merits and demerits of non-renewable energy.

Renewable energy sources: Biomass energy- Biofuels, Biogas plant - Fixed dome type and moving drum type; Wind energy; Wave energy; Tidal energy; Hydroelectricity; Geothermal energy conversion; Ocean thermal energy conversion; Fusion energy; Hydrogen energy- Production and storage; Merits and demerits of each renewable energy sources; Storage of intermittently generated renewable energy.

Module IV (14 Hours)

Solar energy (14 Hours)

Sun as a source of energy- Solar radiation, Solar Constant, Spectral distribution; Solar pond - Convective and salt gradient types; Flat plate collector; Solar water heater - Direct and indirect systems- Passive and active systems; Optical concentrator - Parabolic trough reflector - Mirror strip reflector - Fresnel lens collector; Solar desalination; Solar dryer - Direct and indirect type; Solar cooker; Solar heating of buildings; Solar green houses; Need and characteristics of photovoltaic (PV) systems; Solar cells - Principle, Equivalent circuits, V-I characteristics, fill factor, conversion efficiency; PV Sun tracking systems; Merits and demerits of solar energy.

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Module - V (18 Hours)

Unit 1 - Human Rights

An Introduction to Human Rights, Meaning, concept and development –History of Human Rights- Different Generations of Human Rights- Universality of Human Rights- Basic International Human Rights Documents - UDHR ,ICCPR,ICESCR.-Value dimensions of Human Rights

Unit 2 - Human Rights and United Nations

Human Rights co-ordination within UN system- Role of UN secretariat**-** The Economic and Social Council- The Commission Human Rights-The Security Council and Human rights- The Committee on the Elimination of Racial Discrimination- The Committee on the Elimination of Discrimination Against Women- the Committee on Economic, Social and Cultural Rights- The Human Rights Committee- Critical Appraisal of UN Human Rights Regime.

Unit 3- Human Rights National Perspective

Human Rights in Indian Constitution – Fundamental Rights- The Constitutional Context of Human

Rights-directive Principles of State Policy and Human Rights- Human Rights of Women-children – minorities- Prisoners- Science Technology and Human Rights- National Human Rights Commission- State Human Rights Commission- Human Rights Awareness in Education.

Reference Books:

1. Non-conventional energy sources - G.D Rai- Khanna Publishers, New Delhi
2. A textbook of Environmental Studies- E Bharucha - University Grants Commission, 2004
3. Environmental Science: Principles and Practice- R.C. Das and D.K. Behera - PHI Learning Pvt. Ltd
4. Renewable Energy Sources and Emerging Technologies: Edition 2, D.P. Kothari K. C. Singal, Rakesh Ranjan - PHI Learning Pvt. Ltd, 2011.
5. Solar energy - M P Agarwal - S Chand and Co. Ltd.
6. Solar energy - Suhas P Sukhative Tata McGraw - Hill Publishing Company Ltd.
7. Renewable Energy, Power for a sustainable future, Edited by Godfrey Boyle, Oxford University Press, 2012.
8. Solar Energy: Resource Assesment Handbook- Dr. P Jayakumar APCTT 2009
9. A textbook of Environmental Studies- S.Satyanarayan, S.Zade, S.Sitre and P.Meshram - Allied Publishers, New Delhi, 2009
10. Remote Sensing: Principles and Interpretation, Floyd F. Sabins, Waveland Pr Inc; 3 edition (2007)

Human Rights

1. Amartya Sen, The Idea Justice, New Delhi: Penguin Books, 2009.
2. Chatrath, K. J.S., (ed.), Education for Human Rights and Democracy (Shimla: Indian Institute of Advanced Studies, 1998)
3. Law Relating to Human Rights, Asia Law House, 2001.
4. Shireesh Pal Singh, Human Rights Education in 21st Century, Discovery Publishing House Pvt.Ltd, New Delhi,
5. S.K.Khanna, Children and the Human Rights, Common Wealth Publishers, 1998. 2011.
6. Sudhir Kapoor, Human Rights in 21st Century, Mangal Deep Publications, Jaipur, 2001.
7. United Nations Development Programme, Human Development Report 2004: Cultural Liberty in Today's Diverse World, New Delhi: Oxford University Press, 2004.

Semester-V

OPEN COURSE: Credit-3 (72hours)

PH5OPT01: Our Universe

Scope: *To help the students to comprehend the cosmos and its origin and to developscientific attitude and aptitude*.

Prerequisites: *This course in intended for the students of other disciplines. So asecondary level knowledge of mathematics and physics is enough to study this course. But an inquisitive mind and curiosity are essential from the part of a student.*

Module I

Our universe (10 hours)

Early models of universe- Geo centric model- Ptolemy-Aristotle. Copernican model - Sun at the centre.Galileo and his observations. Planetary paths-Kepler's laws(**No need of derivation**).

Galaxies-Hubble's classification – Spiral, elliptical & irregular galaxies. Milky way galaxy (**qualitative**).

Module II

Cosmology (14 hours)

Origin of the universe - Big bang theory – expansion of the universe – Hubble's law, age of the universe. Doppler effect and red shift(**qualitative**).

Stellar evolution – birth - red giant- death of a star. White dwarf- Chandrasekhar limit. Super novae- neutron star- black hole.

Text Books

1. Architecture of the universe. (cha 3,4,8 and 9) Necia H.Apfel and Allen Hynek-Benjamin Cummins Publishing Company.
2. Astronomy A Beginners guide to the universe sixth edition(Ch.12)-Chaisson Mc Millan
3. Cosmic vistas-A popular history of astronomy(chap 4,5,6,7,8) Biman Basu-national book trust,India

4. Astronomy; A Self Teaching Guide (cha 5&6)-Dinah L Moche
5. The Great Universe (cha 4,5,6,7) G.K Sasidharan-S.Chand

Module III

Observational Astronomy (24 hours)

Celestial sphere- cardinal points, celestial equator, ecliptic, equinoxes.Celestial co-ordinate systems-equatorial co-ordinate system-Right ascension & declination, Ecliptic and galactic co-ordinate systems. Diurnal motion of sun - Summer solstice and winter solstice. Time - apparent and mean solar time, International date line. Constellations-zodiacal constellations. Astronomical distance scales – AU, Parsec and light year. Stellar Parallax and distance to stars from parallax.

Optical Telescopes - Light gathering power, visual angle, angular magnification, Types of telescopes-refracting and reflecting – Newtonian and Cassegrain telescopes **(No need ofderivation of magnification**). HST, Radio telescopes, GMRT (India).

Text Books:

1. Astronomy A beginner's guide to the universe sixth edition(ch-1)-Chaisson Mc Millan
2. Astrophysics stars and galaxies (chap 2,4,20)K D Abhayankar
3. Joy of Star watching (**ch**- 3, 8 &10)- Biman Basu- National Book Trust, India
4. A textbook of Optics(ch-10) N.Subrahmanyan, Brijlal and M.N Avadhanulu
5. Astronomy; A Self Teaching Guide (cha 2&3)-Dinah L Moche
6. www.gmrt.ncra.tifr.in

Module IV

Solar system (24 hours)

The sun- solar atmosphere - Photosphere, chromospheres and corona.Sun spots.Definition of a planet- terrestrial planets & Jovian planets, Comparison of planets.Minor members of solar system- Asteroids, comets, meteors.

Universal law of gravitation.Earth's orbital motion-day to day changes-seasonal changes.

Text Books:

1. Architecture of the Universe (**ch**- 2, 14, 15, 17, 18, 19, 20)- Necia H. Apfel & Allen Hynek- The Benjamin Cummings publishing company, Inc.
2. Astronomy A beginner's guide to the universe sixth edition(ch-1)-Chaisson Mc Millan
3. Astronomy; A Self Teaching Guide (cha 4,9,10,11)-Dinah L Moche
4. The great Universe – G.K Sasidharan-S.Chand

Semester-V

Open Course: **Credits-3 (72 Hrs)**

PH5OPT02: Physics in Daily Life

Module I

Unit 1 **(8 hours)**

Fundamental and derived quantities. Units and dimensions, dimensional analysis, order of magnitude, significant figures, errors.

Unit 2 Light **(12 Hours)**

Reflection, refraction, diffraction, interference, scattering(elementary ideas only) – examples from daily life – apparent depth, blue color of sky, twinkling of stars.

Total internal reflection, mirage, sparkling of diamond, primary and secondary rainbow – optical fibers. Concave and convex mirrors, lenses – focal length, power of a lens, refractive index, prism, dispersion. Human eye, defects of the eye – myopia, hypermetropia, presbyopia and astigmatism and their correction by lens.

Module II

Unit 3 Motion **(12 Hours)**

Velocity, acceleration, momentum, Idea of inertia, force - laws of motion. Newton's law of gravitation, acceleration due to gravity, mass and weight, apparent weight, weightlessness.

Rotational motion, Moment of inertia, torque, centripetal and centrifugal acceleration- examples- banking of curves, centrifugal pump, roller coasters.

Unit 4 Electricity **10 Hours)**

Voltage and current, ohms law. Electric energy, electric power, calculation of energy requirement of electric appliances – transformer, generator, hydroelectric power generation – wind power – solar power – nuclear power

Module III

Unit 5 Matter and energy (18 Hours)

Different phases of matter, fluids - surface tension, viscosity- capillary rise, Bernoulli's theorem and applications.

Heat energy, temperature, different temperature scales – degree Celsius, Fahrenheit and Kelvin.

Waves – transverse and longitudinal waves, sound waves, Doppler Effect.

Lasers, fluorescence, phosphorescence, electromagnetic waves – applications – microwave oven, radar, super conductivity.

Unit 6 Universe (12 hours)

Planets, – solar system, moon- faces of moon, lunar and solar eclipses, constellations, Different types of stars, Galaxies, black hole. Satellites, Artificial satellites, Global positioning system. Geo stationary satellite.

Reference Texts

1. Fundamentals of Physics with Applications by Arthur Beiser
2. Conceptual Physics by Paul G Hewitt

Semester-V

OPEN COURSE: Credit-3 (72hours)

PH5OPT03: COMPUTER HARDWARE AND NETWORKING

Module I (24 hours)

Microprocessors – Basic concepts of Intel 80186, 80286, 80386, 80486 and Pentium processors. Motherboard, Expansion buses, Memory, upgrading / adding memory, BIOS Motherboard – removing, installing / configuring motherboards, BIOS set up, troubleshooting memory.

Module II (24 hours)

Data storage devices, IDE and SCSI controllers, hard disk, installing / upgrading CD ROM drives, DVD, Optical storage, Tape back – ups. Printers, Keyboards, pointing and positioning devices, digital camera, Scanners, Monitors, Hard disks- installing / upgrading, troubleshooting, formatting, Error codes, BIOS disk routines

MODULE III (24 hours)

Multimedia, Graphical accelerators, audio, modems, I/E add on, Networks, Power supplies, UPS

Printer installation, Software installation – DOS, Windows 95, 98, Linux, WindowsNT – installation,

Administration, Installing PASCAL, C, ORACLE, VISUAL BASIC, Software diagnostics –

PC tools, Norton utilities, XT/AT diagnostics, Viruses and anti-viruses.

References:

1. *IBM PC and CLONES- Hardware, troubleshooting and maintenance – B Govindarajalu*
2. *PC Hardware, a beginners guide – Ron Gilster*
3. *All about Motherboard: - Manahar Lotia, Pradeep Nair*

Semester-VI

Core Course: IX **Credit-3 (54 hours)**

PH6CRT09: THERMAL AND STATISTICAL PHYSICS

Module I

Equation of state for gases **(5 hours)**

Equation of an ideal gas, behavior of real gases, Andrew's experiment on carbon dioxide**,** critical state, two phase region, intermolecular forces, van der Waals equation of state, van der Waals isotherms, critical constants, limitation of van der Waals equation.

Zeroth law of thermodynamics **(4 hours)**

Thermodynamic system, surroundings, variables, thermal equilibrium: zeroth law, thermodynamic equilibrium, thermodynamic processes, reversible and irreversible processes, equation of state, expansivity and compressibility.

First laws of thermodynamics **(7 hours)**

Internal energy, heat, work, cyclic processes, first law, heat capacity, energy equation and difference of specific heat capacities, indicator diagram work done in reversible isothermal expansion of ideal gas, work done in reversible adiabatic expansion of ideal gas.

Heat engines and second law of thermodynamics **(5 hours)**

Second law statements, heat engine, efficiency, Carnot's ideal heat engine, work done by the engine per cycle, reversibility, Carnot refrigerator, heat pump, Carnot theorem, absolute scale of temperature, Clausius- Clapeyron latent heat equation.

Text Book: Thermal and Statistical Physics, R.B. Singh, part-1 chapter 3, 4, 5 and6

Module II

Entropy **(5 hours)**

Definition of entropy, principle of increase of entropy, entropy and unavailable energy, change in entropy in heat conduction, change in entropy in reversible and irreversible process, efficiency of Carnot cycle from TS diagram, entropy of an ideal gas, entropy and disorder.

Thermodynamic relations (8hours)

Maxwell's thermodynamic relations, TdS equations, energy equation, heat capacity equations, thermodynamic functions, third law of thermodynamics.

Conduction and radiation (4 hours)

Conduction, thermal conductivity, thermal conductivity of bad conductor Lee's disc experiment -thermal resistance, thermal radiation and its properties, fundamental definitions of energy flux, intensity and radiant emittance, Stefan's law, Stefan-Boltzmann law.

Text Book: Thermal and Statistical Physics, R.B. Singh, part-1 chapter7,8,10 and 11.

Module III

Statistical mechanics (8 hours)

Microstates and macrostates, Phase space, density of states, mu space and Gamma space, principle of equal a priori probability, ergodic hypothesis, statistical equilibrium, ensemble,ensemble formulation of statistical mechanics, microcanonical, canonical and grand canonical ensemble, partition function, average energy of particle, equipartition theorem.

Statistical distributions (8 hours)

Maxwell Boltzmann, Fermi-Dirac and Bose-Einstein statistics, distribution laws, Maxwell-Boltzmann, Fermi-Dirac and Bose-Einstein distribution.

Text Book: Thermal and Statistical Physics, R.B. Singh, part-2, Chapters 2, 3,4 and 5.

Text Book:

1. *Thermal and Statistical Physics, R.B. Singh, New Age Pub. (2010)*

References:

1. *An introduction to thermodynamics by Y.V.C. Rao (New Age Pub.)*
2. *An introduction to Thermal Physics by D.V. Schroeder (Pearson Pub.)*
3. *Heat and thermodynamics by Mark W Zemansky, Richard H Dittman & Amit K Chattopadhyay. MCH New Delhi.*
4. *Thermodynamics and Statistical physics Brij Lal, N.Subrahmanyam and P S Hemne (S. Chand &Co, Multi colour edition 2007).*
5. *Berkeley Physics Course Volume 5; Statistical Physics; Frederick Reif. McGraw Hill.*
6. *Statistical Mechanics, R.K. Pathria, Pergamon press, Oxford*

Semester-VI

Core Course: X **Credit-3 (72 hours)**

PH6CRT10: RELATIVITY AND SPECTROSCOPY

Module I

Special Theory of Relativity **(18 hours)**

Inertial and non inertial frames of reference- Galilean transformation, Significance of Michelson-Morley experiment, Postulates of Special Theory of Relativity, Lorentz transformation, Spatial contraction, Time dilation, composition of velocities, mass of moving particle, Equivalence of mass and energy. Introductory concept of general theory of relativity.

Text Book: Modern Physics, Kenneth S Krane.

Concepts of modern Physics, Arthur Beiser

Module II

Atomic Spectroscopy **(21 hours)**

Historical introduction. Electrostatic spectrum.Types of spectra. Absorption and emission of light by atoms, quantum theory, early atom models – Bohr model, electron spin and magnetic moment, Exclusion principle, Stern-Gerlach experiment, Vector atom model, quantum numbers associated with vector atom models, Total angular momentum and LS coupling, fine structure of Sodium D lines, Zeeman effect, quantum mechanical explanation for anomalous Zeeman effect, Paschen-Back effect.

Text Book: Molecular structure and Spectroscopy, G Aruldas.

Concepts of modern Physics, Arthur Beiser

Module III

Molecular Spectroscopy **(21 hours)**

Molecular energy levels. Electronic, rotational and vibrational energies, rotational spectra, explanation in terms of rigid rotator model, vibrational energy levels, explanation in terms of harmonic oscillator.

Electronic energy levels of atoms, Fluorescence and phosphorescence, Raman effect – experimental arrangement and result, classical theory and its failure, quantum theory of Raman effect.

IR and Microwave spectroscopes.

Text Book: Fundamentals olf Molecular Spectroscopy, C.Banwell and E. Mccash.

Molecular structure and Spectroscopy, G Aruldas.

NMR and ESR Spectroscopy (12 hours)

NMR Spectroscopy- Basic principles and instrumentation- Medical applications of NMR.

Text Book: Molecular structure and Spectroscopy, G Aruldas – Chapter 10 (Sections 10.1, 10.2,10.3 and 10.19).

ESR Spectroscopy- Basic principles and instrumentation.

Text Book: Molecular structure and Spectroscopy, G Aruldas – Chapter 11 (Sections 11.1, 11.2 and 11.3).

Text Books:

1. *Molecular structure and spectroscopy, Aruldas 2nd ed. EEE.*
2. *Modern Physics, Kenneth S Krane (2nd Edition) -Wiley.*
3. *Concepts of modern Physics, Arthur Beiser (6th Edition) - SIE.*

References:

1. *Spectroscopy: Straughan and Walker –(Vol.1) John Wiley*
2. *Fundamentals of Molecular Spectroscopy: CN Banwell –(4th edition) TMH .*
3. *Introduction to Atomic Spectra, HE White, TMH*
4. *Elements of spectroscopy, Guptha, Kumar and Sharma (Pragathi Prakash)*
5. *Special Relativity- Resnick, (Wiley)*
6. *Mechanics – D.S.Mathur (S.Chand).*
7. *Mechanics by J.C. Upadhayaya (Ramprasad)*
8. *Semiconductor physics and optoelectronics- V Rajendran, J Hemaletha and M S M Gibson.*

Semester-VI

Core Course: XI **Credit - 3 (54 hours)**

PH6CRT11: NUCLEAR, PARTICLE PHYSICS AND ASTROPHYSICS

Module I

Nuclear structure **(10 hours)**

Nuclear composition – Discovery of neutron – Nuclear electrons - Nuclear properties: Nuclear radii – Spin and magnetic moment - Stable nuclei - Binding energy- Binding energy curve, Liquid drop model - Semi empirical binding energy formula with correction factors - Shell model - Nuclear forces- Meson theory of nuclear forces – Discovery of pion – Virtual Photons

Nuclear Radiation Detectors, Counters and Particle Accelerators (8 Hours)

Interactions between energetic particles and matter (basic concepts only) - Ionization chamber - Solid state detectors - Proportional counter - Geiger-Muller counter - The Wilson cloud chamber - Bubble chamber - Scintillation counters - Van de Graaff generator - Linear accelerator - Cyclotron - Betatron

Module II

Nuclear Transformations **(15 hours)**

Radioactive decay – Radiation hazards – Half life – Radiometric dating – Radioactive series - Alpha decay, tunnel theory of alpha decay, derivation for alpha decay constant - Beta decay, positron emission, electron capture, inverse beta decay – Gamma decay - The concept of interaction cross section, reaction rate – Nuclear reactions, Resonance, Center of mass coordinate system, Q value of nuclear reaction – Nuclear fission – Nuclear reactors – Breeder reactors - Nuclear fusion in stars – Formation of heavier elements – Fusion reactors – Confinement methods

Cosmic rays **(4 hours)**

Latitude effect – Azimuth effect – Altitude effect - Primary cosmic rays – Secondary cosmic rays – Cosmic ray showers – Discovery of Positron – Mesons Van Allen belts – Origin of cosmic rays

Module III

Particle Physics (10 hours)

Interactions and Particles – Leptons – Neutrinos and Antineutrinos, other leptons – Hadrons – Resonance particles – Elementary particle quantum numbers – Basic concepts of symmetries and conservation principles – Basic concepts of Quarks – color, flavor, Quark confinement –Higgs boson

Astrophysics (7 hours)

Classification of stars – Hertzsprung - Russel diagram – Luminosity of a star – Stellar evolution - White Dwarfs - Chandrasekhar limit - Neutron stars - Black holes - Supernova explosion – Photon diffusion time.

***Text Book**:*

1. *Concepts of Modern Physics, Arthur Beiser, 6th Edition, Tata McGraw-Hill publishing company*
2. *Modern Physics, R Murugeshan and K. Sivaprasath, 15th Edition (Revised) (2010), S.Chand*

References:

1. *Atomic and Nuclear Physics, S N Ghoshal, S.Chand.*
2. *Nuclear and Particle Physics S L Kakani and Subhra Kakani -Viva Books 2008*
3. *Elements of Nuclear Physics, M L Pandya and R P S Yadav, Kedar Nath Ram Nath*
4. *Modern Physics, Kennth Krane, 2nd Edition, Wiley India (Pvt) Ltd.*
5. *Modern Physics , G. Aruldhas and P. Rajagopal, Prentice-Hall India*
6. *An Introduction to Astrophysics, Baidyanath Basu, 2nd Edition, Prentice-Hall India*

Semester-VI

Core Course: XII **Credit-3 (72 hours)**

PH6CRT12: SOLID STATE PHYSICS

Module I

Crystal structure **(18 hours)**

Solid state, crystalline, polycrystalline and amorphous materials, crystal lattice, periodicity, translation vectors, unit cell, basis, symmetry operations, Bravais lattice in two and three dimensions, miller indices, interplanar spacing, simple crystal structures-hcp, fcc, bcc and simple cubic, Structures of NaCl, Diamond and ZnS, X-ray diffraction from crystals- Bragg's law, powder method, reciprocal lattice-properties, reciprocal lattice to sc, bcc and fcc, Bragg's law in reciprocal lattice.

Text book: Solid State Physics by Puri and Babbar- Chapter 1 & 2

Module II

Bonding in solids **(7 hours)**

Inter-atomic forces, ionic bonding, bond dissociation and cohesive energy, Madelung energy, covalent bonding, metallic bonding, hydrogen bonding, van der Waals bonding (basic ideas only).

Text book: Solid State Physics by Puri and Babbar

Free electron theory and elementary band theory **(12 hours)**

Free electron gas in one dimension, three dimension, electronic specific heat, band theory, Bloch theorem, Kronig-Penney model (derivation not expected), energy-wave vector relations, different zone schemes, velocity and effective mass of electron, distinction between metals, insulators and semiconductors.

Semiconducting properties of materials **(12 hours)**

Intrinsic and extrinsic semiconductors, drift velocity, mobility and conductivity of intrinsic semiconductors, carrier concentration and Fermi level for intrinsic semiconductor, carrier concentration, conductivity and Fermi level for extrinsic semiconductor. Hall Effect, Direct and Indirect band gap, Principles of LED and Photodiodes.

Text book: Solid State Physics by Puri and Babbar Chapter 5, 6 and 7

Module III

Dielectric properties of materials (5 hours)

Polarization and susceptibility, local filed, dielectric constant and polarizability, sources of polarizability, Clausius-Mossoti relation, piezoelectricity.

Magnetic properties of materials (7 hours)

Response of materials to magnetic field, classification of magnetic materials, Langevin's classical theory of diamagnetism and paramagnetism, ferromagnetism, Weiss theory, domain theory, antiferromagnetism and ferrimagnetism.

Superconductivity (10 hours)

Origin of superconductivity, response of magnetic field, Meissner effect, super current and penetration depth, critical field and critical temperature, type-I and type –II superconductors, thermodynamic and optical properties, isotope effect, Josephson effect and tunneling- SQUID BCS theory-Cooper pairs-Existence of bandgap.

Text book: Solid State Physics by Puri and Babbar Chapter 5, 6 and 7

Text book:

1. *Solid State Physics by Puri and Babbar (S.Chand)*

References:

1. *Solid State Physics, M.A. Wahab, (2nd Edition), Narosa*
2. *Introduction to Solid State Physics, Charles Kittel, (7th Edition), Wiley*
3. *Crystallography applied to solid state Physics, AR Verma, ON Srivastava, New age*
4. *Solid State Physics, AJ Dekker- Macmillian.*
5. *Solid State Physics, NW Ashcroft, ND Mermin – Cengage Learning.*
6. *Elementary Solid State Physics, M. Ali Omer, Pearson.*
7. *Solid state physics, R L Singal, KNRN &Co.*
8. *Solid state physics, S O Pillai, New age*

Semester-VI

Choice Based Course – XIV-1 **Credit – 3 (54 hours)**

PH6CBT01: INFORMATION TECHNOLOGY

Scope: To learn about the fascinating world of information technology and to use the tools available in Internet and the World Wide Web for a deep study of the subjects related to physics in better way by the students themselves.

Prerequisites: Awareness of basic computer operations.

Module I **(20 hours)**

Information and its Use : Information Technology – Quality of information – Message transmission – Electronic Office – E mail – Document storage – Computers in Industry – Different types – Graphical user interface

Text book: "Information Technology – The Breaking Wave", D.Curtin, K.Sen and K.Morin, Tata McGraw Hill, 1999. Chapter – 1, 2

Computer Networks: Importance of Networks. Components of Networks. Classification of Networks: Broad cast networks-Switched networks. Switching Techniques. Types of Networks – LAN – MAN – WAN. Networking Models – OSI reference model – TCP/IP reference model-Comparison between the OSI and TCP/IP models. Network Topology – Bus- Star-Ring-Tree-Mesh-Cellular.

Text book: Computer Networks, A.S. Tanenbaum - Prentice Hall of India, Chapter - 1

Computer Fundamentals, P.K. Sinha 3rd Edn. BPB Publications, Chapter – 17

THE INTERNET: Internet Protocols – Internet Protocol (IP)-Transmission Control Protocol (TCP) -Internet Address – Structure of Internet Servers Address-Address Space- Services on Internet – Domain Name System-SMTP and Electronic mail – Http and World Wide Web-Usenet and News groups-FTP-Telnet-Network Security

-Digital Signature-E-mail Privacy-Internet Tools – Search Engines-Web browsers-Internet explorer, Netscape Navigator, Mozilla Firefox(Working Knowledge)

Text book: Computer Networks, A.S.Tanenbaum - Prentice Hall of India, Chapter –5, 6, 7

Computer Fundamentals, P.K. Sinha 3rd Edn. BPB Publications, Chapter – 18

Module – II **(20 hours)**

THE HTML: What is HTML? Basic Tags of HTML – HTML-TITLE-BODY - Starting an HTML document – The <!DOCTYPE>declaration-setting boundaries with <HTML>-the HEAD element-the BODY element-the STYLE element and the SCRIPT element. - Formatting of text– Headers-Formatting Tags-PRE tag-FONT tag-Special Characters. Working with Images- META tag -Links – Anchor Tag -Lists – Unordered Lists-Ordered Lists-Definition Lists -Tables –TABLE, TR and TD Tags-Cell Spacing and Cell Padding-Colspan and Rowspan -Frames –Frameset-FRAME Tag-NOFRAMES Tag - Forms – FORM and INPUT Tag-Text Box-Radio Button-Checkbox-SELECT Tag and Pull Down Lists-Hidden-Submit and Reset

Text book: HTML4 – 2nd Edn. Rick Darnell, Techmedia, Chapter – 1, 2,3,4,5

Module – III **(14 hours)**

Basic Idea of DBMS: Need for Data Base – Database Systems versus File systems - View of Data - Data Abstraction-Instances and Schemas - Data Models – ER Model-Relational Model- Network Model-Hierarchical Model (general ideas) -Basic ideas about Structured Query Language.

Text book: Fundaments of Database System – Elmasri, Ramez and Navathe Shamkant B. 4th Edn.Person Education, India, 2004. Chapter – 1

MS – OFFICE/OPEN OFFICE (Working Knowledge): Word processors – PowerPoint - Spreadsheets – Databases

(No specific text book is preferred. MS office (97, 98, 2000, /Open Office which is installed in the lab can be used. Working practice must be given)

References

1. “Information Technology – The Breaking Wave”, D.Curtin, K.Sen and K.Morin,Tata McGraw Hill, 1999.
2. Computer Networks – A.S. Tanenbaum - Prentice Hall of India
3. Computer Fundamentals – P.K. Sinha 3rd Edn. BPB Publications
4. Internet and World Wide Web – Deitel
5. HTML4 – 2nd Edn. Rick Darnell, Techmedia
6. Database System Concepts – Silberschatz-Korth-Sudarshan 4th Edn – TataMac Graw Hill
7. “Information Technology and systems”, Green, B.C., Longman Scientific

&Technical Publishers, England, 1994.

8. Networks – Tirothy S. Ramteke – 2nd Edn. Pearson Edn – New Delhi, 2004
9. Data and Computer Communucation, William Stalling, PHI, New Delhi.
10. Mastering HTML4 – Ray D.S. and Ray E.J. – BPB
11. HTML – The Complete Reference – Tata Mc Graw Hill
12. Fundaments of Database System – Elmasri, Ramez and Navathe Shamkant B. 4thEdn.v Pearson Education, India, 2004.

Semester-VI

Choice Based Course – XIV-2 **Credit-3 (54 hours)**

PH6CBT02: MATERIAL SCIENCE

Module I **(18 hours)**

Structure and Properties of Materials

Classification of materials- Advance materials- Level of structures, Microstructure and Macrostructure, Structure-Property relationships, Physical properties of materials- Imperfections in solids- Point defects, imperfections, dislocations- interfacial and bulk defects. Diffusion Mechanisms- Fick's first and second laws. Mechanical Properties- Stress strain relationship, Basic ideas of anelasticity, plastic deformation, tensile properties, ductility, malleability, brittleness, toughness, resilience, hardness, stiffness, endurance, creep and impact strength- Basic Thermal properties, Thermal cracking- Electrical and Magnetic properties- Dielectric strength and dielectric constant- Basic ideas of Chemical properties

Text Book: Callister's Material Science and Engineering-Adapted by R Balasubramaniam, Wiley

Module II **(18 hours)**

Optical Properties of Materials

Absorption processes- Fundamental absorption-Exciton absorption- Free –carrier absorption- Photoconductivity- Photoelectric effect- Photovoltaic effect- Photoluminescence-colour centres-Generation of colour centres

Text Book: Solid State Physics, M.A. Wahab, Chapter-15

Modern Engineering Materials

Display devices- active and passive-Liquid crystals- Types of Liquid crystals- Nematic liquid crystals-Cholesteric liquid crystals- Smectic liquid crystals-General features of liquid crystals- Numeric display using LCD

Metallic glasses; Shape memory alloy; lead free solders

Text Book: Semiconductor Physics and Optoelectronics, V.Rajendran et al. Unit-II

Module III **(18 hours)**

Nanoscience

Metal nanoclusters-magic numbers, theoretical modelling, geometric and electronic structure, magnetic clusters; Semiconducting nano particles- Rare gas and molecular clusters- carbon nanostructures- Carbon clusters, CNT preparation, properties and applications; Quantum wells, wires and dots – preparation, Size and dimensionality effects, applications .

Text Book: Modern Physics by Murugeshan

Material Characterization Techniques

Qualitative study of Powder XRD, SEM, SPM, TEM, STM, AFM, PES and Raman spectroscopy.

Text Book: Nanotechnology-The science of small- MA Shah and KA Shah, Chapter 5

Text Books:

1. *Text Book: Callister's Material Science and Engineering-Adapted by R Balasubramaniam, Wiley*
2. *Solid State Physics (2nd ed.), M.A. Wahab, Narosa pub.*
3. *Nanotechnology-The science of small, MA Shah and KA Shah, Wiley.*
4. Text Book: Modern Physics by Murugeshan
5. *Semiconductor Physics and Optoelectronics, V.Rajendran et al., Vikas PublishingHouse.*

References:

1. *Crystallography applied to solid state Physics, A.R Verma, O.N Srivastava, New age*
2. *Nanotechnology, L.E Foster, Pearson.*
3. *Nanotechnology: Principles and Practices, 2nd edition, Sulabha K Kulkarni, Springer.*
4. *Introduction to Nanotechnology, C.P Poole, F.J Owens –Wiley*
5. *Textbook of Nanoscience and Nanotechnology, BS Murthy, P Shankar, Baldev Raj,BB Rath and J Murday- Universities Press-IIM*

Semester-VI

Choice Based Course – XIV-3 **Credit-3 (54 hours)**

PH6CBT03: COMPUTATIONAL PHYSICS

Algorithms of all methods required

Module I **(18 hours)**

Solutions of Nonlinear Equations

Bisection Method - Newton Raphson method (two equation solution) – Regula-Falsi Method, Secant method - Fixed point iteration method - Rate of convergence and comparisons of these Methods

Solution of system of linear algebraic equations

Gauss elimination method with pivoting strategies-Gauss-Jordan method-LU Factorization, Iterative methods (Jacobi method, Gauss-Seidel method)

Module II **(18 hours)**

Curve fitting: Regression and interpolation

Least squares Regression- fitting a straight line, parabola, polynomial and exponential curve

Finite difference operators-forward differences, divided difference; shift, average and differential operators- Newton's forward difference interpolation formulae- Lagrange interpolation polynomial- Newton's divided difference interpolation polynomial

Module III **(18 hours)**

Numerical Differentiation and Integration

Numerical Differentiation formulae - Maxima and minima of a tabulated function- Newton-Cote general quadrature formula - Trapezoidal, Simpson's 1/3, 3/8 rule –

Solution of ordinary differential equations

Taylor Series Method, Picard's method-Euler's and modified Euler's method –Heun's method- Runge Kutta methods for 1st and 2nd order

***Text Books**:*

1. *Numerical Methods, Balagurusamy, TMH*
2. *Numerical Methods for Scientists and Engineers- K Sankara Rao- PHI*
3. *Introductory Numerical Methods, S S Sastry, PHI.*

Semester-VI

Choice Based Course – XIV-IV **Credit – 3 (54 hours)**

PH6CBT04: INSTRUMENTATION

Module I **(10 hours)**

Measurements and Measurement Systems

Measurements-Method of measurement-Instruments and measurement systems-Mechanical, Electrical and Electronic instruments-Classification of Instruments-Applications of Measurement Systems - Elements of generalized measurement systems

Text book: A Course in Electrical and Electronics Measurements and Instrumentation, Sawhney. A.K- Chapter 1

Module II **(18 hours)**

Primary Sensing Elements and Transducers

Mechanical Devices as Primary Detectors – Mechanical Spring Devices – Pressure Sensitive Primary Devices – Flow Rate Sensing Elements - Transducers-Classification– Characteristics (Static and Dynamic) and Choice of Transducers – Characterization

Text book: Sensors and Transducers, Patranabis D., Chapter 1

A Course in Electrical and Electronics Measurements and Instrumentation, Sawhney. A.K- Chapter 25

Module III **(18 hours)**

Resistive,Inductive and Capacitive Transducers

Potentiometers –Strain gauges (Theory, types) - Rosettes – Resistance thermometer – Thermistors (materials, Constructions, Characteristics) – Thermocouples-Self inductive transducer – Mutual inductive transducers – Linear Variable Differential Transformer – LVDT Accelerometer – RVDT – Synchros – Capacitive transducer – Variable Area Type – Variable Air Gap type – Variable Permittivity type – Capacitor microphone.

Miscellaneous Transducers **(8 hours)**

Light transducers (photo-conductive, photo emissive, photo-voltaic, semiconductor, LDR)–Piezoelectric transducer – Hall Effect transducers – Digital Encoding transducers

Text book: A Course in Electrical and Electronics Measurements and Instrumentation, Sawhney. A.K- Chapter 1 and 25

Text books:

1. *A Course in Electrical and Electronics Measurements and Instrumentation, Sawhney A.K, 18th Edition, Dhanpat Rai & Company Private Limited, 2007.*
2. *Sensors and Transducers, Patranabis D., 2nd edition, PHI, 2015.*

References:

1. *Measurement Systems-Applications and Design, Doebelin. E.A, Tata McGraw Hill*
2. *Sensors and Transducers, Patranabis. D, Prentice Hall of India*
3. *Principles of Measurement Systems John. P, Bentley,, III Edition, Pearson*
4. *Transducers and Instrumentation, Murthy.D.V.S,, Prentice Hall of India*
5. *Instrumentation- Devices and Systems, Rangan, Sarma, and Mani, Tata-McGrawHill*
6. *Electronic Instrumentation by H.S Kalsi, McGrawHill*
7. *Instrumentation measurements and analysis, Nakra & Choudhary, Tata-McGrawHill*
8. *Mechanical and industrial measurement by R.K. Jain, Khanna Publishers, New Delhi*

Semester-VI

Choice Based Course – XIV-V **Credit – 3 (54 hours)**

PH6CBT05: Astronomy and Astrophysics

Module I

Observational astronomy **(12 Hours)**

Astronomical distance scales – AU, Parsec and light year. Stellar Parallax and distance to stars from parallax. Magnitude scale - Apparent and absolute magnitudes. Variable stars as distance indicators. Cepheid variables. Astronomy in different bands of electromagnetic radiation- Optical, radio and X-ray astronomies, Radiation Laws.

Optical Telescopes.Types of telescopes-refracting and reflecting – Newtonian and Cassegrain telescopes. Magnification and f number. Resolving Power, Telescope mounts
– alt-azimuth and equatorial mounts.

Text Book **:** K D Abhyankar Section 3.1 & 4.3, Ian Morison Chapter 5, Dinah L. Moché, Chapter 2 &3.

Module II

Celestial sphere **(8 Hours)**

Concept of celestial sphere - cardinal points, celestial equator, ecliptic, equinoxes.Diurnal motion of sun - summer solstice and winter solstice. Celestial co-ordinate systems: – Horizon system – Azimuth & Altitude, Equatorial system-Right ascension & declination, Ecliptic coordinate system.

Time - apparent and mean solar time, sidereal time. Twilight, Seasons- causes of seasons (qualitative ideas).International Date Line.

*Text Book***:**K D Abhyankar, Chapter 2 & Dinah L. Moché, Chapter 1

Sun (**5 Hours)**

Sun - solar atmosphere and internal structure – Photosphere, chromosphere and corona. Radiation zone & Convection Zone. Sun spots, Activity Cycles, flares, prominences, coronal holes, Solar wind.

*Text Book***:** Dinah L. Moché, Chapter 4, Ian Morison Chapter 2

Galaxies **(3 hours)**

Galaxies - our galaxy, galaxy types & turning fork diagram. Structure on the largest scale- clusters, super clusters and voids.

*Text Book***:** Dinah L. Moché, Chapter 6

Module III

Astrophysics (14 hours)

Gravitational contraction - Virial theorem, Jeans mass. Energy production inside stars.Thermonuclear fusion. Hydrogen burning. p-p chain. CNO cycle. Evolution of stars – birth – protostar, hydrostatic equilibrium, red giant, late stages of evolution - white dwarfs & Chandrasekhar limit, Neutron stars, Supernovae, Pulsars, Black holes. Stellar Classification, H-R diagram - Main sequence stars

*Text Book***:** K D Abhyankar, Chapter 10, Dinah L. Moché Chapter 5

Cosmology (12 hours)

Large scale structure of the universe – isotropy and homogeneity.Cosmological principle.

Standard big bang model - GUT, Planck Epoch, Inflation, Nucleosynthesis, Recombination & CMBR. Expanding universe - red shift. Hubble's law and Hubble parameter. Age of universe and its determination. Dark energy and Dark Matter (qualitative idea).

*Text Book***:** Dinah L. Moché Chapter 7 & Ian Morison Chapter 9

References:

1. A short history of the Universe – Joseph Silk
2. Introduction to Astronomy and Cosmology, Ian Morison, John Wiley & Sons, Inc.
3. ASTRONOMY, A Self-Teaching Guide, Dinah L. Moché, John Wiley & Sons, Inc.
4. Introduction to cosmology- J V Narlikar
5. http://www.astro.cornell.edu/academics/courses/astro201/topics.html
6. http://www.ualberta.ca/~pogosyan/teaching/ASTRO_122/lectures/lectures.html
7. http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html
8. Astrophysics: Stars and Galaxies- K D Abhyankar

B. Sc. PHYSICS PRACTICAL

Minimum of experiments to be done in each paper is 14.

Minimum number of experiments for appearing practical examination is 8.

Maximum possible number of repetitions must be done to reduce error in a measuring quantity.

Do calculation of percentage error for all experiments.

The S.I. units must be specified along with the results.

Division of internal marks for record (maximum 4 marks)

No. of Experiments	Marks
14 and above	4
12 & 13	3
10 & 11	2
8,9 & 10	1
Less than 8	0

SEMESTER	PAPER	PAPER CODE	TITLE
1 & 2	01	PH2CRP01	Mechanics and Properties of Matter
3 & 4	02	PH4CRP02	Optics and Semiconductor Physics
5 & 6	03	PH6CRP03	Electricity, Magnetism and LASER
5 & 6	04	PH6CRP04	Digital Electronics
5 & 6	05	PH6CRP05	Thermal Physics, Spectroscopy and C++ Programming
5 & 6	06	PH6CRP06	Acoustics, Photonics and Advanced Semiconductor Physics

SEMESTER 1&2 (First Year)

Core Practical 1: PH2CRP01 – Mechanics and Properties of Matter

1. Symmetric Compound Pendulum – Determination of acceleration due to gravity (g), radius of gyration(K) and moment of inertia (I)
2. Asymmetric Compound Pendulum – Determination of acceleration due to gravity (g), radius of gyration(K) and moment of inertia (I)
3. Kater's pendulum – Determination of acceleration due to gravity (g)
4. Torsion Pendulum – Determination of rigidity modulus (n) and moment of inertia (I)
5. Torsion Pendulum (Method of equal masses) – Determination of rigidity modulus (n) and moment of inertia (I)
6. Measurement of density of a solid – Sensibility method to find mass using beam balance and screw gauge / venier calipers for dimension measurements
7. Uniform bending – Pin and Microscope – Determination of Young's modulus
8. Non Uniform bending – Pin and Microscope – Determination of Young's modulus
9. Uniform bending – Optic Lever – Determination of Young's modulus
10. Non Uniform bending – Optic Lever – Determination of Young's modulus
11. Cantilever – Scale and telescope – Determination of Young's modulus
12. Cantilever – Pin and Microscope – Determination of Young's modulus
13. Vertical oscillations of a spring – Determination of Young's modulus
14. One dimensional elastic collision – Hanging sphere method – Law of conservation of energy and momentum
15. Static Torsion – Determination of rigidity modulus
16. Flywheel – Determination of moment of inertia
17. Constant pressure head – Determination of viscosity of a liquid
18. Variable pressure head – Determination of viscosity of a liquid
19. Stokes's method – Determination of viscosity of a liquid
20. Capillary rise method – Determination of surface tension
21. Quincke's method – Determination of surface tension

SEMESTER 3&4 (Second Year)

Core Practical 02: PH4CRP02 –Optics and Semiconductor Physics

1. Liquid Lens – Determination of optical constants of a convex lens – water and mercury given
2. Liquid Lens – Determination of refractive index of a liquid – water and unknown liquid
3. Spectrometer – Prism – Determination of refractive index of material of the prism
4. Spectrometer – Hollow Prism – Determination of refractive index of liquid
5. Spectrometer – Small angled prism – Normal incidence – Determination of refractive index of material of the prism
6. Spectrometer – i – d curve – Determination of refractive index of material of the prism
7. Newton's rings – Determination of wavelength of sodium light
8. The air wedge – Determination of diameter of thin wire
9. Zener characteristics – forward and reverse – Study of dynamic and static properties
10. Transistor characteristics – Common Emitter Configuration
11. Half wave rectifier – Study of ripple factor and load regulation with and without filter circuit
12. Full wave rectifier – (center tap) – Study of ripple factor and load regulation with and without filter circuit
13. Full wave rectifier – (bridge) – Study of ripple factor and load regulation with and without filter circuit
14. FET – characteristics – Determination of parameters
15. Voltage regulator using zener diode – Study of line and load regulations
16. Clippers – positive, negative and biased – Study of output waveforms
17. Clampers – positive, negative and biased – Study of output waveforms
18. OPAMP characteristics – Study of CMRR and open loop gain
19. OPAMP – inverter, non inverter and buffer – Study of gain
20. LC Oscillator – Colpit's /Hartley – using transistor
21. Phase shift oscillator – using transistor

SEMESTER 5&6 (Third Year)

Core Practical 03: PH6CRP03 – Electricity, Magnetism and LASER

1. Potentiometer – Measurement of resistance of wire
2. Potentiometer – Calibration of low range voltmeter
3. Potentiometer – Calibration of high range voltmeter
4. Potentiometer – Calibration of ammeter
5. Tangent galvanometer – Calibration of ammeter
6. Moving coil galvanometer – figure of merit
7. Conversion of galvanometer into voltmeter
8. Conversion of galvanometer into ammeter
9. Field along the axis of a circular coil – magnetic flux variation
10. Field along the axis of a circular coil – m and B_h
11. Searle's vibration magnetometer – magnetic moment
12. Deflection and vibration magnetometer – m and B_h
13. Carey Foster's bridge – Measurement of resistivity of wire
14. LCR seriesand parallel resonant circuit analysis
15. Verification of Thevenin's and Norton's theorems
16. Verification of Superposition and Maximum power transfer theorems.
17. Laser – Grating – Determination of wavelength
18. Laser – Determination of spot size and divergence
19. Optical fiber – Determination of numerical aperture
20. Single slit diffraction using laser – Determination of slit width
21. e/m – Thomson's apparatus – Bar magnet/magnetic focusing
22. Determination of Dielectric constant of a thin sheet/ a liquid

SEMESTER 5&6 (Third Year)

Core Practical 04: PH6CRP04 – Digital Electronics

1. Realization of logic gates – AND, OR and NOT – Using diodes, transistors etc.
2. Realization of logic gates – AND, OR and NOT – Using universal gates
3. Verification of truth table of NAND, NOR, XOR and XNOR gates
4. Verification of De Morgan's theorems – Using IC 7400
5. BCD to 7 segment decoder
6. Realization of Half adder/ Full adder using gates – Verification of truth table
7. Astable Multivibrator using Transistor
8. Astable Multivibrator using IC 555
9. Monostable Multivibrator using Transistor
10. Monostable Multivibrator using IC 555
11. D/A converter using IC 741 – Using binary weighed resistor / R – 2R ladder type
12. A/D converter using IC 741
13. SR Flip Flops using IC 7400 – Verification of truth table
14. JK Flip Flops using IC 7400 & 7410 – Verification of truth table
15. Digital counter using IC 7490 / 7495 / 74194 / 74151 – Verification of truth table
16. Schmitt trigger using IC 741
17. Bistable multivibrator using IC 555
18. Multiplexer using gates
19. Demultiplexer using gates
20. Shift register – SISO
21. Shift register – SIPO
22. 4-Bit Binary to Gray conversion
23. 4-Bit Gray to Binary conversion

SEMESTER 5&6 (Third Year)

Core Practical 05: PH6CRP05 – Thermal Physics, Spectroscopy and C++ Programming

1. Thermistor – Resistance - Temperature characteristics and temperature co-efficient of resistance
2. Newton's law of cooling – Specific heat capacity of a liquid
3. Thermal conductivity of bad conductor – Lee's disc
4. Carey Foster's bridge – Temperature co-efficient of resistance
5. Study of Seeback effect/Peltier effect
6. Electrochemical equivalent of Copper
7. To determine e/k using transistor
8. Spectrometer – Cauchy's constants
9. Spectrometer – Resolving power of a prism.
10. Spectrometer – Resolving power of grating.
11. Spectrometer – Dispersive power of grating
12. Spectrometer – Dispersive power of prism
13. Computer programming in C++ – Conversion of temperature scale
14. Computer programming in C++ – Solving a quadratic equation
15. Computer programming in C++ – Generation of Fibonacci series
16. Computer programming in C++ – Conversion of a decimal number into binary number
17. Computer programming in C++ – Simple Pendulum – Calculation of 'g' from experimental data
18. Computer programming in C++ – Resistance colour code to numerical value conversion
19. Computer programming in C++ – For different initial velocity and angle of projection, find out time of flight, horizontal range, Maximum height of a Projectile
20. Computer programming in C++ – sorting the numbers in ascending and descending order
21. Computer programming in C++ – multiplication of two matrices

SEMESTER 5&6 (Third Year)

Core Practical 06: PH6CRP06 – Acoustics, Photonics and Advanced Semiconductor Physics

1. Melde's string – Determination of frequency of given tuning fork
2. Sonometer – Determination of frequency of AC
3. Sonometer – Determination of frequency of given tuning fork, unknown mass and verification of laws of strings
4. Kundt's tube – Determination of velocity of sound
5. Spectrometer – Quartz prism – Refractive indices of quartz for the ordinary and extra –ordinary rays
6. Characteristics of LED – V- I characteristic for different colors
7. Characteristics of solar cell / photodiode – V- I characteristics
8. Characteristics of Light Depend Resistors
9. Planck's constant using LED's of at least 3 different colours
10. Weinbridge Oscillator using IC 741
11. Realization of XOR and Ex NOR using transistor
12. Sweep wave generator using transistor
13. Regulated power supply using zener diode and IC 741 – Study of line and load regulations
14. Regulated power supply using IC 78XX/79XX etc – Study of line and load regulations
15. Voltage regulator using zener diode and transistor – Study of line and load regulations
16. RC coupled common emitter amplifier – Study of frequency response and bandwidth
17. Voltage multipliers – doubler & tripler
18. Wave shaping R C circuits – Integrator and differentiator
19. OPAMP – adder and subtractor
20. Amplitude modulation using transistor
21. Pulse Width Modulation using IC 555

References:

1. *Advanced course in Practical Physics by D Chattopadhyay*
2. *Practical Physics – Joseph Ittiavirah, Premnath and Abraham(2005)*
3. *Practical Physics, CL Arora, S.Chand*
4. *Practical Physics, Harnam Singh , S Chand*
5. *Electronics lab manual Vol 1 & 2, K A Navas.*
6. *A course of Experiments with He –Ne Laser – R.S Sirohi (2nd Edition) Wiley Eastern Ltd.*
7. *Electronics lab manual Vol 1 & 2, Kuryachan T D and Shyam Mohan S, Ayodhya pub.*

9. COMPLEMENTARY PHYSICS FOR MATHEMATICS AND STATISTICS

Semester I **2 credits (36 hours)**

PH1CMT01: PROPERTIES OF MATTER & ERROR ANALYSIS

Module I

Elasticity **(13 hours)**

Stress- strain- Hooke's law- Elastic moduli- Poisson's ratio- twisting couple- determination of rigidity modulus- static and dynamic methods- static torsion- torsion pendulum, bending of beams- cantilever, uniform and non-uniform bending, I section girder.

Module II

Surface tension **(3 hours)**

Molecular theory of surface tension - surface energy - excess pressure in a liquid drop, factors affecting surface tension - applications

Hydrodynamics **(7 hours)**

Streamline and turbulent flow - critical velocity - Coefficient of viscosity - Derivation of Poiseuille's equation, Stokes equation-Determination of viscosity by Poiseuille's method - Brownian motion – Viscosity of gases – Bernoulli's theorem.

Module III **(13 hours)**

Error Analysis

Basic ideas – uncertainties of measurement – importance of estimating errors – dominant errors – random errors – systematic errors - rejection of spurious measurements. Estimating and reporting errors – errors with reading scales, errors of digital instruments – number of significant digits –absolute and relative errors – standard deviation. Propagation of errors – sum and differences – products and quotients – multiplying by constants – powers

References:

1. *Elements of properties of matter, D S Mathur*
2. *Advanced course in Practical Physics by D Chattopadhyay*
3. *Properties of Matter- Brijlal and N. Subrahmanyam (S. Chand and Co.)*
4. *Concepts of Modern Physics- A. Beiser (Tata McGraw-Hill, 5th Edn.)*
5. *Modern Physics- G. Aruldas and P. Rajagopal (PHI Pub)*
6. *Physics- Resnick and Halliday*
7. *An Introduction to Error Analysis: The Study of Uncertainties in Physical Measurements, John R. Taylor - Univ. Science Books*

Semester II **2 credits (36 hours)**

PH2CMT01: MECHANICS AND ASTROPHYSICS

Module I

Motion under Gravity **(5 hours)**

Velocity- acceleration- force – acceleration due to gravity - compound pendulum (symmetric and asymmetric) radius of gyration – Kater's Pendulum- centripetal acceleration and force - centrifugal force

Rotational Dynamics **(10 hours)**

Angular velocity- angular momentum- torque- conservation of angular momentum- angular acceleration- moment of inertia- parallel and perpendicular axes theorems- moment of inertia of rod, ring, disc, cylinder and sphere- flywheel

Module II

Oscillations **(9 hours)**

Periodic and oscillatory motion- simple harmonic motion- differential equation, expression for displacement, velocity and acceleration- graphical representation- energy of a particle executing simple harmonic motion - damped oscillation- forced oscillation and resonance.

Waves **(4 hours)**

Waves-classifications- progressive wave- energy of progressive wave- superposition of waves-theory of beats- Doppler Effect.

Module III

Astrophysics **(8 hours)**

Temperature and color of a star- elements present in a stellar atmosphere- mass of star- life time of a star- main sequence stars-HR diagram- evolution of stars- white dwarf- supernova explosion- neutron star- black hole- (all topics to be treated qualitatively)

References

1. Elements of properties of matter, D S Mathur Mechanics- H.S.Hans and S.P.Puri. (TMH)
2. Mechanics, D S Mathur
3. Modern Physics- R. Murugeshan, Er. Kirthiga Sivaprasad

4. A text book on oscillations waves and acoustics, M.Ghosh , D Bhattacharya
5. Introduction to Astrophysics-Baidyanath Basu.
6. Mechanics by D.S. Mathur and P.S. Hemne, S. Chand.
7. Waves, Mechanics & Oscillations- S B Puri

Semester III **3 credits (54 hours)**

PH3CMT01: MODERN PHYSICS AND ELECTRONICS

Module I

Modern Physics **(18 hours)**

Basic features of Bohr atom model-formula for energy- vector atom model- various quantum numbers-coupling schemes – LS & JJ-Pauli's exclusion principle- magnetic moments of orbital electrons

Atomic nucleus-classification-basic properties of nucleus-charge, mass, spin, magnetic moment binding energy and packing fraction-nuclear forces-salient features

Radioactivity- properties of alpha, beta and gamma-Soddy Fajan's displacement law, law of radioactive disintegration-decay constant-half life and mean life-radioactive equilibrium - measurement of radioactivity-radio carbon dating

Module II

Quantum Mechanics **(12 hours)**

Inadequacies of classical physics-experimental evidences-evidences for quantum theory-Planck's hypothesis-foundation of quantum mechanics-wave function & probability density- Schrödinger equation-time dependent and time independent particle in a potential box.

Spectroscopy **(6 hours)**

Optical spectra- spectral terms, selection rules, hyperfine structure; molecular spectra-rotational, vibrational and electronic spectra; Raman effect- experimental study, quantum theory; fluorescence and phosphorescence; comparison of Raman, fluorescence and IR spectra; NMR

Module III

Electronics (8 hours)

Current-voltage characteristics of a diode-forward and reverse bias-breakdown mechanism of p-n junction diode-Zener diode and its characteristics-half wave and full wave rectifiers- bridge rectifier-ripple factor, efficiency. Bipolar junction transistor-Construction and operation.

Module IV

Digital Electronics (10 hours)

Different number systems – decimal, binary, octal, hexa decimal number systems-conversion between different number systems- binary mathematics – addition, subtraction (1's compliment and 2's compliment methods) - basic theorems of Boolean algebra- de Morgan's theorems – Simplification of Boolean equations - AND, OR, NOT, NAND, NOR, XOR gates- truth tables- half adder- full adder

References

1. *Modern Physics- R. Murugeshan, Er. Kirthiga Sivaprasad*
2. *Principles of electronics, V K Mehta*
3. *Digital principles and applications- A. P. Malvino and P. Leach*
4. *Concepts of Modern Physics: Arthur Beiser (TMH).*
5. *Basic Electronics , B L Thereja (S. Chand)*

Semester IV 3 credits (54 hours)

PH4CMT01: OPTICS & ELECTRICITY

Module I

Interference, Diffraction and Polarization (22 hours)

Light waves- phase difference and coherence, optical path and phase change, principle of superposition, Analytical treatment of interference-young's double slit experiment, conditions for interference, bandwidth - Interference in thin films-reflected system-colour of thin films-fringes of equal inclination and equal thickness. Newton's rings-reflected system-measurement of wavelength

Fresnel and Fraunhofer diffractions.Fresnel's theory of approximate rectilinear propagation of light-.Fraunhofer diffraction.Theory of Plane transmission grating-determination of wavelength-dispersive power of grating. Prism and grating spectra, resolving power, Rayleigh criterion, resolving power of grating,

Polarization, types of polarization, Brewster's law, dichroism, birefringence – e ray and o-ray, polarizer and analyser, Malu's law, optical activity

Module II

Laser and Fiber Optics (10 hours)

Principle of operation of laser-population inversion, metastable states, optical resonator-components of laser- active medium, pump, optical resonant cavity- principal pumping schemes- three level and four level- laser beam characteristics applications of lasers. Light propagation in optical fibers, acceptance angle, numerical aperture-step index fiber - graded index fiber.

Module III

Dielectrics (10 hours)

Dielectrics- polar and non-polar dielectrics- polarization- sources of polarization-Gauss's law in dielectrics- permittivity- dielectric displacement vector- dielectric constant-susceptibility- ferro-electricity.

Module IV

Varying Currents (12 hours)

Transient currents – Growth and decay of current in an inductive circuit – charging and discharging of a capacitor through a resistance - Peak, mean, rms and effective values of a.c, Ac circuits-AC through RC, LC, LR and LCR series circuits resonance-sharpness of resonance-power factor.

References:

1. *Optics - Brijlal and N. Subrahmanyam, S Chand-2015*
2. *Electricity and Magnetism , D C Tayal*
3. *Electricity and Magnetism- J. H. Fewkes & John Yarwood*
4. *Electricity and Magnetism – R. Murugeshan*

5. *Nuclear physics –Irvin Kaplan*
6. *Lasers – theory & applications- Thyagarajan & Ghatak*
7. *Concepts of Modern Physics- A. Beiser*
8. *Laser Physics and Applications, V K Jain (Narosa Publication)*
9. *Optical Fiber Communications, John M Senior*

10. COMPLEMENTARY PHYSICS FOR CHEMISTRY AND GEOLOGY

Semester 1

PH1CMT02: PROPERTIES OF MATTER AND THERMODYNAMICS

Module I

Elasticity (13 hours)

Stress- strain- Hooke's law- Elastic moduli- Poisson's ratio- twisting couple- determination of rigidity modulus- static and dynamic methods- static torsion- torsion pendulum, bending of beams- cantilever, uniform and non-uniform bending, I section girder.

Module II

Surface tension (3 hours)

Molecular theory of surface tension - surface energy - excess pressure in a liquid drop, factors affecting surface tension - applications

Hydrodynamics (7 hours)

Streamline and turbulent flow - critical velocity - Coefficient of viscosity - Derivation of Poiseuille's equation, Stokes equation-Determination of viscosity by Poiseuille's method - Brownian motion – Viscosity of gases- Bernoulli's theorem.

Text Book: Elements of properties of matter, D S Mathur, Chapter- 14

Module III

Thermodynamics (13 hours)

Thermodynamic systems- thermodynamic equilibrium- thermodynamic processes- isothermal process- adiabatic process- zeroth law of thermodynamics, first law of thermodynamics- heat engine- the Carnot engine- refrigerator, concept of entropy- second law of thermodynamics- third law of thermodynamics- Maxwell's thermodynamic relations

Text Books:

1. Elements of properties of matter, D S Mathur- S Chand
2. Heat and Thermodynamics-Brijlal & Subrahmanyam (S.Chand)

References

1. Mechanics - H.S.Hans and S.P.Puri. (Tata McGraw-Hill)
2. Properties of Matter - Brijlal and N. Subrahmanyam (S. Chand and Co.)
3. Mechanics - J.C. Upadhyaya (Ram Prasad and sons)
4. Heat and Thermodynamics – Mark W Zemanski (Tata McGraw-Hill)

Semester 2

PH2CMT02: MECHANICS AND SUPERCONDUCTIVITY

Module I

Motion under gravity **(5 hours)**

Velocity- acceleration- force – acceleration due to gravity - compound pendulum (symmetric and asymmetric) radius of gyration –centripetal acceleration and force - centrifugal force

Rotational dynamics **(10 hours)**

Angular velocity- angular momentum- torque- conservation of angular momentum- angular acceleration- moment of inertia- parallel and perpendicular axes theorems- moment of inertia of rod, ring, disc, cylinder and sphere- flywheel

Module II

Oscillations **(9 hours)**

Periodic and oscillatory motion- simple harmonic motion- differential equation, expression for displacement, velocity and acceleration- graphical representation- energy of a particle executing simple harmonic motion damped oscillation- forced oscillation and resonance.

Waves **(4 hours)**

Waves-classifications- progressive wave- energy of progressive wave- superposition of waves-theory of beats- Doppler effect.

Module III

Superconductivity (8 hours)

Super conducting phenomenon- Occurrence- BCS theory (qualitative) Meissner Effect- Type I and Type II superconductors- Josephson effects (qualitative) - High temperature superconductors- Applications of Superconductivity

Text Books:

1. *Elements of properties of matter, D S Mathur- S Chand*
2. *Mechanics- D S Mathur- S Chand*
3. *Solid State Physics- P K Palanisamy- Scitech*

References

1. *Properties of Matter- Brijlal and N. Subrahmanyam (S. Chand and Co.)*
2. *A text book on oscillations waves and acoustics, M.Ghosh , D Bhattacharya*
3. *Solid State Physics- R. K. Puri and V.K. Babbar (S. Chand and Co.)*
4. *Elementary Solid State Physics,Ali Omar*
5. *Modern Physics- Murugeshan- S Chand*

Semester III

PH3CMT02: MODERN PHYSICS AND MAGNETISM

Module I

Modern Physics (18 hours)

Basic features of Bohr atom model-formula for energy-vector atom model- various quantum numbers- Coupling schemes-LS and JJ coupling-Pauli's exclusion principle- magnetic moment of orbital electrons,

Atomic nucleus classification-basic properties of nucleus-charge, mass, spin, magnetic moment binding energy and packing fraction-nuclear forces-salient features

Radioactivity- properties of alpha, beta and gamma- Soddy Fajan's displacement law, law of radioactive disintegration -decay constant-half life and mean life-radioactive equilibrium - measurement of radioactivity-.Radio carbon dating

Module II

Quantum Mechanics (12 hours)

Inadequacies of classical physics-experimental evidences-evidences for quantum theory-Planck's hypothesis-foundation of quantum mechanics-wave function & probability density- Schrödinger equation-time dependent and time independent particle in a potential box.

Spectroscopy (6 hours)

Optical spectra- spectral terms, selection rules, hyperfine structure; molecular spectra-rotational, vibrational and electronic spectra; Raman effect- experimental study, quantum theory; fluorescence and phosphorescence; comparison of Raman, fluorescence and IR spectra; NMR

Module III

Electronics (8 hours)

Current-voltage characteristics of a diode-forward and reverse bias-breakdown mechanism of p-n junction diode-Zener diode and its characteristics-half wave and full wave rectifiers- bridge rectifier-ripple factor, efficiency. Construction and operation of a bipolar junction transistor

Module IV

Magnetism (10 hours)

Properties of magnetic materials, Paramagnetism, Diamagnetism, Ferromagnetism, Hysteresis, Ferrites, Magnetostriction, Earth's magnetism-elements of earth's magnetism-dip, declination, horizontal and vertical components-magnetic maps- magnetographs-cause of earth's magnetism

Text Books:

1. *Modern Physics- R. Murugeshan, Er. Kirthiga Sivaprasad . S Chand*
2. *Principles of electronics, V K Mehta, S Chand*
3. *Electricity and magnetism, D C Tayal,*

References

1. *Functional Electronics, Ramanan (Tata McGraw-Hill)*
2. *Electricity and magnetism - Brijlal and N. Subrahmanyam (S. Chand and Co.)*

Semester IV

PH4CMT02: OPTICS AND SOLID STATE PHYSICS

Module I

Interference, Diffraction and Polarization (22 hours)

Light waves- phase difference and coherence, optical path and phase change, principle of superposition, Analytical treatment of interference-- young's double slit experiment, conditions for interference, bandwidth Interference in thin films-reflected system-colour of thin films-fringes of equal inclination and equal thickness. Newton's rings-reflected system-measurement of wavelength

Fresnel and Fraunhofer diffractions.Fresnel's theory of approximate rectilinear propagation of light. Fraunhofer diffraction.Theory of Plane transmission grating-determination of wavelength- dispersive power of grating. Prism and grating spectra, resolving power, Rayleigh criterion, resolving power of grating,

Polarization, types of polarization, Brewster's law, dichroism, birefringence – e ray and o-ray, polarizer and analyzer, Malu's law, optical activity

Module II

Laser and Fiber Optics (10 hours)

Principle of operation of laser-population inversion, metastable states, optical resonator-components of laser- active medium, pump, optical resonant cavity- principal pumping schemes- three level and four level- laser beam characteristics, applications of lasers. Light propagation in optical fibers, acceptance angle, numerical aperture-step index fiber - graded index fiber.

Module III

Dielectrics (10 hours)

Dielectrics- polar and non-polar dielectrics- polarization- sources of polarization-Gauss's law in dielectrics- permittivity- dielectric displacement vector- dielectric constant-susceptibility- ferro-electricity.

Module IV

Crystallography (12 hours)

Crystal structure-crystal lattice and translation vectors-unit cell-types of lattices- Miller indices- lattice directions and planes interplanar spacing-simple crystal structures- sc, fcc, bcc, hcp close packed structures- -sodium chloride structure. X-ray crystallography-diffraction of x-rays-Bragg's law

Text Books:

1. *Optics - Brijlal and N. Subrahmanyam - S Chand-2015*
2. *Electricity and Magnetism , D C Tayal*
3. *Solid State Physics, S O Pillai*

References:

1. *A text book of Applied Physics – A .K Jha*
2. *Electricity and Magnetism – R. Murugeshan (S Chand & Co.)*
3. *Solid state physics, P. K Palanisami*
4. *Lasers – theory & applications- Thyagarajan &Ghatak*

COMPLEMENTARY PHYSICS PRACTICALS

Semester I & II

Complementary Physics Practical 1: PH2CMP01

1. Vernier Calipers -- Volume of cylinder (solid and hollow), sphere and beaker
2. Screw gauge – Radius of wire, volume of sphere and glass piece
3. Beam balance - Mass of a solid (sensibility method)
4. Spectrometer - Refractive Index of material of prism.
5. Diode characteristics- ac and dc resistance
6. Coefficient of viscosity of the liquid – Constant **OR** Variable pressure head method
7. Surface Tension – Capillary rise method
8. Determination of Young's Modulus- Cantilever (Scale and Telescope)
   OR - Uniform bending (Optic lever method)
   OR- Non-uniform bending (Pin and Microscope method)
9. Acceleration due to gravity (g)- Symmetric Compound Pendulum
   OR Kater's pendulum
10. Symmetric Compound Pendulum - Determination of Radius of gyration and moment of inertia
11. Fly wheel – Moment of Inertia
12. Torsion pendulum -Rigidity modulus
13. Determination of moment of inertia of rotationally symmetric body (solid sphere **OR** cylinder **OR** disc) from their period of oscillation on a torsion axle
14. Spring constant - Hooke's law - oscillation
15. Resistivity of the material of the wire- Ohm's law and verification by multimeter
16. Construction of half wave rectifier with and without filter – Ripple factor
17. Laser- Transmission **OR** Reflection Grating- Determination of wavelength
18. Liquid lens - Refractive Index of glass using a liquid of known refractive index
19. Poisson's ratio of rubber
20. Temperature dependence of capacitance- polymer and ceramic capacitors
21. Resistance of a galvanometer and its figure of merit.

Semester III & IV: Complementary Physics Practical 2: PH4CMP02

1. Determination of Young's Modulus- Cantilever (Pin & Microscope)
   OR Uniform bending (pin and microscope)**OR** Non-uniform bending (optic lever)
2. Asymmetric Compound Pendulum- Determination of moment of inertia and Acceleration due to gravity (g)
3. Torsion pendulum (Equal mass method) - Rigidity modulus and Moment of Inertia
4. Spectrometer – Dispersive power of prism
5. Spectrometer – Dispersive power of a Grating
6. Newton's rings -Wave length
7. Characteristics of Zener diode- ac and dc resistance
8. Conversion of Galvanometer into voltmeter
9. Carey Foster's Bridge -Measurement of resistivity
10. Tangent Galvanometer – Ammeter calibration
11. Potentiometer-Calibration of low range ammeter **OR** voltmeter
12. Construction of full wave rectifier (center-tap **OR** bridge) with and without filter – Ripple factor
13. Construction of regulated power supply using Zener diode- line and load regulation
14. Laser diffraction- width of single slit **OR** thickness of wire
15. Refractive index of liquid- Liquid Lens **OR** Spectrometer and Hollow Prism
16. Air wedge-thickness of wire
17. Static Torsion - Rigidity modulus
18. Deflection and Vibration Magnetometer-m & Bh
19. Field along the axis of circular coil- determination of Bh
20. Searle's Vibration Magnetometer - magnetic moment
21. Gates – AND, OR, NOT- verification of truth tables

References

1. *Practical Physics – C L Arora- S Chand*
2. *Properties of Matter -D.S. Mathur*
3. *Optics -Subrahmanyam& Brijlal*
4. *Electricity &Magnetism -Sreevastava*
5. *Electronics Lab Manual (Vol.1) -K. A. Navas*
6. *Laboratory manual for electronic devices and circuits-David A Bell*
7. *Practical Physics- Joseph Ittiavirah, Premnath and Abraham*

11. COMPLEMENTARY PHYSICS FOR B. Sc. ELECTRONICS (MODEL III) PROGRAMME

SEMESTER I

PH1CMT03: SOLID STATE PHYSICS

Objectives:

1. To provide the students of B.Sc. Electronics programme the bare minimum knowledge in Solid State Physics which is the basis of electronic devices.
2. It aims at developing a taste for solid state physics where the real advances in electronic device technology happens.
3. To enable students to catch up with the new areas related to electronics which include quantum computing, nanotechnology etc.
4. Miniaturization has made the physics of devices more demanding. One requires the application of the methods of quantum mechanics to tackle them.

Hours/Week 4

Contact Hours 72

Credit s 3

Course Outline

Module I- Crystal structure and atomic bonding (15hours)

Basic definitions - Crystal lattice, Unit cell- primitive and non primitive cells, Basis. Types of lattices-Bravais lattices and derived structures, Lattice directions and planes-Miller indices (simple calculations expected). X-ray diffraction-Bragg's law- Powder crystal method (qualitative study).Inter-atomic bonding- ionic, covalent, metallic.

Textbook

Chapter One, Two and Three.Solid State Physics-R.K Puri&V.KBabbar.

Module II – Basic quantum mechanics (15 hours)

Dual nature of matter and wave - de Broglie waves, Particle diffraction - Davison-Germer experiment, Uncertainty principle(derivation based on Fourier integral not needed),Classical mechanics as an approximation of quantum mechanics, Wave function, Wave equation, Schrodinger equation- Time dependent & Steady State forms(Eigen functions and eigen values not needed).

Textbook

Chapter Three &Five.Concepts of Modern Physics-Arthur Beiser.

Module III –Free electron theory of metals and Band theory of solids (10 hours)

Free electron theory in one dimension (qualitative study only)-fermi energy and fermilevel, Band theory -Bloch theorem (proof not required), Metals, insulators and semiconductors according to energy band picture.

Textbook

Chapter Five, Six. Solid State Physics-R.K Puri & V.K.Babbar.

Module IV-Semiconductors (12 hours)

Semiconductors –intrinsic and extrinsic types-doping. Drift velocity, mobility and conductivity of intrinsic semiconductors, Law of mass action and intrinsic carrier concentration (only essential formula required), Hall effect-hall coefficient.

Textbooks

Chapter Seven.Solid State Physics-R.K Puri & V.K.Babbar.

Chapter Six.Elementary Solid State Physics-Principles and Applications-Ali Omar, Pearson Education.

Module V – Magnetism in solids and Super conductivity (20 hours)

Magnetic terminology–Types of magnetism (derivations not needed)-dia, para and ferromagnetism –Weiss Theory of ferromagnetism-Concept Domain and Hysterisis, antiferromagnetism, ferrimagnetism.

Superconductivity, Electrical resistivity- zero resistance, Meissner effect, Critical field and critical temperature, Type I and Type II Superconductors, Applications of superconductivity (basic information only).

Textbook

Chapter Eight and Ten.Solid State Physics-R.K Puri&V.K.Babbar.

Books for study

1. Concepts of Modern Physics -Arthur Beiser, 6th edn., Tata McGraw Hill Publishing Company Ltd.
2. Solid State Physics-R.K Puri & V.KBabbar,S.Chand& Company Ltd.
3. Elementary Solid State Physics-Principles and Applications-Ali Omar, Pearson Education.

Books suggested for further reading

1. Quantum Mechanics-G Aruldhas, PHI Learning.
2. Solid State Physics-S.O Pillai, 6th revised edition. New Age International Pvt. Ltd.
3. Introduction to Solid State Physics - Charles Kittel, 8th edition, Wiley.

4. Introduction to Quantum Mechanics - Griffiths, 2nd edition. Pearson Education.
5. Solid State Physics-Structures and Properties of materials, M.A Wahab, 3rdedition, Narosa Publishing House.
6. Solid State Physics- C.L. Arora, S Chand & Company Ltd.
7. Solid State Physics-P.K. Palanisamy, Scitech Publications.
8. Solid State Physics- Blakemore, J.S. 2nd edition. Cambridge.
9. Solid State Physics - Gupta & Kumar, K.Nath& Co., Educational Publishers,
10. Fundamentals of Solid State Physics –Saxena, Gupta & Saxena, Pragati Prakashan

12. VOCATIONAL COURSES - MODEL II- APPLIED ELECTRONICS

Semester-I

Vocational Course I **Credit-2 (36 hours)**

AE1VOT01: PRINCIPLES OF ELECTRONIC COMPONENTS

Scope: This course is expected to give a familiarization of various electronic components.

Prerequisites: Basic Physics and Mathematics

Module I (12 hours)

Resistors: (6Hours)

Basic Ideas – Resistor Types – Wire wound Resistors – Carbon composition Resistors – Carbon Film Resistors – Metal Film Resistors – Power Rating – Value- tolerance – Variable Resistors – Potentiometers and Rheostat – Fusible resistor – Resistor Colour code –Resistors under 10 Ohm – Resistor troubles – Checking Resistors with an Ohmmeter –Measurement of resistance-Wheststone bridge.

Inductors: (6Hours)

Basic Ideas – Comparison of different cores – Inductance of an Inductor – Mutual Inductance Coefficient of Coupling – Variable Inductors – Series and Parallel combination of inductors – Energy stored – troubles in coils – Reactance – Impedance – Q factor – Power factor and wattless current - Measurement of Inductance-Hay's and Maxwell's bridge.

Basic Electronics – Solid State, B.L. Theraja-S Chand (2005)

Electronic Components, D.V.Prasad- Radiant Publishing House, Hyderabad.

Module II (12 hours)

Capacitance (8Hours)

Basic ideas – Capacitor connected to the battery – Capacitance – Factors controlling capacitance – Types of Capacitors – Fixed Capacitors:- Paper, Mica, Ceramic, Electrolytic – Variable Capacitors:- Gang, Trimmer, Padder - Voltage ratings of Capacitors – Stray circuit capacitance – Leakage Resistance – Series and Parallel combination Capacitors – Energy stored – Troubles in Capacitors – Checking Capacitors with Ohmmeter – Charging of a Capacitor – Capacitor connected across and AC source – Capacitive Reactance – Q factor –Power factor – Measurement of Capacitance-Schering bridge.

Transformers (4Hours)

Principle, Symbols – Mains and isolation transformers – Auto, Audio, IF, RF and Power transformers – Impedance matching – Losses in transformers – Equivalent circuit – Frequency response – Common fault in transformers.

Electronic Instruments and Systems, R.G. Gupta – TMH (2001) Basic Electronics – Solid State, B.L. Theraja-S Chand (2005)

Electronic Components, D. V. Prasad- Radiant Publishing House, Hyderabad.

Module III (12 hours)

Switches and Relays:(9Hours)

Basic ideas: switching actions, momentary contact actions, maintained contact actions – Types of switches: SPST, SPDT, DPST, DPDT, Toggle, rotary-Fuses: General idea, fuse rating – Circuit breaker-Relays: General information, Symbol-Types of relays: electromagnetic, reed relay – Specifications – Application areas.

A text Book of Applied Electronics, R.S. Sedha – S. Chand (2005)

Electronic Components and materials, Madhuri A. Joshi – Wheeler Publishing (1996)

Display Devices: (3 Hours)

LED, LCD, Segmental Displays using LEDs, LCDs.

Electronic Instrumentation (2 Ed.) H.S. Kalsi, TMH (2 Edn)

Semester-I

Vocational Course:II Credit-2 (36 hours)

AE1VOT02: ELECTRONIC APPLICATIONS

Scope: This course is expected to provide knowledge of various electronic circuits and its application.

Pre-requisites: Basic Electronics, Physics and Mathematics

Module I

Measuring Instruments (6 Hours.)

PMMC Multimeter – Digital Multimeter– Cathode Ray Oscilloscope (CRO):- Principle – Cathode Ray Tube – Deflection of the Beam – Blanking or Flyback or Retrace-Deflection Sensitivity- Single Trace Oscilloscope – Recurrent Sweep.

Electronic Instruments and Systems, R.G. Gupta – TMH (2001)

Tuning Circuits and Filters: (6Hours)

Resonance in series and parallel LCR circuits – Operating characteristic of a tuning circuit – Q value – Bandwidth – Tuning circuit in radio receivers – Double tuned transformers – direct and indirect coupled circuits – coefficient of coupling – filters: low pass filter-high pass filter

– band pass filter-band stop filter.

Basic Electronics – Solid State, B.L. Theraja-S Chand (2005)

Module II

Time base Circuits: (6Hours)

General features of a time base signal – Types of time base circuits – Methods of Generating a time base Waveform – Exponential Sweep circuit – Sweep Circuit Using Transistor Switch– A Transistor Constant Current Sweep – Miller Sweep Circuit – Bootstrap Sweep Circuit –Current Time Base Generator.

A text Book of Applied Electronics, R.S. Sedha – S. Chand (2005)

Transducers: (6Hours)

General information-LDR-Thermistor –Thermocouple –Photodiode –Phototransistor – LVDT-Piezoelectric transducer, Microphone-moving coil.

Basic Electronics – Solid State, B.L. Theraja-S Chand (2005) Electronic Instrumentation (2 Ed.) H.S. Kalsi, TMH (2006).

Module III

Optical Recording: (4Hours).

Compact Disc – Optical recording of disc -CD playback process – Advantages and disadvantages of compact discs.

Audio and Video Systems, R.G. Gupta – TMH (2002)

Printed Circuit Board and Soldering: (8Hours)

General Information-Types of PCBs-Steps involved in development of PCB using FeCl3 solution- Preparation of layout of simple circuits, transferring the lay out to the board and etching, Advantages of PCB. Soldering and Desoldering Techniques- Solder joint, Dry solder joint, Cold solder joint, Good and bad solder joints, Soldering material, Soldering tools, Soldering iron, Ultrasonic soldering, Advantages of ultrasonic soldering, Tools for desoldering, Desoldering techniques, Soldering techniques.

A text of Applied Electronics, R.S. Sedha – S.Chand (2005)

Electronic Instrumentation and Systems, R.G.Gupta, Tata McGraw-Hill (2004), Chapter-4.

Electronic Components and materials, Madhuri A. Joshi – Wheeler publishing (1996)

Semester-II

Vocational Course:III **Credit-2 (36 hours)**

AE2VOT03: BASICS OF POWER ELECTRONICS

Scope: This course is expected to provide knowledge of various Power Electronic components and its application.

Prerequisites: Basic Electronics, Physics and Mathematics

Module I

Field-Effect Transistors: 12 hours.

Introduction– Types of Field-Effect Transistor. Junction Field-Effect Transistor – Formation of Depletion Region in JFET – Operation of JFET – Characteristics of JFET – Drain Characteristics – Effect of Gate-to-Source Voltage on Drain Characteristics – Transfer Characteristics – Specifications Sheet of JFET – JFET Parameters – Mathematical Expression for Transconductance – Comparison between Junction Field Effect Transistors and Bipolar Junction Transistor

A Text book of Applied Electronics, R.S. Sedha – S. Chand (2005).

Basic Electronics – Solid State, B.L. Thereja-S Chand (2005)

Electronic Devices and Circuits, J.B.Gupta-S.K.Kataria & Sons Module II

MOSFET: 12Hours.

Types of MOSFET – Depletion-Type MOSFET – Working of a Depletion-Type MOSFET – Drain Characteristics of Depletion-Type MOSFET – Transfer Symbol for Depletion

Type MOSFET – Circuit Symbol for Depletion-Type MOSFET – Enhancement-Type MOSFET – Drain characteristics for enhancement type MOSFET - Transfer Characteristics of Enhancement-Type MOSFET – Circuit Symbol for Enhancement type MOSFET – The MOSFET as a Resistor – Advantages of N-Channel MOSFET's Over P-Channel – Complementary MOSFETs (CMOS), Handling Precautions for MOSFET's.

A Text Book of Applied Electronics, R.S. Sedha – S. Chand (2005).

Basic Electronics – Solid State, B.L. Theraja-S Chand (2005)

Electronic Devices and Circuits, J.B.Gupta-S.K.Kataria & Sons

Module III

FET Amplifiers: 12Hours.

Introduction-Biasing the FET- Biasing the JFET-Gate Bias-Self Bias-Setting a Q-Point - Setting a Q-Point Using Load Line – Biasing Against Device Parameter Variation – Voltage Divider Bias – Source Bias – Current Source Bias – Biasing the Enhancement Type MOSFET 's – Biasing the Depletion Type MOSFET 's -The Field –Effect Transistor amplifier-Common source Amplifier-Analysis of Common Source Amplifier-Effect of AC load on amplifier parameters-Effect of external source resistance on Voltage gain, Common Drain Amplifier- Analysis of Common Drain Amplifier-Common Gate Amplifier- Analysis of Common Gate Amplifier

A Text book of Applied Electronics, R.S. Sedha – S. Chand (2005)

Electronic Devices and Circuits, J.B.Gupta-S.K.Kataria & Sons

Semester-II

Vocational Course:IV **Credit-2 (36 hours)**

AE2VOT04: POWER ELECTRONICS

Scope: This course is expected to provide a knowledge of various Power electronic circuits and its application.

Prerequisites: Basic Electronics, Physics and Mathematics

Module I

Thyristors, SCR, Diac, Triac: (14 hours.)

Basic ideas and Types of Thyristors Basic construction of Silicon Controlled Rectifier – SCR biasing – SCR operation – SCR equivalent Circuit- Two transistor model of SCR –

Trigger Current and Trigger voltage- Turning ON & Turning OFF an SCR– V-I characteristics – Forward characteristic – Reverse characteristic – Thyristor Specifications and ratings – Applications. Basic construction of Diac:- V-I characteristic- Applications. Basic construction of Triac:- Operation – V-I characteristic – Applications – Difference between SCR and Triac.

Module II

Uni Junction Transistors, Silicon Controlled Switch: (10 hours.)

Unijunction Transistors (UJT) : Basic construction-Equivalent circuit, Symbol, Intrinsic Standoff ratio- UJT operation. V-I characteristic –UJT Relaxation Oscillator- Applications of UJT. Silicon Controlled Switch(SCS)-SCS operation, V-I characteristics, SCS application. Silicon Unilateral Switch (SUS)- Symbol, Operation, V-I characteristics, Application. Silicon Bilateral Switch (SBS) – Symbol, Operation, V-I characteristics, Application. Silicon Asymmetrical Switch (SAS)- Symbol, Operation, V-I characteristics, Application.

Module III

Controlled Rectifiers: 12 Hours.

Introduction-SCR – Power control using SCR – SCR half wave rectifier – Average values of load voltage and current - 90°Variable Half Wave Rectifier - 180º Variable Half Wave Rectifier – SCR Full Wave Rectifier – UJT Triggered SCR phase control – Triac power control – Diac-Triac Phase Control Circuit – General ideas of Inverters -Single phase inverter– Push-pull inverter.

A Text book of Applied Electronics, R.S. Sedha – S. Chand (2005)

Power Electronics, B.R.Gupta and V.Singhal- S.K. Kataria & Sons

Power Electronics, Dr.P.S.Bimbhra, Khanna Publishers

Semester-III
Vocational Course:V **Credit-4 (54 hours)**

AE3VOT05: MICRO PROCESSOR AND INTERFACING DEVICES

Scope: This course is expected to provide knowledge of Micro Processor and Interfacing Devices

Prerequisites: Basic Electronics, Physics and Mathematics

Module I (34 hours)

Intel 8085(34hours)

Microprocessor Architecture – Intel 8085 – Instruction cycle - Timing diagram – Instruction set of Intel 8085 – Addressing Modes – Status Flags – Intel 8085 Instructions – Simple program for data transfer and arithmetic operations, program branching, looping, using sub routines, Program for finding smallest and largest number, Program for arranging data in ascending and descending order, Delay sub routine.

References: Fundamentals of Microprocessors and Microcomputers – B Ram Pub: Dhanpat Rai Publications (P) Ltd.(6 th Edn.)

Micro Processor Architectures Programming and Applications – R.S. Gaonkar, Pub: Penram International

ModuleII (20hours)

Peripheral Devics

Address space partitioning – Data transfer schemes – Interrupts of Intel 8085 – Programmable Peripheral Interface (PPI) Intel 8255 - Programmable DMA Controller Intel 8257 – Programmable Interrupt Controller Intel 8259

Fundamentals of Microprocessors and Microcomputers – B Ram Pub: Dhanpat Rai Publications (P) Ltd.(6th Edn.)

Micro Processor Architectures Programming and Applications – R.S. Gaonkar, Pub: PenramInternational

Semester-III

Vocational Course:VI **Credit-3 (54 hours)**

AE3VOT06: COMMUNICATION ELECTRONICS

Scope: This course is expected to provide knowledge of various communication systems and its working

Prerequisites: Basic Electronics, Physics and Mathematics

Module I (18 hours)

Communication Systems (6Hours)

Communication Systems- Information, Transmitter, Channel, Noise, Receiver - Modulation- need for modulation.

Electronic Communication Systems- Kennedy & Davis, TMH, 4th Edition. Electronic Devices: Floyd, Pearson , 6th Edition.

Radio waves (12Hours)

Propagation of radio waves: Ground waves, Sky waves, Space waves, Frequency and band allocation- ionospheric influence on radio waves. Terms relating sky wave communication, skip distance, maximum usable frequency, Single and multihop transmission, Fading.

Electronics: Fundamentals and Applications- D. Chattopadhyaya , P.C.Rakshit, Newage- Revised 6th edition.

Module II (18 hours)

Modulation and Demodulation (7Hours)

Modulation and Demodulation: Amplitude modulation- Modulation index, Frequency spectrum, Sidebands, Power in AM wave, Amplitude modulation generation. Frequency modulation- Modulation index, Generation of FM wave, Reactance modulator, Voltage controlled oscillator.

Wave detectors (11Hours)

Detection of AM wave- Diode detector (qualitative) - Detection of FM waves- Slope detector, phase discriminator, Pre emphasis, De emphasis - Comparison between AM & FM Pulse modulation-Analog & digital Pulse modulation, Basic idea of Pulse amplitude

modulation (PAM), Pulse width modulation (PWM) & Pulse position modulation (PPM) - Radio Receivers- Super heterodyne AM receiver & Super heterodyne FM receiver (Explanation with block diagram).

Electronics: Fundamentals and applications- D. Chattopadhyaya , P.C.Rakshit, Newage- Revised 6th edition.

Electronic Communication Systems- Kennedy & Davis, TMH, 4th Edition. Electronic Devices: Floyd, Pearson , 6th Edition.

Module III (18 hours)

Antenna Television and Radar (12Hours)

Antenna – Half-wave dipole – Antenna parameters – Dipole antenna with reflector and director – Yagi-Uda Antenna –Principles of radar, Radar range equation, Basic pulsed radar set, Applications of radar.

Forms of communication systems (6Hours)

Other communication systems: Satellite communication- Microwave communication- Mobile communication- Cellular mobile communication (Basic ideas only).

Electronics: Fundamentals and applications- D. Chattopadhyaya, P. C. Rakshit, Newage- Revised 6th edition.

Monochrome and Colour Television, R.R. Gulati- New Age International (P) LTD, Publishers.

Semester-IV

Vocational Course: VII **Credit-4 (54 hours)**

AE4VOT07: LINEAR INTEGRATED CIRCUITS

Scope: This course is expected to provide knowledge of various Linear Integrated Electronic circuits and its application.

Prerequisites: Basic Electronics, Physics and Mathematics

Module I (18 hours)

Operational Amplifiers: 18 Hours.

Introduction – Operational Overview – Op-Amp supply voltages – IC Identification – Packages – Parameters. Op-amp as an Voltage Amplifier-Inverting Amplifier – Non inverting amplifier –inverting–Voltage follower(buffer) – Summing Amplifier – Differential Amplifier- Op. Amp frequency response – Frequency versus gain Characteristics

A Text book of Applied Electronics, R.S. Sedha – S. Chand (2005). Electronic Devices and Circuits, J.B.Gupta-S.K.Kataria & Sons

Linear Integrated Circuits, M.P.A.Jaleel-Maliyakkal Publishers, Calicut.

Module II (18 hours)

Op-amp Applications: 18Hours.

Comparators- Integrator – Differentiator – Audio amplifier – High Impedance, Voltmeter – Op-Amp based oscillator circuits: Wein Bridge Oscillator – Colpitts Oscillator, Crystal Oscillator, Triangular wave Oscillator, Voltage-Controlled Saw tooth Oscillator, Square Wave Relaxation Oscillator. Active Filters: Low-pass Filters, High Pass Filters, Band Pass Filters, Notch Filter

A Text book of Applied Electronics, R.S. Sedha – S. Chand (2005) Electronic Devices and Circuits, J.B.Gupta-S.K.Kataria & Sons

Op-Amps and Linear Integrated Circuits, Ramakant.A.Gayakwad-PHI(2004) Linear Integrated Circuits, M.P.A.Jaleel-Maliyakkal Publishers, Calicut.

Module III (18 hours)

IC Timer (555): 9Hours.

Monostable Multivibrator – Applications, Astable Multivibrator – Applications, Bistable Multivibrator – Applications, Schmitt trigger – Applications, VCO

Phase – Locked Loops (PLL): 9Hours.

Operating Principles – Phase Detector – Low –Pass Filter – VCO – monolithic PLL

References:

Op-Amps and Linear Integrated Circuits, Ramakant.A.Gayakwad-PHI (2004) Electronic Devices and Circuits, J.B.Gupta-S.K.Kataria & Sons

Linear Integrated Circuits, M.P.A.Jaleel-Maliyakkal Publishers, Calicut.

Semester-IV

Vocational Course: VIII **Credit-3 (54 hours)**

AE4VOT08:- APPLICATIONS OF MICROPROCESSORS

Scope: This course is expected to provide knowledge of architecture and applications of Microprocessors

Prerequisites: Basic Electronics, Physics and Mathematics

Module I

Applications of Intel 8085 (12Hours)

7 segment LED display – Temperature measurement and control- Stepper Motor – Traffic control – Generation of square wave or pulse using I/O Port.

Fundamentals of Microprocessors and Microcomputers – B Ram Pub: Dhanpat Rai Publications (P) Ltd. (6th Edn.)

Module II

Micro Controller 8051 (10Hours)

Microprocessors and Microcontrollers – Comparison –The Z 80 and the 8051 – A Microcontroller survey – Four bit, Eight bit, Sixteen bit, Thirty Two bit microcontrollers – Development system for microcontrollers.

1. *The 8051 Microcontroller, Architecture, Programming & Applications-Kenneth J Ayala –Second Edition*
2. The 8051 Microcontroller and Embedded system- Muhammed Ali

   Mazidi, Janice Gillispie Mazidi & Rolin D Mckinlay.

Module III

The 8051 Architecture (32Hours)

Introduction – 8051 Microcontroller hardware – The 8051 Oscillator and Clock – Program Counter and Data Pointer – A and B CPU Registers – Flags and the Program Status Word (PSW) – Internal Memory – Internal RAM – The Stack and the Stack Pointer – Special Function Registers – Internal ROM – Input/output Pins, Ports, and Circuits – Port 0 – Port 1– Port 2 – Port 3 - External Memory – Connecting External Memory – Counter and Timers –Timer Counter Interrupts – Timing – Timer Modes of Operation – Counting – Serial Data Input/output – Serial Data Interrupts – Data Transmission – Data Reception – Serial Data Transmission Modes – Interrupts – Timer Flag Interrupt – Serial Port Interrupt – External Interrupts – Reset – Interrupt Control – Interrupt Priority – Interrupt Destinations – Software– Generated Interrupts

1. The 8051 Microcontroller, Architecture, Programming & Applications-Kenneth J Ayala –

Second Edition

1. The 8051 Microcontroller and Embedded system- Muhammed Ali

   Mazidi, Janice Gillispie Mazidi & Rolin D Mckinlay.

VOCATIONAL COURSES (1): APPLIED ELECTRONICS-PRACTICAL

SEMESTER 1 & 2

Vocational Practical I: AE2VOP01 (Minimum 14 experiments)

1. Familiarization of passive components
2. Familiarization of active components
3. Familiarization of CRO
4. PCB layout and fabrication (Hartley, Colpitt's oscillators, RC coupled amplifier)
5. Zener Diode Characteristics
6. RC Integrator (Design – Set up – Its response to pulses or square waves)
7. RC Differentiator (Design-Set up-its response to pulses or square waves)
8. RC low pass filter (Study the frequency response)
9. RC high pass filter (Study the frequency response)
10. Photo diode–Characteristics
11. Soldering practice
12. Construction & study of regulated power supply using regulator IC's 78xx 79xx Line regulation(for a given full load) and load regulation
13. JFET characteristics (Static drain characteristics – Calculation of parameters)
14. UJT characteristics
15. SCR Characteristics
16. DIAC Characteristics
17. TRIAC Characteristics
18. UJT relaxation Oscillator
19. Common emitter amplifier design and construction. (a) Study the influence the biasing resistors on D.C operating point.(b)Variation of gain with collector resistor.
    (c) Measure the gain with and without the bypass capacitor
20. Common source JFET amplifier

References:

1. *Electronics Lab Manual, Vol 1 and 2, K.A. Navas – Rajath Publishers*
2. *Digital Electronics Theory and Experiments, Virendra Kumar-New Age International Publishers.*
3. *Electronics Laboratory Primer, Poorna Chandra and B. Sasikala – S.Chand*

SEMESTER 3 and 4

Vocational Practical II: AE4VOP02 (Minimum 14 experiments)

1. Op-amp – Square Wave Generator
2. Op-amp – First Order Low Pass Filter (Design, Construction, Study)
3. Op-amp – First Order High Pass Filter (Design, Construction, Study)
4. Op-amp – Pulse Width Modulation
5. Op-amp – Digital/Analog Converter
6. Op-amp – A /D Converter
7. Op-amp –Summing Amplifier
8. OP-Amp – inverter, non inverter, buffer for A.C input voltages
9. Decade Counter (BCD Counter) (IC 7490)
10. Bistable multivibrator using IC 555
11. µP – Conversion of 8 bit binary to BCD/BCD to binary
12. µP – Square of a number
13. µP – Square root of a number
14. µP – Multi byte decimal addition
15. µP – Largest among the set of numbers
16. µP – Smallest among the set of numbers
17. µP – Hex number to ASCII Hex Code conversion
18. µP – ASCII Hex Code to Hex number conversion
19. µP – Binary to BCD conversion
20. µP – BCD to Binary conversion

References:

1. *Electronics Lab Manual, Vol 1 and 2, K.A. Navas – Rajath Publishers*
2. *Digital Electonics Theory and Experiments, Virendra Kumar-New Age International Publishers.*
3. *Electronics Laboratory Primer, Poorna Chandra and B. Sasikala – S. Chand*

Vocational Practical III: AE4VOP03 (Minimum 14 experiments)

1. Amplitude Modulator (Set up – Study using CRO)
2. Demodulator (Set up – Study using CRO)
3. IF Tuned amplifier (Frequency response)
4. Mixer Circuit for 455Hz (Design and set up)
5. Frequency modulation using IC 555
6. Pulse width modulation using IC 555
7. Construction of VCO using PLL (IC 565)
8. FM using PLL (IC 565)
9. LED- Characteristics
10. LDR- Characteristics
11. Photo Diode-Characteristics
12. Opto Coupler- Characteristics
13. µP – Move a block of data from one section of memory to another
14. µP – Square from look up table
15. µP – 16 bit multiplication
16. µP – Sorting (ascending order)
17. µP – Sorting (descending order)
18. µP – Factorial of a number
19. µP – Counting the number of occurrence
20. µP – Decimal counter to count 00to99
21. µP – Generation of pulse waveform
22. µP – Stepper motor interface

Reference:

Electronics Lab Manual, Vol 1 and 2, K.A. Navas – Rajath Publishers

Fundamentals of Microprocessors and Microcomputers – B Ram Pub: Dhanpat Rai Publications (P) Ltd.(6th Edn.)

13.VOCATIONAL COURSES - MODEL II - COMPUTER APPLICATIONS

Vocational Paper I: CA1VOT01 - COMPUTER FUNDAMENTALS

Credits – 2 **No. of contact Hours. –36**

Scope: This course provides the basic knowledge about computers.

Prerequisites: Basic Mathematics, Fundamentals of Electronics.

Module I – (10 Hours.)

Fundamentals of Computers:
Evolution of Computers: Abacus, Napier's Logs and Bones, Mechanical Calculators, Babbage's Engines, Hollerith's Machine, Generation of Computers, Purpose of using computers. Data & Information, Characteristics of a Computer, Capabilities & Limitations of Computers. Type of Computers: Analog-Digital-Hybrid. Classification based on memory size: Micro, Mini and Mainframes, Supercomputers.

Module II – (6 Hours.)

Basic Computer Organization and Number System
Basic Organization & Working of a Computer: Arithmetic Logic unit-Control unit-Central Processing unit.
Number system arithmetic – octal addition, octal Subtraction, hexadecimal addition, hexadecimal subtraction
Computer Codes (BCD, EBCDIC, ASCII), BCD Addition

Module III - (10 Hours.)

Components of a Computer
Input unit: Different types of Keyboards, Mouse and its working, Joystick, Trackball, Scanner: Flat bed, Sheet-fed and Hand-held scanners, Graphic Tablets, Light Pen
Output unit: Working of monochromatic and color CRT, LCD Panel, Plotters, Audio output devices, Printers – Working of Dot Matrix, Laser, Inkjet, Color Thermal printer
Motherboard, Expansion Buses, BIOS
Storage unit: Primary Memory-RAM, ROM, PROM, EPROM and EEPROM, Cache Memory Secondary Memory-Magnetic storage devices, Optical storage devices, Semiconductor memory.

Module IV – (10 Hours.)

Software Components and Computer Languages:

What is software, Relation between Hardware and Software?

Types of Software:

System software: Operating System, Language Translators- Assembler, Compiler & Interpreter

Application software: General Purpose Application Software, Customized Application software.

Utility Software: Antivirus, Disk Defragmenter, Backup Software, Compression Software

Classification of software based on license: Proprietary, Shareware, Freeware, Open source, Free Software

Computer Languages-Machine Language, Assembly Language, High-Level Language, Define program, purpose of program, flowcharts, flowchart symbols, flowcharting rules, advantages and limitations of flowcharts

Book of Study

1. *Computer Fundamentals sixth edition by P.K Sinha,BPB Publications*
2. *Fundamentals of Computers, V Rajaraman, Prentice-Hall of India, New Delhi.*

Reference Books

1. Introduction to Computer Science 2nd Edition, Rohit Khorana, Pearson Publishers

2. An introduction to Digital Computer design by V. Rajaraman and T. Radhakrishnan

3. Computer fundamentals by B. Ram

4. A First Course in Computers 2003, Saxena, VIKAS

Vocational Paper II: CA1VOT02 - COMPUTER NETWORKS & INTERNET TECHNOLOGIES

Credits – 2 **No. of contact Hours. –36**

Scope: This course is expected to provide knowledge of various networking technologies and its applications.

Prerequisites: Basic mathematics, Fundamentals of Computers.

Module I: (8 Hours.)

Computer Networks: Introduction to computer network, data communication, Components of data communication, data transmission mode, Network topologies, LAN, MAN, WAN, Client Server Model- Peer-to-Peer, Uses of networks

Module II: (10 Hours.)

Transmission Media: Introduction, Guided Media: Twisted pair, Coaxial cable,Optical fiber. Unguided media: Microwave, Radio frequency propagation. LAN Topologies: Ring, bus, star, mesh and tree topologies.Network Devices: NIC, repeaters, hub, bridge, switch, gateway and router, Multiplexing – FDM, TDM, WDM

Module III: (11 Hours.)

Network Models: The OSI Model- Layers -Physical Layer, Data Link Layer, Network Layer, Transport Layer, Session Layer, Presentation Layer, Application Layer. TCP/IP Protocol suite-Physical and Data Link Layer, Network Layer, Transport Layer, Application Layer.

Module IV: (7 Hours.)

INTERNET- Basics of internet, features of internet, E-mail, Email Architecture, SMTP, POP,IMAP, WWW Architecture, URL, File transfer, The TELNET, Gopher, Web server, Web Browser.

Book of study

1. *Andrew S. Tanenbaum, David J. Wetherall Computer Networks (5th Edition),PHI, 2010*
2. *Forouzan, Data Communication and Networking, TMH,2003.*

Reference Books:

1. *Computer Networking: A Top-Down Approach 5th Edition, by James F Kurose*
2. *Computer Networks- A system approach, by Peterson*

Semester II

Vocational Paper III: CA2VOT03 - WORD AND DATA PROCESSING PACKAGES

Credits – 2 **No. of contact Hours. –36**

Scope: This course provides the detailed knowledge of Word and data processing software's

Prerequisites: Basic Computer Knowledge.

Module I

MS Word: (12 Hours.)

Word Processing Package: MS-Word: Introduction; Features- Word User Interface Elements; Creating new Documents; Basic editing, Saving a Document; Printing a

Document; Print Preview, Page orientation – Viewing Documents; Setting tabs- Page Margins; Indents; Ruler, Formatting Techniques; Font Formatting, Paragraph Formatting; Page Setup; Headers & Footers; Bullets & Numbered List; Borders & shadings; Find & Replace; Page Break & Page Numbers; Mail Merging ; Spelling & Grammar Checking; Thesaurus; Automating Documents; Macros; Tables- Side by Side & Nested Tables; Formatting Tables; Word Art, E-mail editor

Module II

PageMaker (12 Hours.)

Desktop Publishing: PageMaker: Introduction to Desktop Publishing as a Process- Advantages of PageMaker- PageMaker User Interface Elements; Creating new Documents - PageMaker Tools & Palettes-Master Pages- Page Setup, Page Orientation, Inserting Pages, Removing Pages; Headers & Footers, Page Number - Working with objects- Type Styling Options- Working with text-Formatting Options: Leading, Margins & indents- Scaling Text- Changing Line Specifications, Changing Fill Specifications, Fill & Stroke-Paragraph Formatting Options- Working with Grids- Creating Frames-Adding Graphics to a Frame- Layers- Creating a new layer, moving an object to another layer, hiding layers, locking layers, deleting layers

Module III

MS Excel: (12 Hours.)

Spreadsheet package: MS-Excel Introduction, Excel User interface, working with cell and cell addresses, Selecting a range, Moving, Cutting, Copying & Paste, inserting &deleting cells, freezing cells, adding deleting & copying worksheet within a workbook, Renaming a worksheet. Cell formatting options-Formatting Fonts, Aligning, Wrapping and Rotating Text, Using Borders, Boxes and Colors, Centering a heading, Changing row/column and height/width, Formatting a work sheet automatically, Insert Comments, Clear contents in a cell, using Print preview, Preparing worksheet for the printer, Selecting Print area, Margin and Orientation, Centering a worksheet, Using header & Footer, inserting page breaks, creating list, sorting data, Logical

&Mathematical functions in excel, Linking data between work sheets, pie chart, converting a pie chart on a webpage, Use of Pivot Tables

References

1. *An Introduction to Business Data Processing, Sardino, Prentice Hall.Microsoft Office 97, Ned Snell, PustakMahal, New Delhi.*
2. *Windows and MS Office 2000 with Database Concepts, N Krishnan, Scitech Publications Pvt. Ltd, Chennai.*
3. *Adobe PageMaker 7.0 (Illustrated Series: Complete) by Kevin Proot.*
4. *Discovering Computers and Microsoft Office 2010: A Fundamental Combined Approach (Shelly Cashman Series) by Gary B Shelly and Misty Vermaat*
5. *PageMaker(r) 7: The Complete Reference(Paperback) Carolyn Connally*
6. *PageMaker for Macintosh and windows David D Busch BPB Publications*.

Vocational Paper IV: CA2VOT04 - PROGRAMMING IN ANSI C

Credits – 2 **No. of contact Hours. –36**

Scope: To gain the skills of Programming and to learn the programming concepts in C Language.

Prerequisites: Basic mathematics, basic computer knowledge.

Module-I: (8 Hours.)

Basic concepts of programming.Language classification.Steps in developing a program, Algorithm and flowchart.C language basics: C character set, tokens, Identifiers and keywords, Data types, constants, variables, declarations, qualifiers-long, short and unsigned declarations, expressions, symbolic constants, Input and output operators/functions , compound statements, arithmetic operators, unary operators, relational and logical operators, assignment operators, increment and decrement operators, conditional operators.

Module -II: (10 Hours.)

Decision making and Branching: If statement, if else statement, nested if...else statement, Else if ladder, switch statements, looping - for loop, while loop, do..while statements, nested loop structure, break, continue and go to statements, scope of variables.

Module -III: (8 Hours.)

Arrays one dimensional and two dimensional arrays, initializing, reading, writing, strings, string functions, Library functions: Math.h, Conio.h and Stdio.h.

Module -IV: (10 Hours.)

User defined functions - Elements of functions, different arguments, Return values and their types, Function declaration, Function calls, different types /category of functions. Recursive functions, Call by value and reference methods.

Book of study:

1. Programming in ANSI C – E Balaguruswamy - Mc GrawHill Education

References:

1. *Mastering C – K R Venugopal& S R Prasad – Mc GrawHill Education*
2. *Programming in C – Ashutosh Pandey – Cyber Tech Publications*
3. *Let Us C – YashavantKanetker – BPB Publications*

Semester III

Vocational Paper V: CA3VOT05 - CONCEPTS OF OBJECT ORIENTED PROGRAMMING

Credits – 4 **No. of contact Hours. – 54**

Scope: This course is expected to provide sound knowledge in object oriented programming.

Module I: (9 Hours.)

Basic concepts of Object Oriented Language

Basic concept of object oriented programming- benefits of OOPs- A simple C++ programme, structure of C++ program. Basic data types and declarations, symbolic constants- Reference by variables, operators in C++, Special Assignment Expressions, operator precedence and associatively, control structures- function in C++ - the main

function, function prototyping- call by reference- return by reference- inline function Default argument,- function overloading – friend and virtual function.

Module II: **(12 Hours.)**

Classes and Objects

Specifying a class- Defining member functions- nesting of member functions – private member functions – arrays within a class – Memory allocation for object- static data members – static member functions – arrays of objects – friendly functions.

Module III: (10 Hours.)

Constructors and Destructors

Constructors- parameterized constructors-multiple constructors- copy constructor- dynamic constructor, Destructors.

Module IV:

Inheritance and operator overloading (12 Hours.)

Operator overloading- Defining operator overloading-Overloading unary and binary operators-Inheritance- Defining derived classes- single, multiple, multilevel, hierarchical and hybrid inheritance - virtual base classes.

Pointers, Virtual Functions and Polymorphism (11 Hours.)

Pointers- Declaring and initializing pointers, Manipulation of pointers, Arrays of pointers, Dynamic memory allocation, Pointers and strings, Pointers to functions, Virtual functions, pure virtual function

Book of Study:

1. *E. Balagurusamy , Object Oriented Programming with C++, Fifth edition, McGraw Hill publications*
2. *Object-Oriented Programming in Turbo C++, Robert Lafore, Galgotia.*

Reference:

1. *Mahesh Bhave and Sunil Pateker Object Oriented Programming with C++, Second edition, Pearson*
2. *Ashok N Kamthane and Amit Ashok Kamthane, Programming in C++, Second Edition, Pearson*.

Vocational Paper VI: CA3VOT06 - OPERATING SYSTEM

Credits – 3 **No. of contact hours – 54**

Scope: This course provides a basic knowledge about the role of Operating System in the functioning of computers

Prerequisites: Basic knowledge of computer fundamentals and computer networks

Module I (10 Hours.)

Introduction to operating system:

Operating System: Objectives and functions; Different views of an operating system; Types of operating systems-batch OS, mainframe OS, time sharing OS, multiprocessor OS, personal computer OS, handheld computer OS, embedded OS, real-time OS, Operating system services

Module II (8 Hours.)

Processes management:

Process concept- The process, Process states, Process Control Block; Process Scheduling- Scheduling Queues, Schedulers;

Module III (18Hours.)

CPU Scheduling:

Scheduling concepts- Process behavior, When to schedule, Dispatcher; Scheduling Criteria; Scheduling algorithms-

CPU Scheduling Problems

First Come First Serve (FCFS)-Shortest Job First (SJF) - Priority Non Preemptive (P-NP)-Shortest Remaining Time First (SRTF)-Priority Preemptive - Round Robin (RR)

Module IV (18 Hours.)

Memory Management Basics:

Basic ideas-Memory Management requirements, Address binding, Dynamic address space binding, Fixed partition memory strategies, Variable partition memory strategies,

Dynamic Storage allocation problems: First Fit, Best Fit, Worst Fit, Next Fit, Fragmentation, Swapping, Virtual memory, Page Replacement problems- FIFO, LRU and Optimal replacement

Deadlock:

Introduction, deadlock characterization-deadlock conditions, resource allocation graph; deadlock prevention.

File systems: Files- Basic concept- file attributes, file operations, file types, file structures, file access

Book of Study:

1. *RohitKhurana, Operating System, 2nd edition,Vikas Publishing house pvt ltd.*
2. *EktaWalia, Operating Systems Concepts, Khanna Book Publishing.*

References:

1. *Silberschatz, galvin, gagne, Operating System Concepts, 6th edition.*
2. *Gary Nutt, NabenduChaki, SarmishthaNeogy, Operating Systems, 3rd edition, Pearson.*

Semester IV

Vocational Paper VII: CA4VOT07 - VISUAL BASIC PROGRAMMING

Credits – 4 **No. of contact hours – 54**

Scope: This course is designed to provide basic ideas of VB programming

Prerequisites: Basic knowledge of computer fundamentals and computer programming.

Module I

Introduction (12 hours)

VB Introduction-VB Developing Environment – VB Menu Bar –Toolbars –Project Explorer- Tool Box-Form Designer-Form Layout.

Visual Basic Program Elements: Variables, Data Types, Scope and Lifetime of Variables, Declaring and using Constants; Operators – Arithmetic Operators, Relational or Comparison Operators, Logical operators; User Defined Data Type, Arrays, Multi-dimensional Arrays, Dynamic Arrays, Comments in VB.

Control Flow Statements- if ....then, if...then...else, select case; Loop Statements- do loop, for next, for each next; Input Box and Message Box functions

Using intrinsic controls (10 hours)

Pointer – Label – Frame – Check box – Combo box – Scroll Bar – Timer – Dir list box – Shapes – Image – OLE – Picture box – Text box – Command button – Option button – List box – Drive List Box-Directory List Box-File List Box-Shape Control & Line Control-Horizontal Scroll bar – Vertical Scroll Bar-Adding check box controls – Adding combo box– Standard MDI form features – Building the MDI form.

Module II

Methods, Properties, and Events (14 hours)

Learn about properties and how to manage them – Discover how to call methods –Learn how Visual Basic enables program to respond to events, System Events and User Events.

Debugging Window- Immediate Window, Locals Window, Watch Window, Quick Watch Window, Call Stack Window, creating a toolbar in VB

Module III

Functions and File Handling (8 hours)

Control Arrays, Procedures, Event Procedure, General Procedures-Sub Procedures, Functions; Arguments to functions or sub procedures, Passing arguments by reference and value, Optional arguments , Using named Arguments, Exiting Procedures, Event-Driven Programming, String Functions

Module IV (10 Hours.)

File Handling

File Handling-File, Field, Records, Sequential Access Files, Opening and closing of Sequential Access Files, Editing (Reading & Writing) Files opened for Sequential Access, Random Access Files, Opening and closing of Random Access Files, Editing (Reading & Writing) Files opened for Random Access, Deleting records in Random Access- Binary

Access Files, Opening and closing of Binary Access Files, Editing (Reading & Writing) Files opened for Binary Access, Deleting records in Binary Access

Reference Books:

1. *Visual Basic 6 - Clayton Walnum, Prentice- Hall of India, New Delhi.*
2. *Microsoft Visual Basic 6.0 Professional: Step by Step by by Halvorson*
3. *Visual Basic 6.0, N Krishnan and N Saravanan, Scitech Publications, Pvt Ltd, Chennai.*
4. *Programming With Visual Basic 6.0 by M. Azam*

Vocational Paper VIII: CA4VOT08 - WEB DEVELOPMENT AND PHP PROGRAMMING

Credits – 3 **No. of contact hours – 54**

Scope: This course is designed to provide basic ideas of HTML, JavaScript and MYSQL

Prerequisites: Basic knowledge of computer fundamentals and computer programming.

Module I

HTML & CSS (18 hours)

Basics of HTML:- Html tags, HTML Editors, HTML Documents, Heading Tags, Paragraph Tags, Centering Contents, HTML Elements, frames element, marquee text,

HTML Attributes:- lang, href, size, align, valign, bgcolor, background, width, height, title

HTML styles, HTML symbols, HTML layout, HTML Text formatting elements, HTML comments, HTML Links, Anchor, HTML elements, HTML Tables, HTML List, HTML Block elements, HTML head, HTML forms, GET & POST Methods, Form Attributes, Organization of HTML Document, Creating a webpage using html, HTML editors (Microsoft Front page, dream weaver), Introduction to HTML Web server (IIS - Internet Information Server, PWS - Personal Web Server).

CSS:- Basics, Syntax, CSS Comments, CSS Selectors, External style sheet, Internal style sheet, Inline style, CSS Text

Module II

JavaScript (12 hours)

Basics, Static webpage, Dynamic webpage, Advantages & Limitations of JavaScript, JavaScript Development Tools, External JavaScript, JavaScript Output, JavaScript Data Types, Variables and its scope, JavaScript Reserved Words. JavaScript Operators, Conditional Statements-if statement, if...else statement, if...else if... statement, Switch statement, JavaScript Loops:- while loop, for loop, do-while loop, for-in loop, break & continue statements, various mouse and keyboard events

Module III

PHP& MYSQL (15 hours)

The Structure of PHP- Using Comments, Basic Syntax, Variables, Operators, Variable Assignment, Multiple-Line Commands, Constants, Predefined Constants, The Difference Between the echo and print Commands, Functions, Variable Scope. Conditional Statements-if statement, if...else statement, if...else if...else statement, Switch statement, PHP Loops:- while loop, for loop, do-while loop, for each loop, break statement, functions, arrays, super globals, PHP sessions and cookies, PHP file handling.

Module IV

Implementing MYSQL using PHP (9 Hours.)

Introduction, Database, opening a connection, closing a connection, Create Database, drop database, select database, MYSQL Data types, tables, Drop tables, insert, select tables, Where clause, update, delete records, Like clause, Order By, Joins, alter, dropping adding or repositioning a column,

References

1. *Learning Web Design 2nd Edition by Jennifer Niederst*
2. *DHTML and JavaScript by Gilorien*
3. *PHP and MySQL for Dynamic Web Sites: Visual QuickPro Guide by Larry Ullman*
4. *HTML & CSS: The Complete Reference, Fifth Edition by Thomas Powell*
5. *HTML and CSS: Design and Build Websites by Jon Duckett*
6. *PHP: The Complete Reference by Steven Holzner*
7. *Learning PHP, MySQL & JavaScript with j Query, CSS & HTML by Robin Nixon*

VOCATIONAL SUBJECT COMPUTER APPLICATIONS PRACTICAL SYLLABUS

SEMESTER I& II

Vocational Practical 1

CA2VOP01: INTRODUCTION TO COMPUTERS & ANSI C PROGRAMMING

1. Introduction to various hardware components of a computer.
2. Preparation and printing of a simple document using DOS TEXT Editor.
3. Development of a batch file to copy the contents of a text file into another text file.
4. Development of a batch file to create a directory named “Computer” and any two subdirectories inside “Computer
5. Development of a batch file to copy all files from a source drive to a target drive.
6. Development of a batch file to copy all the files, directories and all hidden files (if any) from one disk to another identical disk.
7. Development of a batch files to rename any existing directory by giving a new name with all possible error messages.
8. Composing and sending an E-Mail message.
9. Program to find the sum and average of n numbers.
10. Obtain roots of a quadratic equation in all possible cases.
11. Program that read a four digit number from keyboard and then prints it in reverse case.
12. Program to compute x to the power n using for loop.
13. Program to calculate the standard deviation of an array of values. The array elements are read from terminal. Use function to calculate standard deviation and mean.
14. Program to read the elements of the given two matrices of order n x n and to perform the matrix multiplication.
15. Program to print the first n Fibonacci numbers using function.
16. Program to find the sum of the following series using a function declaration. Sum = $x - x^3/3! + x^5/5! - x^7/7! + \ldots x^n/n!$. Where n and x are entered from the keyboard.
17. Program that uses a function to sort an array of integers.
18. Program to reverse a string without using string function

19. Program to find the length of the given string without using string function
20. Program to print prime numbers within a range.
21. Program to print the following pattern by using any loop. Range of star (*) must be entered from keyboard.

    *

    **

    ***

References

1. *Operating systems Gary Nutt 3rd Edn. Pearson.*
2. *Microsoft MS-DOS User's Guide & Reference.*
3. *Programming in ANSI C – E Balaguruswamy - Mc GrawHill Education*
4. *Visual Basic 6 - Clayton Walnum, Prentice- Hall of India, New Delhi.*

SEMESTER III & IV

Vocational Practical II

CA4VOT01 - DATA PROCESSING PACKAGES, OPERATING SYSTEM & VISUAL BASIC PROGRAMMING

(Minimum 14 experiments)

1. Implement the concept of First Come First Serve (FCFS) using C or C++
2. Implement the concept of Shortest Job First (SJF) using C or C++
3. Implement the concept of First Fit algorithm.
4. Create a worksheet which contain Employee no, Emp. name, Salary, department, Designation. Calculate the gross salary. Gross Salary = (Salary+HRA+DA) - PF. HRA = 50% of salary, DA = 30% of salary, PF = 10% of salary. Extract all employees who are managers. Extract all the employees whose salary is between 20000 and 40000. List the total salary and gross salary in each department.
5. Create the following work sheet. Marks of 4 subjects of 15 students and calculate the total mark, Average mark, Result and Grade. Sort the total marks in the descending order. All the numeric fields in the left alignment. Centralize the name of the Institute that you are studying.
6. Create a work sheet for preparing merit list for BSc admission in your college.
7. Create two documents using MS WORD exactly the way they are seen.

8. Create a document and type 30 lines in it. Spell-check the document and create five AutoCorrect entries on your own. Then create five Auto text entries. Print only the current page of the document.
9. Create a file, inviting your friends to a dinner. Use the Mail Merge facility so that you do not have to re-type the letter with their names and addresses.
10. Create two documents using PageMaker exactly the way they are seen.
11. Create two documents using PageMaker. Change its character width, indents, space around paragraphs; add special characters, figures, tables etc.
12. Design a text book cover page with title and pictures using page maker.
13. Create a VB project that will display pictures in a PictureBox and ImageBox controls, when the user click display button
14. Using a text box and a command button in the form, enter a number in the text box and on clicking on command button display whether the number a single, two or three-digit number in a message box.
15. Create a project to change the shape of a shape control at the interval of one second using Timer control.
16. Create an event procedure to convert a text from lowercase to uppercase.
17. Create a function procedure to calculate the sum of “n” Fibonacci numbers
18. Create a function procedure to find simple interest.
19. Create a program to accept a number and print it in the reverse order.
20. Create a program to accept a set of numbers and find the largest and smallest number.
21. Create a program to count the number of vowels in a string and replace with ‘*’ symbol.
22. Create a program to check whether a given string is palindrome or not.
23. Create a function procedure to find prime numbers within a range
24. Implement traffic system demonstration

References

1. *E. Balagurusamy , Object Oriented Programming with C++, Fifth edition, McGraw Hill publications.*
2. *Visual Basic 6 - Clayton Walnum, Prentice- Hall of India, New Delhi.*
3. *Operating systems Gary Nutt 3rd Edn. Pearson.*
4. *Discovering Computers and Microsoft Office 2010: A Fundamental Combined Approach (Shelly Cashman Series) by Gary B Shelly and Misty Vermaat*

Vocational Practical III

CA4VOP03: C++ PROGRAMMING & WEB DEVELOPMENT

(Minimum 14 experiments)

1. Write a function called reversit() that reverses a string (an array of char). Use a for loop that swaps the first and last characters, then the second and next –to-last characters, and so on .The string should be passed to reversit() as an argument. Write a program to exercise reversit().The program should get a string from the user, call reversit(), and print out the result.
2. A program to perform simple arithmetic operations of two complex numbers using operator overloading.
3. Create a class called employee that contains a name and an employee no: Create another class called scientist that inherits the properties of employee and it contains the function for entering the name of the award he gets and display it. Create objects for class scientist that contain their name, no and the award they get. Implement single inheritance.
4. Imagine a publishing company that markets both book and audio-cassette versions of its works. Create a class “publication” that stores a title (a string) and price (type float) of a publication. From this class derive two classes; “book”, which adds a page count (type int); and “tape”, which adds a playing time in minutes (type float). Each of these three classes should have a getdata() function to get its data from the user at the keyboard, and a putdata() function to display its data. Write a main() program to test the “book” and “tape” classes by creating instances of them, asking the user to fill in their data with getdata(), and then displaying the data with putdata().
5. Declare a class to represent bank account of 10 customers and the following data members: Name of the depositor, Account Number, Type of Account (S for saving and C for current Account), Balance Amount. The class also contains the following member functions. a). To initialize data members, b) To deposit money. c) For withdrawal of money after checking the minimum balance (minimum balance is Rs1000) d) To display the data members.
6. A program to concatenate using two strings into one string using a pointer method.

7. Write a program that read a group of numbers from the user and places them in an array of type float. Once the numbers are stored in the array, the program should average them and print the result. Use pointer notation wherever possible
8. Program to find Armstrong numbers within a range.
9. Write any program to implement the concept of friend function.
10. Write an HTML code for a webpage for your college with the following details and features
    - A heading followed by a paragraph of 5 sentences about your college using text formatting tags and attributes.
    - Provide yellow color to the background of the page.
    - Include an image of the college.
    - Include a marquee that "Admission for the new academic year commences on 1st June"
11. Write an HTML code to display an online application form for BSc admission. The application form must contains columns for name, address, parent's name, age, sex, caste, marks, photo etc.
12. Write an HTML code to create a list of 3 bikes of your choice in a frame. Link each one to display the description with a picture in another frame.
13. Create an HTML document with following formatting – Bold, Italics, Underline, Color, Headings, Title, Font and Font Width, Background, Paragraph, Line Brakes, Horizontal Line, Blinking Text as well as marquee Text.
14. Develop a website to display an email login page. The page must contain one text box for entering the username and one password box for entering the password. The username must contain at least 4 characters and the password must contain at least 6 characters. The first two characters in the password must be numbers. On clicking show login button, if the valid data are given in the boxes, a message "Correct Data" should be displayed. Otherwise "Wrong Data" message should be displayed.
15. Develop a webpage to implement a simple calculator. The page should have two textboxes to enter two numbers. It should also have 4 buttons to add, subtract,

multiply and divide the two numbers. The answer should be displayed in a third text box on clicking the button.

16. Design an HTML page that contains five text boxes, three textboxes for marks of three subjects, and remaining for total marks and average marks. Provide validations for this textbox in a separate JavaScript file and link it with the HTML file. The validations are (i) Textboxes should not be empty (ii) It should be a number (iii) It should be between 0 and 99.
17. A webpage contains a button. Write HTML code for the button which executes a function Message() on the occurrence of the following events. (a) When user clicks the mouse on the button. (b) When user moves the mouse over the button.
18. Write HTML codes to create two web pages to show some information about the science and the commerce department of your college. Create another webpage to divide the browser window horizontally into two. In the first frame, a brief introduction of the college and two links are to be provided- one for science and other for commerce. On clicking these links the respective webpage is to be opened in the second frame.
19. Create a form using HTML which has the following types of controls:
    I. Text Box
    II. Option/radio buttons
    III. Check boxes
    IV. Reset and Submit buttons

References

1. *E. Balagurusamy , Object Oriented Programming with C++, Fifth edition, McGraw Hill publications*
2. *Object-Oriented Programming in Turbo C++, Robert Lafore, Galgotia.*
3. *Learning Web Design 2nd Edition by Jennifer Niederst*
4. *HTML & CSS: The Complete Reference, Fifth Edition by Thomas Powell*

14.B. Sc. PHYSICS - MODEL III- ELECTRONIC EQUIPMENT MAINTENANCE

Semester-I

Core 2- Course:I **Credit-2 (36 hours)**

PH1CRT21 - PRINCIPLES OF ELECTRONICS

MODULE – I

Switches, Cables and Connectors (Qualitative study only)

SPDT, DPDT, Band switches, Touch switches, Thumb Wheel switches, Micro switches – specifications and application areas.

Batteries and Fuses

Dry cells, Lead acid accumulators, Nickel – Cadmium cells – Principles and specifications. Fast and Slow fuses

Semiconductors

Intrinsic and Extrinsic, P-type and N-type, PN junction Diode and its characteristics Zener diode, Photodiode, LED

LCR and Wave Shaping Circuits

Serial and Parallel response, Integrator and Differentiator using RC circuits, Clipper and Clamper circuits, Rectifiers – Half and Full wave Filter circuits – Capacitor input, L - section and π filter

MODULE – II

Transistors

PNP and NPN- Configurations, characteristics and constants, Phototransistors Transistor Amplifiers – Biasing and stabilization, frequency response, Voltage regulators – Series, Shunt and IC regulators

Oscillators

Feedback- Positive and Negative, LC and RC oscillators

MODULE – III

Power Amplifiers

Class A, Class B, Class AB, Class C transformer coupled

Push – pull amplifiers – Phase splitter circuit, complementary symmetry, thermal run away, heat sink, power ratings of transistors, thermal resistance.

References:

1. Electronic Devices and Circuits – Allen Mottershed
2. Principles of Electronics – V K Mehta
3. Applied Electronics - R S Sedha
4. Linear Integrated Circuits – Roy Choudhury
5. Principles of Electronics and Linear circuits – N.N. Bhargava, D. C. Kulshreshtha, S.C. Gupta, T.M.H. Publications.

Semester-I
Core 2-Course:II **Credit-2 (36 hours)**

PH1CRT22 - COMMUNICATION ENGINEERING (2 Credits)

MODULE – I

Modulation – Need of modulation, AM and FM modulation and demodulation principles, DSB, SSB, DSBSC and Vestigial sideband transmission systems

Super Heterodyne Radio Receiver

Principles, advantages, block diagram, RF tuner, IF amplifier, detector, audio amplifiers, loud speaker, power supply and voltage regulators, alignment of RF and IF sections, Waveforms and voltages at different check point.

MODULE – II

Sampling reconstruction Aliasing PAM, PDM, PPM, Time Division Multiplexing, Noise in Pulse Modulation, Base Band Digital Transmission, Digital Signals, Pulse Code Modulation, Generation and Reconstruction, Quantization noise, Companding Law, Band Pass Digital Transmission, Digital CW Modulation, ASK, FSK, PSK, DPSK.

MODULE – III

Monochrome Television System

Elements of television system – Picture and sound transmission and reception, Composite Video Signal, Scanning process adopted in TV system, Sync details, channel bandwidth, vestigial side band transmission.

Television Receiver

Receiving Antenna, RF tuner, VIF amplifiers, video amplifier, Video detector, SIF amplifier, FM detector, Sweep section, keyed AGC, Delayed AGC, AFC, sync separator, SMPS **References:**

1. *Modern Electronic Communicating Theory and System – AshokRaj*
2. *Video Demystified - Keith Jack, LLHT TechnologyPublishing*
3. *Electronic Communication - Dennis Roody andCoolen*
4. *Principles of Electronic Communication systems –Kennedy*
5. *Monochrome and colour television – R RGulati*

Semester-II

Core 2- Course:III **Credit-2 (36 hours)**

PH2CRT23 : POWER ELECTRONICS

MODULE I

Introduction – Concept of power electronics, Applications of power electronics, Advantages and disadvantages of power electronic converters, power electronic systems, power semiconductor devices, types of power electronic converters, power electronic modules.

MODULE II

Power transistors, Power MOSFETS, Insulated Gate Bipolar Transistor (IGBT), Power semiconductor Diodes – Characteristics of power diodes, types of power diodes,

MODULE III

Thyristors; Terminal characteristics of thyristors, thyristor turn on methods, thyristor Gate characteristics, Two – transistor model of a thyristor, thyristor ratings, other members of thyristor family, Gate turn off (G.T.O) Thyristor, MOS controlled Thyristor (MCT)

References:

1. *Modern Power Electronics – Dr. P.S. Bimbhara*
2. *Power Electronics Circuits Devices Application – M.H. Rashid*

Semester-II

Core 2- Course:IV **Credit-2 (36 hours)**

PH2CRT24 - ANALOGUE INTEGRATED CIRCUITS

MODULE I

Operational Amplifiers: Basic Differential Amplifier Analysis, Block Diagram Representation of Typical OP-Amp., OP-Amp. Parameters, Inverting and non-inverting

amplifier, Voltage follower.OP-Amp. Circuits, , Differential Amplifier, Instrumentational Amplifier, Integrator, Differentiator

MODULE II

Active Filters: Introduction:Simple circuits and Explanation of Lowpass, Highpass, Bandpass, band reject and Allpass filters.

Waveform Generators: Sine wave generators, triangular wave generators.

MODULE III

555 timer – Astable, Monostable, VCO, - Basic comparators, Characteristic, Typical comparator circuit using OP-Amp.

References:

1. *OP-Amp and Linear IC's – Gayakward*
2. *Integrated Circuits – Botkar*

Semester-III

Core 2- Course:V **Credit-3 (54 hours)**

PH3CRT25 – **MICROPROCESSORS AND ITS APPLICATIONS**

MODULE I

The 8085 Microprocessor

Block Diagram and functions, architecture of microprocessor, machine and assembly languages, Instruction cycle, timing diagram, Memory Organization, Mapping and Types, Types of Input Output (I/O), Addressing Memory Mapped I/O

MODULE II

Instruction set of 8085 µP

Arithmetic instructions, Logical instructions, data transfer instructions, branch instructions, call and return instructions, stack, I/O and machine control instructions, Addressing modes Straight line programmes, Mathematical programmes, branching programmes, looping programmes, programmes using subroutine and time delay.

MODULE III

Programming Concept of 8085 µP

Introduction to Programmable Peripheral Devices (8255A, 8251A, 8253A, 8279A) function of each chip.

Applications

Traffic control, Temperature control, Digital clock, stepper motor control, washing machine control

References:

1. *0000 to 8085 – Gosh and Sridhar*
2. *Fundamentals of microprocessors and microcomputers – B Ram*
3. *Microprocessor architecture, programming and applications with the 8085 – Gaonkar*
4. *Microprocessor and its applications – Nagurkani*

Semester-III
Core 2- Course:VI **Credit-3 (54 hours)**

PH3CRT26 - NETWORK THEORY

MODULE – I

Signals, Periodic Wave Forms, Types of Signals, Fourier representation of Signals, Laplace Transformation Properties, Inverse Transform. Voltage and Current – Sources – Dependent Sources, Kirchhoff's Law – Node and Mesh analysis, Superposition Theorem, Reciprocity theorem.

MODULE – II

Thevenin's, Norton, Power Transfer Theorems, Transient and Steady State Analysis **–** Transient analysis of RC and RL circuits, Time Constant, Sinusoidal Study State Analysis, Resistance, Impedance, Admittance, Millor Theorem, Analysis of RC and LC circuit.

MODULE – III

Two port networks, Short circuited admittance parameters, Open circuited impedance parameters, hybrid parameters, Transmission parameters, Relationship between parameter sets, Attenuator, Lattice type, Insertion loss, Network function – Poles and Zeros, Time domain behavior from Pole Zero Plot.

References:

1. Networks and Systems - *D. RoyChoudhury*
2. Basic Circuit Theory -*Desor*
3. Network Analysis – *VanValkenberg*
4. Network Lines and Fields –*Ryder*
5. Principles of Network Synthesis – *VanVakenberg*

Semester-IV
Core 2- Course:VII **Credit-3 (54 hours)**

PH4CRT27 - TROUBLE SHOOTING OF AUDIO EQUIPMENTS

MODULE – I

Characteristic of Sound

Nature of sound, pressure and intensity of sound waves, sensitivity of human ear for sound, frequency, overtone, harmonics, resonance of sound waves. Reflection and diffraction of sound waves.

Audio Devices and Their Applications

Microphones – Different types, Loud Speakers – Characteristics, Different types, Basic knowledge about speaker, enclosures, cross over network, multi way speaker system, woofer and tweeter, consequence of mismatch between amplifier output and loudspeaker impedance, Audio Amplifiers and Hifi systems, equalizers and tone controlled circuits.

MODULE – II

Digital Audio Fundamentals – Principle of ADC and DAC, optical recording of digital audio on disc conversion technologies, EFM, error correction method, playback process of digital audio from CD, comparison of CD and conventional (Gramophone) disc, audio as data, compression and expansion of digital audio, channel coding, disc based recording, digital audio broadcasting and networks, introduction Home Theatre systems such as 2.1, 4.1 and5.1.

MODULE – III

Introduction to audio cd players, block diagram, transport mechanism, MP3 player, block diagram assembling of MP3 player, different types of cables in audio industry, introduction to remote controllers, troubleshooting of audio, cd , DVD player, MP3 player power supply modules used in ACD/MP3/amplifiers. Troubleshooting of remote controllers, amplifiers and Home Theatresystems.

References

1. *Modern Television Parctice with 4th Edition – RRGulathi*
2. *Audio and Video systems 2nd edition –R.G.Gupta*
3. *Video de-mystified – KeithJack*
4. *Audio Engineering know it all series – NewnesPress*
5. *Essential guide to digital video – John Watkinson Snell and Wilcox IncPublications.*
6. *Guide to compression - Wilcox IncPublications.*
7. *Audio Video Systems Principles practices and Troubleshooting – Bali and Bali, Khanna publishingcompany*

Semester-IV

Core 2- Course:VIII **Credit-3 (54 hours)**

PH4CRT28 - TROUBLE SHOOTING OF VIDEO EQUIPMENTS

MODULE – I

Digital Video Compression Techniques and Standards, Digital Video, The RGB and YVB representation of video signals, need for compression, how compression works, compression format for video, MPEG – XH.26 format, DVD players and standards.

MODULE – II

DVD/ VCD player block diagram, transport mechanism, power supply and assembling of VCD/DVD player with kit. Troubleshooting of DVD players, Introduction to Digital TV transmission and Reception, Signal Quantizing encoding techniques

MODULE – III

Introduction to DTH, Video on demand, CCTV, LCD/LED TV, LCD technology, LCD matrix type operation, Introduction to plasma TV, Comparison between LCD and Plasma TV, Introduction to LED TV. Difference between LED backlit and backlit LCDdisplays.

References:

1. *Modern Television Parctice with 4th Edition – RRGulathi*
2. *Audio and Video systems 2nd edition –R.G.Gupta*
3. *Video de-mystified – KeithJack*
4. *Audio Engineering know it all series – NewnesPress*
5. *Essential guide to digital video – John Watkinson Snell and Wilcox Inc Publications.*
6. *Guide to compression - Wilcox IncPublications.*
7. *Audio Video Systems Principles practices and Troubleshooting – Bali and Bali, Khanna publishingcompany.*

ELECTRONIC EQUIPMENT MAINTENANCE – SYLLABUS FOR PRACTICALS

SEMESTER 1 & 2

Core 2 Practical1: PH2CRP21 (Credit2)

(Minimum 14 Experiments)

1. Diode characteristics – PN junction diode & Zenerdiode.
2. Integrator and differentiator using RCcircuit.
3. Clipper and clampercircuits.
4. Single stage & two stage RC coupled amplifier – comparison of gain andbandwidth
5. Oscillators – RC phase shift, Wein bridge, Hartley &Colpitts
6. Multivibrators – Astable &Monostable
7. Rectifiers – half wave & full wave (ripple factors with and withoutfilters)
8. Transistor characteristics – CB &CE
9. Poweramplifier
10. JFETCharacteristics
11. UJTCharacteristics
12. MOSFETcharacteristics
13. SCRcharacteristics
14. Triaccharacteristics
15. AM generation anddetection
16. Frequency modulation and demodulation using 565PLL
17. AGC generation usingIC
18. IF tunedamplifier

SEMESTER 3&4
Core 2 Practical2: PH4CRP22 (Credit2)
(Minimum 14 Experiments)

Semester 3

1. Block transfer of data bytes
2. Largest among a set of numbers
3. Smallest among a set of numbers
4. Addition with carry
5. BCD addition and subtraction
6. Binary multiplication
7. Counting the number of occurrence
8. Sorting in ascending / descending order
9. Decimal counter to count 00 to99

Semester 4

1. Operational amplifier and its characteristics
2. OP-Amp Inverter, Non -Inverter
3. OP-Amp Buffer or Voltage Follower
4. OP-Amp Adder & Subtractor
5. Integrator &Differentiator
6. Astable Multi Vibrator –555
7. Monostable Multi Vibrator –555
8. Schmitt Trigger
9. Voltage Controlled Oscillator (VCO) using555
10. High pass Filter & Low pass Filter

SEMESTER 3 &4

Core 2 Practical3: PH4CRP23 (Credit2)

(Minimum 14 Experiments)

Semester 3

1. Study of Multimeter (Analog and Digital)
2. Study and familiarization of passive components
   - General purpose resistor
   - Precision resistor
   - Wire wound resistor
   - Ceramic encased resistors
   - Capacitors (non electrolyte, electrolyte, colour coded)
   - Inductors (general purpose, colou rcoded)
   - Surface Mount Devices(SMD)
3. Study of electrical components
   - Transformers (low power and power)
   - Basics of house wiring
   - Electrical relays
   - Mechanical switches
   - Familiarization of electrical home appliances
4. Study of semiconductor devices - Diodes, Transistors, FETs
5. Practicing different types of soldering works
6. Familiarization of tools in lab and workshops
7. How to draw schematic diagrams
8. Assembling practice on various media
   - On breadboard
   - On PC type breadboard
   - On Printed circuit board
9. Fabrication of PCB
10. Power supply – assembling and faultfinding
    - Unregulated
    - Regulated(Shunt)

- Series regulated(transistorized)
- Series regulator (IC version)

11. Assembling of regulated variable power pack
12. Assembling and fault finding of SMPS

Semester 4

1 Assembling and fault finding of tape recorders
2 Assembling and fault finding of power amplifiers
3 Assembling and fault finding of home theatre system
4 Fault finding of TV power supply(SMPS)
5 Assembling and fault finding of VCD
6 Assembling and fault finding of DVD
7 Assembling and fault finding of LCDTV
8 Assembling and fault finding of MP3player
9 Fault finding of IR remote controller in VCD, DVD or Home Theaters
10 Fault finding of SMPS in VCD, DVD, Home Theatres

15. COMPUTER APPLICATION – COMPLIMENTARY COURSES FOR Model III

COMPLIMENTARY COURSES FOR B. SC. PHYSICS EEM

(Complimentary Computer Application Offered by BOS of Computer Science-complementary for Mathematics and Statistics)

DEPARTMENT OF PHYSICS, THE COCHIN COLLEGE – TIME TABLE - 2021 -22 DEC-MARCH

DAY	1	2	3		4	5
1	I BSc(C) JM I Bsc(P)(El./Phy. Lab (PB, X) III BSc AN I MSc VP II MSc Lab SNK	I BSc(P)(El./Phy. Lab (PB, X) III BSc US I MSc JM II Msc Lab SNK	III BSc MVM I MSc AN II Msc VP		II BSc(P)Phy/Ele.lab (PB, MVM) III BSc VP I MSc Lab US II MSc AN	II BSc(P)Phy./Ele.lab (PB, MVM) III BSc SNK I MSc Lab US II MSc JM
2	III BSc MVM I MSc Lab X II MSc AN	II BSc (C)(AN) II BSc(P)Elec/Phy.Lab (PB,SNK) III BSc MVM I MSc Lab X II MSc VP	I BSc (P) VP II BSc(P)Elec./Phy.Lab (PB,SNK) III BSc JM I MSc MVM II MSc US		III BSc(P) lab. (JM, AN) I MSc US II MSc LAB MVM	III BSc(P) lab (JM, AN) I MSc SNK II MSc LAB MVM
3	II BSc (P) SNK III BSc(P) lab (JM, US) I MSc LAB X II MSc VP	II BSc(Ele.) PB II BSc(C) (VP) III BSc(P) lab (JM, US) I MSc LAB X II MSc AN	III BSc SNK I MSc MVM II MSc AN		I BSc(P)Phy/Ele.lab (PB,VP) III BSc SNK I MSc US II MSc LAB MVM	I BSc(P)Phy/Ele.lab (PB, VP) III BSc US I MSc JM II MSc LAB SNK
4	I BSc (P) (Ele) PB I BSc (C)X II BSc (P) MVM II BSc(C)Phy.lab (AN,VP) III BSc JM I MSc LAB US II MSc SNK	II BSc(Ele) PB II BSc(C)Phy.lab (AN,VP) III BSc MVM I MSc LAB X II Msc US	III BSc SNK I MSc JM II MSc MVM		III BSc(P) lab (JM, US I MSc SNK II MSc LAB VP	III BSc(P) lab(JM, AN) I MSc MVM II MSc LAB VP
5	I BSc(C)Practicals (US,X) I BSc (P) (El)(PB) III BSc VP I MSc JM II MSc AN	I BSc(C)Practicals (US,X) III BSc JM I MSc SNK II MSc LAB VP	II BSc(P) SNK III BSc AN I MSc MVM II MSc LAB VP		I BSc (P) X II BSc (P) (El) PB II BSc (C) VP III BSc(P) lab (JM, AN) I MSc LAB US II MSc SNK	III BSc(P) lab (JM, AN) I MSc LAB US II MSc MVM

DEPARTMENT OF PHYSICS INDIVIDUAL TIME TABLE 2021 AUGUST-NOVEMBER

	1	2	3	4	5		1	2	3	4	5
	DR. ANNIETA PHILIP K. (HOD) (16)						DR. MANJUSHA M.V. (16)				
MON	III BSc		II Msc	II Msc	I MSc			III BSc		II BSc Phy lab	II BSc Phy lab
TUE	II MSc	II BSc (C)		III BSc(P) lab	III BSc(P) lab			III BSc	I MSc	II MSc LAB	II MSc LAB
WED		II MSc	II MSc				II MSc		I MSc	II MSc LAB	
THU	II BSc(C) lab	II BSc(C) lab			III BSc(P) lab		II BSc	III BSc	II MSc		I MSc
FRI	I MSc		III BSc	III BSc(P) lab	III BSc(P) lab			III BSc	I MSc		
	VIJEESH P (16)						DR.UMA S. (17)				
MON	I BSc Lab	I BSc Lab	I MSc	III BSc			I Msc Lab	I Msc Lab	II MSc		
TUE		II MSc	I BSc (P)		I MSc		III BSc		II MSc	I MSc	
WED		II BSc(C)					III BSc(P) lab	III BSc (P) lab		I MSc	III BSc
THU	II BSc(C) lab	II BSc(C) lab		II MSc LAB	II MSc LAB		I MSc lAB	II MSc		III BSc (P) lab	
FRI	III BSc	II MSc LAB	II MSc LAB	II BSc (C)			I BSc (C) LAB	I BSc (C) LAB		I MSc LAB	I MSc LAB
	DR.JOSE MATHEW (17)						DR.SATHYA NARAYANAN (16)				
MON	I BSc(C)			I MSc	III BSc		II MSc LAB	II MSc LAB	III BSc (O)		II MSc
TUE			III BSc (O)	III BSc(P) lab	III BSc(P) lab			II BSc Phy Lab	II BSc Phy Lab		
WED	III BSc(P) lab	III BSc(P) lab			I MSc		II BSc (P)		III BSc (O)	III BSc	II MSc LAB
THU	III BSc		I MSc	III BSc(P) lab	III BSc(P) lab		II MSc		III BSc (O)	I MSc	
FRI	II MSc	I MSc		III BSc(P) lab	III BSc(P) lab				II BSc(P)	II MSc	II MSc
	GUEST FACULTY (11)										
MON											
TUE	I Msc Lab	I Msc Lab									
WED	I Msc Lab	I Msc Lab		I BSc Lab	I BSc Lab						
THU	I BSc(C)	I MSc lAB									
FRI	I BSc (C) LAB	I BSc (C) LAB		I BSc (P)							

Master of Science
Zoology

PROGRAM STRUCTURE AND SYLLABUS
2019-20 ADMISSIONS ONWARDS

(UNDER MAHATMA GANDHI UNIVERSITY PGCSS REGULATIONS 2019)

BOARD OF STUDIES IN ZOOLOGY (PG)
MAHATMA GANDHI UNIVERSITY

2019

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Acknowledgement

We, the Board of Studies (PG), Zoology, Mahatma Gandhi University, Kottayam are extremely happy to introduce the revised syllabus of Post Graduate Programme under Credit Semester System – 2019 (PG-CSS-2019).

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Chairman and Members
Board of Studies in Zoology (PG)

Table of Contents

Sl.No.	Particulars	Page Numbers
1.	M. Sc. Zoology Programme and its structure	5 -7
2.	First Semester courses	8-22
3.	Second Semester courses	23-36
4.	Third Semester courses	37-50
5.	Fourth Semester courses	51-95
6.	Model Question Papers	96-106

M.Sc. Zoology Degree Program

(Mahatma Gandhi University Regulations PGCSS2019 from 2019-20 Academic Year)

1. **Aim of the Program**

   To provide quality education in Zoology with different specializations and motivate the students for self-employment in applied branches of Zoology.

   To inculcate the spirit of natural resource conservation and conduct filed studies and different projects of interests in Zoology.

2. **Eligibility for Admissions**

   B Sc. Zoology with 50% marks

3. **Medium of Instruction and Assessment**

   English

4. **Faculty under which the Degree is Awarded**

   Science

5. **Specializations offered, if any**

   Fishery Science, Environmental Sciences, Entomology and Medical Microbiology.

6. Note on compliance with the UGC Minimum Standards for the conduct and award of Post Graduate Degrees

   Two years having four semesters

7. THE PROGRAM STRUCTURE

Course Code	Title of the Course	Type of the Course	Hours per week	Credits
	FIRST SEMESTER			
ZL010101	Animal Diversity: Phylogenetic and Taxonomic Approaches	Theory	**4**	**4**
ZL010102	Evolutionary Biology and Ethology	Theory	**4**	**4**
ZL010103	Biochemistry	Theory	**4**	**4**
ZL010104	Biostatistics and Research Methodology	Theory	**3**	**3**
ZL010105	PRACTICAL 1 Animal Diversity: Evolutionary, Ethological and Biochemical methods &Approaches	Practical	**10**	**4**
	SECOND SEMESTER			
ZL010201	Field Ecology	Theory	**4**	**4**
ZL010202	Developmental Biology	Theory	**4**	**4**
ZL010203	Genetics and Bioinformatics	Theory	**4**	**4**
ZL010204	Microbiology and Biotechnology	Theory	**3**	**3**
ZL010205	PRACTICAL 2 Diversity of Life: Ecological, Embryological, Hereditary and Microbial Methods and Approaches	Practical	**10**	**4**
	THIRD SEMESTER			
ZL010301	Animal Physiology	Theory	**4**	**4**
ZL010302	Cell and Molecular Biology	Theory	**4**	**4**
ZL010303	Biophysics, Instrumentation and Biological Techniques	Theory	**4**	**4**
ZL010304	Immunology	Theory	**3**	**3**
ZL010305	Practical 3 Molecular, Physiological and Immunological Methods and Approaches in Biosciences	Practical	**10**	**4**
	FOURTH SEMESTER			
ZL80-830401	Elective 1	Theory	**5**	**4**
ZL80-830402	Elective 2	Theory	**5**	**4**
ZL80-830403	Elective 3	Theory	**5**	**4**
ZL80-830404	Practical	Practical	**10**	**4**
ZL010401	Project			**5**
ZL010402	Viva			**2**

ELECTIVES	COURSE CODE	COURSE TITLE
A – FISHERY SCIENCE	ZL800401	Nutrition, Growth and Physiology of fishes
	ZL800402	Fishery Resource Management
	ZL800403	Fishery Science and Technology
	ZL800404	Practical : Fishery Science – Methods and Approaches
B – ENVIRONMENTAL SCIENCE	ZL810401	Environmental Science: Concepts and Approaches
	ZL810402	Environmental Pollution and Toxicology
	ZL810403	Environmental Management and Development
	ZL810404	Practical : Environmental Science
C -ENTOMOLOGY	ZL820401	Morphology and Taxonomy
	ZL820402	Anatomy and Physiology
	ZL820403	Applied Entomology
	ZL820405	Practical : Morphology, Aanatomy and Ttaxonomy, Insect Physiology and Applied Entomology
D- MEDICAL MICROBIOLOGY	ZL830401	General Microbiology and Parasitology
	ZL830402	Bacteriology, Virology and Mycology
	ZL830403	Clinical Microbiology
	ZL830404	Practical : Microbiology

FIRST SEMESTER COURSES

ZL010101	Name of the Course 1 Animal Diversity: Phylogenetic and Taxonomic Approaches
ZL010102	" 2 Evolutionary Biology and Ethology
ZL010103	" 3. Biochemistry
ZL010104	" 4 Biostatistics and Research Methodology
ZL010105	" 5 PRACTICAL 1 Animal Diversity: Evolutionary, Ethological and Biochemical methods & Approaches

ZL010101 ANIMAL DIVERSITY: PHYLOGENETIC AND TAXONOMIC APPROACHES

72 Hours (45+27) 4 hrs/week **Credit – 4**

Objectives:

- To understand the phylogenetic relationshipsamong the different groups of animals
- To provide the latest trend in animal taxonomy and phylogenetic systematics

PHYLOGENETIC APPROACHES 45hrs

Module 1 **(20hrs)**

Origin of Animals **(5hrs)**

Progenote, Prokaryotes and Eukaryotes. Extant and ancient stromatolites. Unicellularity to metazoans – consequences and complexity.

Multicellular organisms – Ediacaran fauna, Burgess Shale Fauna. Cambrian explosion, Cropping and Red Queen Principle. Different hypothesis of metazoan origin – Gastraea hypothesis, Planula hypothesis.

Invertebrate Phylogeny **(15hrs)**

Phylogeneticrelationships amongPorifera, Placozoa, Mesozoans; Cnidaria andCtenophora; Platyhelminthes and other acoelomates.

Phylogenetic relationships among the protostome lineage – Mollusca, Annelida and Arthropoda. Evolutionary advantages of Symmetry, Metamerism and Coelom. Reasons for the success of Arthropod.

Adaptive radiation in Mollusca, Annelida, Arthropod and Echinoderms. Position and phylogeny of Hemichordates.

Module II

Vertebrate Phylogeny **(10hrs)**

Affinity with invertebrates and protochordata.Paedomorphosis in vertebrate phylogeny. Jawless vertebrates – Ostracoderms and Cyclostomes. Properties and advantages of bone in vertebrate evolution. Evolution of jawed vertebrates – Acanthodian, Placoderm, Chondricthyes, Osteichthyes. Actinoptegygians and Sarcopterygians.

Module III **(15hrs)**

Phylogeny of Herpetofauna **(8 hrs)**

Amphibian phylogeny– Osteolepiforms, stem tetrapods and early amphibians. Lissamphibians – distribution, diversity, status and threats.

Reptilian phylogeny – amniotic egg, distinguishing features between amniotes from extant amphibians. Adaptive radiation in reptiles. Importance of skull in reptilian classification. Endothermy inDinosours. Causes of extinction.

Phylogeny of Birds and Mammals (7 hrs)

Evidences for the origin of birds from reptiles.Mammalian phylogeny and therapsids – significance of teeth, jaws and hearing. Adaptive radiation in mammals. Phylogeny of mammalian orders. Rare, endangered and endemic birds and mammals of Indian subcontinent.

Prerequisite: Classification of mammals

TAXONOMIC APPROACHES 27hrs

Module IV (16hrs)

Biological Classification (9 hrs)

Hierarchy of categories and higher taxa. Taxonomic Procedures-collection, preservation, curetting and process of identification (Brief and general account only). Taxonomic characters of different kindsand analysis of variation. Concept of species.
Zoological type – Principles of typification,different kinds of type.
International code of Zoological Nomenclature – features, principles and rules. Phylocode. Zoobank.

New trends in Taxonomy (7 hrs)

Modern methods – Morphological, embryological, ecological, behavioural, cytological, biochemical, numerical, molecular. Cytotaxonomy, Chemotaxonomy.
Bar coding of life – basics of barcoding, application of barcode. Molecular operational taxonomic units (MOTU), Integrated operational taxonomic unit (IOTU). Global taxonomic initiative (GTI). Constraints of DNA taxonomy. Integrative taxonomy.
Microtaxonomy and macrotaxonomy. e-taxonomy. Cybertaxonomy. Significance of Taxonomy and biosystematics.

Module V (11 hrs)

Taxonomic Keys and Publications (4 hrs)

Different types of keys – single access keys, diagnostic and synoptic keys, dichotomous and polytomous keys. Taxonomic keys presentation. Computer aided keys. Merits and demerits of keys.
Types of taxonomic publications – atlas, catalogue, checklist, filed guide, field book, hand book, manual, monographs. Zoological records. Ethics in taxonomy.

Molecular Phylogeny and Systematics (7 hrs)

Use of protein and nucleotide sequence in molecular phylogeny. Protein sequence – haemoglobin and cytochrome. Nucleic acid phylogeny. Importance of molecular phylogeny.

Cladistic analysis – Apomorphy, Plesiomorphy, Symplesiomorphy and Synapomorphy. Characteristic features of cladistics. Methodology of cladistics analysis – construction of cladogram. Significance of phylogenetic systematics. Phylogenetic trees. Different kinds – cladogram, phenogram, phylogram, dendrogram, curvogram, eurogram, swoopogram, chronogram.

Recommended Text Books/Reference Books

Anderson,T.A.2001. *Invertebrate Zoology* (2nd edn). Oxford University Press, New Delhi.

Ashok Verma 2017. Principles of Animal Taxonomy. NarosaPublicing home pvt. Ltd.

Barnes, R. D.1987. *Invertebrate Zoology*. Saunders College Publishing/Harcourt Brace; 5th Revised edition

Barrington, E. J. W. 2012. *Invertebrate Structure and Functions*. Affiliated east-west press Pvt. Ltd. New Delhi, 2nd edition.

David, M. H, Craig Moritz and K.M. Barbara.1996. *Molecular Systematics*. Sinauer Associates, Inc.

Hickman Jr., Cleveland, Larry Roberts, Susan Keen, Allan Larson, and David Eisenhour.2011. *Animal Diversity*. McGraw-Hill Companies, Inc. NY

Kapoor, V.C. 2017. *Theory and Practice of Animal Taxonomy*. 8th edition, Oxford and IBH Publishing Co., Pvt. Ltd. New Delhi.

Margulis,Lynn and M.J.Chapman 2001. *Kingdoms and Domains: An Illustrated Guide to the Phyla of Life on Earth*(4th edn.). W.H.Freeman&Company,USA

Mayer, E.2014. *Principles of Systematic Zoology*. 2nd edition, McGraw Hill Book Company, Inc., NY.

Narendran, T.C. 2008. *An introduction to Taxonomy*. Zoological survey of India.

Strickberger, M.W. 2013. *Evolution*. Jones and Bartett Publishers, London.

Simson G. G. 2012. Principles of animal taxonomy. Scientific publishers, India.

Winston, J.E.2000. *Describing species: Practical Taxonomic Procedures for Biologists*. Columbia University Press,Columbia, USA.

ZL010102 EVOLUTIONARY BIOLOGY AND ETHOLOGY

72 Hours (44+28) (4hrs/week) **Credit- 4**

Objectives:

- To describe the concept of relatedness and its connection to biological evolution
- To apply knowledge to new information and data, as well as the capacity to effectively communicate the principles of evolution and its application to human biology.
- To expose students to the basics and advances in ethology, and generate an interest in the subject in order to understand the complexities of studying animal behavior on every level of the biological hierarchy

EVOLUTIONARY BIOLOGY **44 hrs**

Module I **(22hrs)**

Concepts in Evolution **(6 hrs)**

Concepts of variation, adaptation, struggle, fitness and natural selection-spontaneity of mutation and the evolutionary synthesis. Contributions of Margulis (Endosymbiotic theory), Eldredge and Gould (Punctuated equilibrium), Rose Mary and Peter Grant (Molecuar evolution in Darwinian finches).

Origin and Evolution of Life **(5 hrs)**

The RNA world, The First Cell. Evolution of Prokaryotes- origin of eukaryotic cells- evolution of unicellular eukaryotes. Anaerobic metabolism - origin of photosynthesis and aerobic metabolism.

Molecular Evolution **(11 hrs)**

Neutral theory of molecular evolution; molecular divergence; molecular drive. Molecular clocks- genetic equidistance. Phylogenetic relationships- Homology; Homologous sequences of proteins and DNA - orthologous and paralogous; parsimony analysis; nucleotide and protein sequence analysis.

Module II **(13hrs)**

Population Genetics **(8 hrs)**

Gene pool, gene frequency, Hardy-Weinberg Law. Rate of change in gene frequency through natural selection, migration and random genetic drift, Founder effect and Bottle check phenomenon, Isolation and speciation, Co-evolution

Developmental and Evolutionary Genetics **(5 hrs)**

The idea of Evo-Devo, Heterochrony, Heterotopy, Heterometry and Heterotypy. Developmental genes and gene co-option. Evolution of plasticity and complexity.

Module III

Primate Evolution and Human Origins **(9 hrs)**

Geological time scale, Mass extinction and its consequences, Stages in Primate evolution- Prosimii, Anthropoidea and Hominids. Factors in human origin – morphological, anatomical, hominid fossils. Cytogenetic and molecular basis of origin of man - African origin of modern man - Mitochondrial Eve, Y chromosomal Adam.

ETHOLOGY **28 hrs**

Module III **(13hrs)**

Introduction **(3 hrs)**

Definition, historical out line,
Terminologies : Sign stimuli, key stimuli, social releasers, displacement activities, ritualization, Ethograms, super normal stimuli, stimulus filtering, open and closed IRM, mimetic releaser, code breakers. JP Scotts categories of behaviour.

Neurophysiological Aspects of Behaviour **(4 hrs)**

Reflex action, Sherrington's neuro-physiological concepts in behavior – Latency, summation, fatigue. Fixed action patterns.Goal oriented drive, Psycho-hydrologic model of motivation. Studies of motivation in guppies.

Learning and Genetics **(3 hrs)**

Short and long term memory, Habituation, Sensitization. Conditioning, Reasoning. Genetic basis of behaviour.

Communication **(3 hrs)**

Evolution of communication, Sensory mechanisms: Electrical, Chemical, Olfactory, Auditory and Visual. Dance language of honey bees, Pheromonal communication (Ants and mammals).

Module IV **(15hrs)**

Reproduction and Behaviour **(3 hrs)**

Reproductive strategies, Mating systems, Courtship, Sexual selection- intrasexual and intersexual, good gene hypothesis, parental care and investment – significance of prolactin

Complex behavior/Biological rhythm **(4 hrs)**

Orientation, Navigation, Migration, Navigation cues. Biological rhythms – Circadian, Circannual, Lunar periodicity, Tidal rhythms. Genetics of biological rhythms.

Social Behaviour **(4 hrs)**

Sociobiology (Brief account only), Aggregations – schooling in fishes, herding in mammals, Group selection, Kin selection, altruism, reciprocal altruism, inclusive fitness, Hamilton's rule, co-operation, alarm call, social organization in insects and primates.
Foraging behavior: Habitat selection and optimality in foraging; social foraging, territoriality.

Stress and Behaviour **(4 hrs)**

Adaptations to stress- basic concept of environmental stress, acclimation, acclimatization, avoidance and tolerance. Adolescent behavior- emotions aggression. Hormones and behavior.

Recommended Text Books/Reference Books

Evolutionary Biology

Arthur,W. (2011). *Evolution – A Developmental Approach.* Wiley-Blackwell, Oxford,UK
Barton, N. H., Briggs, D. E. G., Eisen, J. A., Goldstein, D. B. and Patel, N. H. (2007). Evolution.Cold Spring, Harbour Laboratory Press.

Camilo J.Cela - Conde and Francisco J. Ayala. (2007). *Human Evolution-Trails from the Past*. Oxford University Press.Oxford ,UK
Campbell.B.G. (2009). *Human Evolution*. Transaction Publishers, NJ, USA
Chattopadhyay Sajib. (2002). Life, Origin, Evolution and Adaptation.Books and Allied (P) Ltd. Kolkata, India.
Dan, G. and Li,W.H. (2000). *Fundamentals of Molecualr Evolution*. (2nd edn.). Sinauer Associates Inc. MA, USA
Gould, S,J. (2002). *The Structure of Evolutionary Theory*. Harvard University Press, MA, USA.
Hall, B. K. and Hallgrimsson, B. (2008), Evolution. 4th Edition; Jones and Bartlett Publishers
Hall, B.K and Hallgrimsson, B. (2008). *Strickberger's Evolution* (4th edn). Jones and Bartlett Pub.London,UK
Hall, B.K. and Olsen, W. M., (Ed). (2007). Keywords and Concepts in Evolutionary Developmental Biology. Discovery Publishing House, New Delhi,
Jha A.P (2000) Genes and Evolution - Macmillan Publishers India
Kimura,M. (1983). *The neutral theory of molecular evolution*.Cambridge University Press
Lindell Bromham (2016) An Introduction to Molecular Evolution and Phylogenetics, 3rd edition, Oxford press
Ridley, M. (2004), Evolution 3rd Edition. Blackwell Publishing
Roderick Page, D.M. and Edward Holmes, C.(2009). Molecular Evolution: A phylogenetic approach, Willey Blackwell publisher.
Strickberger, M.W. (2000) Evolution. Jones and Bartlett, Boston.

Web Resources

http://www.talkorigins.org http://www.ucmp.berkely.edu http://www.academicearth.org

Ethology

Alcock John (2009). *Animal Behaviour : An Evolutionary Approach* (8th edn). Sinauer Associates Inc. Sunderland, Massachusetts.
Aubrey Manning and Mariam Stamp Dawkins (2000). *An Introduction to Animal Behaviour* (5th Edn). Cambridge University Press, U.K.
Dawkins, M.S. (1995).Unravelling Animal Behaviour. Harlow: Longman.
Fatik Baran Mandal (2009). *A Textbook of Animal Behaviour*. PHI Learning Private Limited, New Delhi.
Gundevia J.S. and Singh H.G. (1996), A Text Book of Animal Behaviour. S. Chand and Company Pvt. Ltd., New Delhi.
Hauser, M.(1998). *The Evolution of Communication*. MIT Press, Cambridge, Mass. USA.
Judith Goodenough, Betty McGuire .2010. *Perspectives of Animal Behaviour*. John Wiley & Sons Inc. USA
Lee Alan Dugatkin (2009). *Principles of Animal behaviour* (2nd edn). W.W. Norton and Company.
Macfarland, D (1998). *Animal Behaviour – Psychobiology, Ethology and Evolution*. Pitman publication Ltd. London.
Michael D. Breed and Janice Moore (2015) Animal Behaviour, Academic press, USA.
Scott Graham (2005). *Essential animal behavior*. Blackwell Publications Company, Oxford ,UK
Wilson, E.O. (2000). *Sociobiology: The new synthesis.* Harvard Univ. Press, Cambridge, Mass. USA.

Web Resources: www.animalbehavioronline.com/modestable.html

ZL010103 BIOCHEMISTRY

72Hours (4hrs/week) **Credit- 4**

Objectives:

- To understand the chemical nature of life and life process
- To provide an idea on structure and functioning of biologically important molecules
- To generate an interest in the subject and help students explore the new developments in
- Biochemistry.
- To understand the importance of metabolism of bio macromolecules in normal physiology of a man
- To understand the abnormal metabolism of biomolecules and the resultant diseases.

Module I **18hrs**

Carbohydrates **(6hrs)**

Classification, Structure, nomenclature and Biologicalfunctions of carbohydrates. Glycoproteins and Mucoproteins. Isomerism – structural isomerism and stereoisomerism, optical isomerism,epimerism and anomerism. Mutarotation and inversion of sugars. Glycosidic bond.

Carbohydrate Metabolism **(9hrs)**

Major metabolic pathways- Glycolysis, Citric acid cycle and its significance. Oxidative and substrate level phosphorylation. Gluconeogenesis, Cori cycle. Glycogen metabolism- Glycogenesis, Glycogenolysis, Rgulation of carbohydrate metabolism, Role of insulin and glucagon. Adenylate cascade system, Ca+2 Calmodulin-sensitive phosphorylase kinase. Regulation of glycogen synthesis. Minor metabolic pathways of carbohydrates: Pentose Phosphate pathway, Glucuronic acid metabolism, Galactose metabolism.

Disorders of Carbohydrate Metabolism **(3hrs)**

Diabetes mellitus, glucose and galactose tolerance tests, sugar levels in blood, renal threshold for glucose, factors influencing blood glucose level, Inborn errors associated with carbohydrate metabolism. Glycogen storage diseases, Lactose intolerance, Galactosuria, pentosuria, galactosemia.

Module II **18hrs**

Proteins **(9hrs)**

Structure, classification and properties of amino acids. Amphoteric properties of amino acids, pH, Buffer, pK value and iso-electric point of amino acids.Classification, properties and biological functions of proteins. Primary structure of protein (e.g. insulin). Conformation of proteins- chemical bonds that stabilise higher order structures. Secondary structure- Alpha helix, Collagen helix, Beta pleated sheet, Ramachandran angles and Ramachandran map. Fibrous proteins- examples (brief account on any two: Keratin, Collagen, Elastin, Resilin, Fibrous muscle proteins). Chaperons. Tertiary structure- e.g. Myoglobin. Quaternary structure – e.g. Haemoglobin.

Metabolism of Proteins **(7hrs)**

Amino acid metabolism-Deamination, Transamination and Trans-deamination. Formation and disposal of ammonia. Urea cycle. Fate of carbon skeletons of aminoacids: glucogenic, ketogenic, partly glucogenic and ketogenic with examples. Synthesis of biologically significant compounds from different aminoacids with special reference to glycine, glutamic acid, phenylalanine, tyrosine and tryptophan.

Inborn Errors of Metabolism **(2 hrs)**

Phenylketonuria, alkaptonuria, albinism, tyrosinosis, maple syrup urine disease, Lesch-Nyhan syndrome, sickle cell anemia, Histidinemia.

Module III **18hrs**

Lipids **(9 hrs)**

Classification of lipids: simple, compound and derived lipids. Biological importance of lipids. Fatty acids: classification, Genevan system of nomenclature. Simple fats: Triacylglycerol (Triglycerides) :-fats, oils and waxes. Physical properties. Reactions-Hydrolysis, Saponification, Rancidity. Acid number, Saponification number, Iodine number, Polenske number and Reichert-Meissl number of lipids. Compound lipids: Phospholipids- Lecithin, Phosphatidyl inositol, Cephalins, Plasmologens. Glycolipids, Sphingolipids. Derived Lipids, Steroids: Biologically important steroids-cholesterol, Vitamin D, Bile acids, Ergosterol, Terpenes, Lipoproteins. Prostaglandins- structure, types and functions.

Metabolism of Lipids **(7hrs)**

Beta oxidation, alpha oxidation and omega oxidation of fatty acids. De novo synthesis of fatty acids.

Lipid peroxidation. Free radicals and antioxidants, Generation of free radicals. Reactive oxygen species. Free radical scavenger systems. Preventive antioxidants and chain breaking antioxidants.

Disorders of Lipid metabolism **(2hrs)**

Plasma lipoproteins, cholesterol and its clinical significance,, triglycerides & phospholipids in health and disease, hyperlipidemia, hyperlipoproteinemia, Gaucher's disease, Tay-Sach's and Niemann-Pick disease, ketone bodies, Abetalipoproteinemia.

Module IV **8 hrs**

Nucleic Acids **(6hrs)**

Structure of nucleic acids, Structural organization of DNA (Watson –Crick model) Characteristic features of A, B, C and Z DNA. DNA topology of circular forms. Structural organization of tRNA; Protein-nucleic acid interaction. DNA regulatory proteins, folding motifs and conformation flexibilities, denaturation, renaturation, Biological roles of nucleotides and nucleic acids.

Nucleic Acid and Mineral Metabolism **(2hrs)**

Catabolism of purines and pyrimidines.

Module V **10hrs**

Enzymes: Classification- (I.U.B.system), co-enzymes, ribozyme. Enzyme specificity. Mode of enzyme action: Concept of Active site, Formation of enzyme substrate complex,Lowering of activation energy.Lock and key theory, induced fit theory, transition state and strain theory. Enzyme kinetics: Michaelis-Menten equation. Km value and its significance. Enzyme velocity and factors influencing enzyme velocity. Kinetics of enzyme inhibition, suicide inhibition, feedback inhibition- sequential, concerted and cumulative feedback control. Control of enzyme activity:-control of activity by changes in covalent structures of enzymes, control of activity by ligand induced conformational changes in enzymes. Enzyme regulation: Allosteric regulations-Monod-Wyman-Changuex model, Koshland-Nemethy-Filmer model Key enzymes, Flux analysis. Iso-enzymes and clinical significance.

Recommended Text Books/Reference Books

Creighton, T.E. Protein Structure and Molecular Properties. 1993. W.H. Freeman & Co, NY.
Deb, A.C.2004. Fundamentals of Biochemistry. New Central Book Agency (P) Ltd. New Delhi.
Elliott, W.H and C. Elliott, 2003. Biochemistry and Molecular Biology. Oxford University Press, Oxford,UK.
Eric E. Conn, Paul K. Stumpf, George Bruening, Roy H. Doi, 2007. Outlines of Biochemistry. (5th edn). John Wiley &Sons Inc., NY.
Garret, R.H. and C.M. Grisham. 1995. Biochemistry. Saunders College Publishers,USA.
Lenhninger, A.L. 2008. Principles of Biochemistry. (5th edn). CBS Publishers and Distributors, New Delhi. Hanes, B. D. and N.M. Hoopar. 1998. Instant notes: Biochemistry. University of Leeds, Leeds, UK.
Horton, H.R., Morsan, L.A., Scrimgeour,K.G.,Perry, M.D and J.D.Rawn. 2006. Principles of Biochemistry. Pearson Education International, New Delhi.
Keith Wilson and John Walker. 2008. Principles and Techniques of Biochemistry and Molecular biology(6th edn). Cambridge University Press, UK.
Murray, K., Granner, D.K., Maynes, P.A and V.W.Rodwell, 2006. Harper's Biochemistry (25th edn). McGraw Hill, New York, USA.
Oser, B.L.1965. Hawk's Physiological Biochemistry. McGraw Hill Book Co. New Delhi.
Palmer Trevor. 2001. Enzymes: Biochemistry,Biotechnology & Clinical chemistry. Horwood Publ.Com., England.
Rama Rao, A.V.S.S. 1986. Text Book of Biochemistry. L.K. & S Publishers, New Delhi.
Stayer, L. 2011. Biochemistry. (7th edn). W.H. Freeman & Co. NY.
Vasudevan, D.M. and S.Sreekumari. 2000. Text of Biochemistry for Medical Students. Jaypee Brothers, Medical Publishers (P) Ltd. New Delhi
Voet, D and J.G Voet, 2004. Biochemistry. John Wiley & Sons.,NY.
Zubay, G, 1989. Biochemistry. McMillan Publishing Co., New York.

BIOSTATISTICS AND RESEARCH METHODOLOGY

54 hrs (30+24) 3 hrs/week **Credit – 3**

Objectives:

- To impart concepts of statistics and research methodology, and create awareness about the gadgets, tools and accessories of biological research
- To help students improve analytical and critical thinking skills through problem solving
- To enable learners to effectively apply suitable statistical tests in research
- To sensitize students about the ethics involved in research and enable them to come up with innovative research designs
- To equip learners to prepare research papers and project proposals

BIOSTATISTICS **30 hrs**

Module 1 **(9hrs)**

Basics of Biostatistics **(3 hrs)**

Scope and Significance of Biostatistics. Steps in Statistical Investigation, Data and Variable (Collection, Types, Sources).

Statistical Analysis Tools - Parametric and Non-Parametric; Bivariate and Multivariate Analysis. Interpretation and Forecasting.

Measures of Central Tendency – mean, median and mode.

Measures of Dispersion **(6 hrs)**

Introduction, Characteristics. Quartiles and Percentiles. Merits and Demerits of Range, Quartile Deviation, Mean Deviation and Standard Deviation. Relative Measures of Dispersion.

Calculations/Problems for frequency table. Standard error. Skewness and Kurtosis (Brief account only).

Module II **(11hrs)**

Correlation Analysis **(3 hrs)**

Correlation - types and methods of correlation analysis, Problems for Karl Pearson's correlation coefficient and Spearman's rank correlation.

Regression Analysis **(4 hrs)**

Regression and Line of Best Fit, Types and methods of regression analysis.

Graphic Methods (Scatter method, Curve fitting). Algebraic method (Fitting of strait line through regression equation). Comparing correlation and regression.

Probit Analysis (Brief account only).

Theory of Probability **(4 hrs)**

Measures of Probability and Theorems in Probability. Probability distributions – Binomial, Poisson and Normal (Brief Account only).

Module III **(10hrs)**

Testing of Hypothesis **(7 hrs)**

Hypothesis and types, Confidence Interval, Sampling, Methods and Errors.

Tests of significance (For large and small samples – Critical Ratio and P value).

Z Test (Problem for small samples), Chi- Square Test – test of independence and goodness of fit (Problem for 2×2 table only).

Student's 't' test (Problem for small samples comparing mean of two variable).

F-test, Analysis of Variance (ANOVA - One way), Kruskal Wallis test (Brief account only).

Mc Nemar and Mann Whitney U test (Brief account only).

Mathematical modeling in Biology **(3hrs)**

Introduction to mathematical modeling. Applications: Medicine - models to predict spread of infectious diseases, drug discovery, Systems Biology – Blue Brain project, Ecology – Lotka Volterra model. Length - Weight Relationship. Von- Bertalanffy's Growth (VBG) Model.

Statistical Software: MS Excel, SPSS; Introduction to 'R' (Basics only).

RESEARCH METHODOLOGY **24 hrs**

Module IV **(12hrs)**

Concepts of Research **(4 hrs)**

Scientific temper, Empiricism and Rationalism. Knowledge, Information and Data. Science and Pseudoscience. Basic concepts of research -Meaning, Objectives, Motivation and Approaches.

Types of Research - Descriptive/Analytical, Applied/ Fundamental, Quantitative/Qualitative, Conceptual/Empirical. Research methods versus Methodology, Research Process.

Research Formulation **(4 hrs)**

Research formulation -Observation and Facts, Prediction and explanation, Induction, Deduction.

Defining and formulating the research problem, Selecting the problem and necessity of defining the problem. Literature review - Importance of literature review in defining a problem, Critical literature review. Theory, Principle, Law and Canon.

Research Designs **(4 hrs)**

Research Design -Basic principles, Meaning, Need and features of good design. Types of research designs.

Development of a research plan - Exploration, Description, Diagnosis, Experimentation, determining experimental and sample designs. Case-control studies and cohort studies.

Module V **(12 hrs)**

Scientific Documentation and Communication **(6 hrs)**

Structure and components of Scientific Reports – types of Report – Technical Reports and Thesis/dissertations.

Preparing Research papers for journals, Seminars and Conference; Impact factor, Citation Index, h-index. DOI. ISBN & ISSN.

Conventions and strategies of authentication – citation styles, bibliography, referencing and foot notes. Software for managing bibliographies - EndNote.

Presentation techniques - Assignment, Seminar, Debate, Workshop, Colloquium, Conference, Oral presentation, Poster Presentation.

Preparation of Project Proposal. Project funding agencies – UGC, DST, BDT, MoEF. Women Scientists schemes.
Global Information System – BIOSIS, Medline and Medlars, AGRIS, Pubmed, Google Scholar.

Information Science, Extension and Ethics (6 hrs)

Sources of Information - Primary and secondary sources.
Library - books, journals, periodicals, reference sources, abstracting and indexing sources, Reviews, Treatise, Monographs.

Online resources – INFLIBNET, e-libraries, e-Books, e-Encyclopedia, e-Journals, e-Thesis, Shodhganga, PG-Pathshala, TED Talk, Institutional Websites. MOOC - SWAYAM, NPTEL.
Networking platforms for researchers - Academia, ResearchGate.
Ethics in research - Plagiarism, Plagiarism checking softwares - Turnitin, Viper, Urkund; Citation and Acknowledgement.
Extension: Lab to Field, Extension communication, Extension tools.

Recommended Text Books/Reference Books

1. Chap T. Le.2003.*Introductory Biostatistics*. John Wiley &Sons, NJ, USA.
2. Clough, P. and C.Nutbrown.2002. *A Student's Guide to Methodology: Justifying Enquiry*. Sage, London.
3. Daniel W.W. 2006. *Biostatistics: A Foundation for Analysis in the Health Sciences* (7th edn). John Wiley & Sons, New York.
4. Freedman D. F., Pisani R. and Purves R. 2011. Statistics. Viva Books, New Delhi.
5. Dharmapalan Biju. 2012. *Scientific Research Methodology*. Narosa Publishing House, New Delhi.
6. Gupta S. P. 2014. Statistical methods for CA foundation course. Sultan Chand & Sons, New Delhi.
7. Kothari C. R. 2009. *Research Methodology: Methods and Techniques* (2ndedn.). NewAge International Publishers, New Delhi.
8. Paul Oliver. 2005. *Writing Your Thesis*. Vistaar Publications.New Delhi.
9. Rajathi A. and P. Chandran, 2010. *SPSS for You*. MJP Publishers, Chennai
10. Samuels M. L., Witmer J. A. and Schaffner A. 2016. Statistics for Life Sciences (5^{th} edn). Pearson Education Inc., New delhi.
11. Sundar Rao P.S.S. and Richard J. 2006. .*Introduction to Biostatistics and Research Methods* (4th edn). Prentice Hall, New Delhi.
12. Zar J. H. 2008. *Biostatistical Analysis* (3^{rd} edn.). Pearson Education Inc., New Delhi

ZL010105: PRACTICAL 1

ANIMAL DIVERSITY: EVOLUTIONARY, ETHOLOGICAL AND BIOCHEMICAL METHODS & APPROACHES

180 Hours (10hrs/week) **Credit-4**

Biosystematics, Evolutionary Biology and Ethology **60 hrs**

- Study of museum specimens - 50 invertebrates and 20 vertebrates (List the studied items with brief descriptions enlisting at least five taxa or taxonomic rank (Diagrams not necessary)

- Larval forms - any 10 larvae from different taxa (emphasizing phylogenetic, morphological, ecological and pathological significance)

- Mounting and Submission of any three larval forms
  (Diversity should be maintained depending on the number of students and one specimen each should be submitted for the practical examination, Repetition should be avoided for examination)

- Preparation of dichotomous key up to the family of four specimens each from any of the three, from the following five groups (ie., from insects, spiders, fishes, amphibians and snakes) with necessary diagrams.

- Dichotomous key using appropriate software or online tools (students should be familiarized with the computer aided keys)

- Hardy Weinberg Law for calculation of gene frequency

- Preparation of Cladogram based on the specimens provided (at least five museum specimen) (OR software programmes can be used for construction with more number of specimens).

- Study on the skull pattern of reptiles/mammals.

- Behavioural study or activity pattern of any two organism (insects, fish, reptile, birds, mammals) based on field observation with respect to diurnal and seasonal. Viva based on behavioral observation reported. (Repetition of reports, organism and observations should be avoided on records)

Biochemistry **80hrs**

- Study of structure of biomolecules (carbohydrate , aminoacids , cholesterol), using ball and stick models and Protein and Nucleic acid using software tools
- Preparation of Buffers of specific pH using pH meter
- Calculation of Molality, Normality, percentage W/V, serial dilution and preparation of standard solutions
- Preparation of standard curve for protein (by Lowry or Biuret methods) , glucose, cholesterol and/or creatinine and estimation of unknown concentration.
- Estimation of protein or cholesterol from fresh tissue
- Estimation of Enzyme activity from fresh tissue (alkaline phosphatase or acid phosphatase)

Biostatistics **40hrs**

- Calculation of corrected mean, and standard deviation (Problems can be solved using scientific calculator).
- Derive regression equation for protein, cholesterol and creatine using Optical density and Concentration
- Drawing best line of fit for protein, cholesterol and creatine (Problems can be solved using scientific calculator).
- Calculation of Pearson correlation coefficient.
- Calculation of regression coefficient and regression equation ('x' on 'y' only)
- Calculation of Chi -square value (2x2 table only)
- Calculation of 't' value (for small sample comparing two samples)
- MS Excel: Preparation of graphs (bar, histogram, frequency polygon, frequency curve, pie diagram and ogives)
- MS Excel/PH Stat/SPSS: Basic statistics (mean, median, mode, standard deviation), Correlation Analysis, Regression analysis , Test of significance (T test between two sample or sample and population), Chi-square test, Problems using one way ANOVA

SECOND SEMESTER COURSES

ZL010201	Name of the Course 1 Field Ecology
ZL010202	" 2 Developmental Biology
ZL010203	" 3. Genetics and Bioinformatics
ZL010204	" 4 Microbiology and Biotechnology
ZL010205	5. PRACICAL 2 Diversity of Life: Ecological, Embryological, Hereditary and Microbial Methods and Approaches

ZL010201 FIELD ECOLOGY

72 Hours (4 hrs./Week) **Credit – 4**

Objectives:

- To provide the knowledge of animal adaptations to a variety of environment
- To learn the different aspects of population and its interactions
- To understand the natural resources and manmade issues on environment and its management

Module I

Animal and Physical Environment **(18 hrs)**

Effect of cold and hot temperature on organisms. Global warming and change of species phenologies. Effect of soil development on nutrient level. Herbivore population and plant nutrient level. Availability of O_2 and Co_2 on growth and distribution of organisms. Water availability and abundance of organism. Significance of salt concentration in soil and water. Effect of soil and water pH on distribution of organisms.
Cybernetic nature of ecosystem, homeostasis and feedback systems.
Animals and nutrient acquisition – herbivory, carnivory, omnivory, detritus feeding.
Animal adaptations to thermal environment – thermal balance, poikilotherms, homeotherms, heterotherms. Animal adaptations to moisture environment – maintenance to water balance, response to drought and flooding. Animal adaptations to light environment.

Prerequisite: Ecosystem concept – structure and function, Productivity, Food chain and food web, Energy flow

Module II

Population Ecology **(15 hrs)**

Properties – patterns of dispersion, dispersal movements, age structure, sex ratio, life table, survivorship curve, density, population growth-exponential and logistic growth, time lags, carrying capacity. Population growth and global warming.
Density dependent and density independent influences. Population fluctuations and cycle. Extinction – deterministic extinction and stochastic extinction.
Life history strategies – Reproductive strategies, *r* and *k* selection.
Human population growth. Concept of ecological foot print.
Population regulation – dispersal, social dominance, territoriality: types of territory, territorial defence, floaters, home range.
Aggregation, Allee's principle, Isolation
Metapopulation – Concept, Structure

Module III **(17 hrs)**

Population Interactions: Competition and Predation **(10 hrs)**

Interspecific competition – Competitive Exclusion Principle, Resource partitioning and utilization. Niche, Niche overlap, Niche width, Niche responses-niche compression and niche shift. Character replacement. Ecological and evolutionary effects of competition.
Predation – Antipredator adaptations.
Foraging theory – optimal diet, foraging efficiency, risk-sensitive foraging.
Animal prey defence – chemical defence, warning coloration and mimicry, cryptic colouration, armor and defence, behavioural defence, predatory sanitation.
Predator offence – hunting tactics, cryptic coloration and mimicry in predators, adaptations of hunting. Cannibalism, Intraguild predation (IGP).

Population Interactions: Parasitism and mutualism (7 hrs)

Characteristics and life-cycle of parasite, host response to parasitism –biochemical, abnormal growth, sterility, behavioural change, mate selection. Social parasitism – Brood parasitism and kleptoparasitism.
Types of defence against parasites by host. Invasive parasite. Parasitism and climate change. Non-native parasite and biological control.
Mutualism – Origin and types. Dispersive mutualism, defensive mutualism, resource based mutualism. Mutualistic relationship of human with crops.

Module IV

Applied Ecology (10 hrs)

Air, water, soil and radioactive pollution – Sources, causes and consequences. Disposal of radioactive waste. Ecological indicators.
Concept of waste – types and sources of solid waste. Health and environmental implications. E-waste-types and management aspect. Environmental biotechnology and solid waste management – aerobic and anaerobic systems. Concept of bioreactors in waste management. Liquid wastes and Sewages.
Scope of bioremediation. Phytoremediation, bio-augmentation, biofilms, bio filters, bio scrubbers and trickling filters.

Module V

Resource Ecology (12 hrs)

Currents status of forest resources and deforestation in India. Fresh water sources, water scarcity and water conservation measures. Wet lands, its importance, reclamation and conservation measures. Sand mining and its impacts.
Energy resources – solar, fossil fuels, hydro, tidal, wind, geothermal and nuclear. Recent issues in energy production and utilization. Green technology and sustainable development. Depletion of natural resources and its impacts on life.
Ecosystem monitoring – GIS and its application, Role of remote sensing in ecology. Environmental Impact Assessment (EIA)-Tools and technique. Ecosystem modelling (Brief account only).

Recommended Text Books/Reference Books

Abbasi, S.A. and Ramasami, E.V 1998. Biotechnological Methods of Pollution Control. Oxford University Press, Hyderabad.

Benton, A.H. and Werner, W.E 1976. Field Biology and Ecology. Tata McGraw Hill, New Delhi. Boitani, L and T.K.Fuller2000.Research Techniques in Animal Ecology. Columbia University Press, USA
Daniel, C.D 2010.Environmental Science.(8th edn.).Jones and Bartlett Publishers.
Misra, S P and Pandey S. N.2009. Essential Environmental Studies. AneBooksPvt. Ltd.
Odum, E P. 2017.Fundamentals of Ecology, India edition.
Peter Stilling, 2012. Ecology: Global Insights and Investigations. The McGraw-Hill companies, New york
Peter, H.R., Berg, L.R., and Hassenzahl, D.M. 2008. Environment. (5thedn.).John Wiley Publishers. Pianka, E. R. 1981. Competition and Niche Theory in "Theoretical Ecology". (2nd edn.).In: May, R.M. (Ed.). Blackwell, London.
Rana,S.V.S. 2009.Essentials of Ecology and Environmental Science.(4thedn.). PHI learning Pvt. Ltd., New Delhi
Simons, I.G. 1981. Ecology of Natural Resources. Edwin-Arnold Ltd., London.
Robert Leo Smith and Thomas M Smith 2001. Ecology and Field biology (6th Edition), New York

ZL010202 DEVELOPMENTAL BIOLOGY

72 Hours (4hrs/week) Credit – 4

Objectives:

• To introduce the concepts and process in developmental biology
• To help students understand and appreciate the genetic mechanisms and the unfolding of the same during development
• To expose the learner to the new developments in embryology and its relevance to Man

Module I (24hrs)

Introduction: Basic Concepts of Development (14 hrs)

Potency of embryonic cells, Commitment, Specification (Autonomous and Conditional), Induction,eye lens induction, Regional specificity of induction, Genetic specificity of induction, Competence, Determination and Differentiation, Morphogenetic gradients, Cell fate and cell lineages.Genomic equivalence and Cytoplasmic determinants, DNA methylation, Genomic imprinting.

Fertilization and Early development (10 hrs)

Fertilization-(biochemical and molecular aspects, cell surface molecules in sperm-egg recognition), Polyspermy. Earlydevelopmentandaxisspecificationin*Caenorhabditiselegans*, Vulval induction in *C.elegans*

Module II

Development of Model organisms—Drosophila (14 hrs)

Early development and axis specification in Drosophila (cleavage, midblastula transition, gastrulation).Anterior-posteriorpatterninginDrosophila(Maternaleffectgenes,zygoticgenes,gapgenes,pairrulegenes,segmentpolaritygenes;homeoticselectorgenes,realisatorgenes),Dorsal-ventralpatterningandleftrightpatterning,Dorsalproteingradient.

Module III

Axis and Pattern Formation in Amphibians (16 hrs)

Axis formation in amphibia -- Anterior-posterior patterning in Amphibia.Hox code hypothesis.Nieuwkoopcentreandmesodermalpolarity.Molecularbasisofmesoderminduction.Transcriptionfactorsinducedintheorganizer.Neuralinduction.Vertebrate limb development.

Module IV (14hrs)

Cellular Interactions in Development (6 hrs)

Paracrine factors - Hedgehog family, Wnt family, TGF, BMP. Surface receptors and signal transduction pathway - RTK pathway,Smadpathway,Wnt pathway, Hedgehog pathway and cell death pathway.

Metamorphosis and Regeneration (8 hrs)

Metamorphosis of Amphibians and Insects; Hormonal control of metamorphosis.Heterochrony-neoteny, progenesis (Brief accounts); regeneration - different types of regeneration; Histological processes during regeneration; Polarity and Metaplasia in regeneration; Lens regeneration in amphibia.

Module V

Human Welfare and Developmental Biology (4 hrs)

Stem cells and their applications, ethical issues. Malformations and disruptions,Gene – phene relationship, Autophene, Allophene and Pleiotrophy; Environmental oestrogens.

Recommended Text Books/Reference Books

Balinsky, B.I.2004. An Introduction to Embryology.W.B.SaundersCo.,Philadelphia.

Berril, N.J. 1979. Developmental Biology.Tata McGraw-Hill Pub.Co.Ltd.,New Delhi.

Gilbert, S.F. 2016. Developmental Biology (11thedn).Sinauer Associates Inc., Publishers, Masachusettes, USA

Hopper, A.F. and Hart ,N.H.1985. Foundations of Animal Development.Oxford University Press, Oxford.

Lewis Wolpert. 2007. Principles of Development. Oxford University Press.Oxford Saunders,

J.W.1982. Developmental Biology-Patterns,Principles and Problems. Macmillan Publishing Co.,New York.

Subramanian, T. 2002. Developmental Biology.Alpha Science International Ltd.,New Delhi

Sunstard,D.P., Simmons, M. J. and J.B Jenkins.1997. Principles of Genetics.John Wiley and sons, New York.

Wolpert L. and C. Tickle. 2011. Principles of Development.(4thedn). Oxford University Press, Oxford.

ZL010203 GENETICS AND BIOINFORMATICS

72 Hours (54+18) (4 hrs/week) **Credit -4**

Objectives:

- To learn and understand the principles and mechanism of inheritance
- To study the fine structure of genetic material and molecular basis of hereditary transmission
- To understand the significance of Genetics in Principle in heritance of traits in Man
- To understand the role of genetics in evolution
- To explore the emerging field of bioinformatics and to equip the students to takeup bioinformatics studies

GENETICS **54 Hours**

Module 1 **(14hrs)**

Principles of Genetic Transmission **(4hrs)**

(Prerequisites: The basic principles of inheritance: Alleles, Pseudo alleles, Dominance, Segregation, Independent assortment, Test cross and ratios)

Extensions of Mendelian Principles: Codominance, Incomplete Dominance, Gene interactions with Epistasis,Pleiotropy, Penetrance and Expressivity, Phenocopy,

Linkage,Recombination and Crossing over,Cytogenetic Mapping **(10hrs)**

Linkage, Recombination, Stern's experiment, Crossing over as the physical basis of recombination,Molecular mechanism of crossing over and recombination, Holiday Model

Recombination mapping with a three point test cross in Drosophila, Interference and the Coefficient of Coincidence. Mitotic recombination, Evolutionary significance of recombination

Mapping genes using conjugation data,Fine structure Mapping of Phage genes: Complementation Mapping,Deletion Mapping,

Organization and mapping of mitochondrial genome

(Prerequisites:Mechanisms of genetic exchange in Bacteria)

Module II **16hrs**

Molecular Organization of Chromosomes **(6hrs)**

Genome size and C – value paradox, Chromatin Structure and levels of DNA packaging in Prokaryotic and Eukaryotic chromosomes,Molecular structure of Centromere andTelomere, Telomere shortening and Aging (Werner's syndrome), Repeated DNA sequences in Eukaryotic Genome:Highly repetitive,Moderately repetitive,Single copy,Kinetics of renaturation,Cot Curve.

(Prerequisites: DNA, Histone, Chromatin, Euchromatin and heterochromatin)

Gene Fine Structure **(10hrs)**

Classical versus Molecular concept of the gene, Cis-Trans test for functional allelism, Fine structure of the phage T4 rll locus, Modern findings on the nature of gene: Interrupted genes in eukaryotes, Exons and introns, Genes with in genes in phage φx174, Gene synthesis : in vitro synthesis - Works of Watson and Crick, Khorana, Kornberg and Nirenberg.

Transposible genetic elements

Transposible elements in Bacteria, Cut and Paste transposons in Eukaryotes, Retrotransposons Transposable elements in Humans. Genetic and evolutionary significance of transposable elements.

Module III

Replication and Mutation (10 hrs)

Unidirectional replication,Bidirectional replication, Theta replication,Rolling circle replication,eukaryotic replication and Replication Machineries – prokaryotes and eukaryotes.

Mutagenesis and Molecular Mechanism of Mutation,Tautomeric shift, DNA Repair Mechanisms, Inherited Human Diseases with defects in DNA repair, Gene conversion, The Ames test.

(Prerequisites:Messelson and Stahl Experiment, Semiconservative replication,Somatic or germinal mutation,Spontaneous or induced Mutation,Conditional lethal mutation, *Variation in chromosome Number and Structure: Aneuploidy, Deletions and Duplications, Invertions, Translocations*)

Module IV 14hrs

Human Genetics, Quantitative Genetics and Population Genetics (11hrs)

Karyotype,Chromosome banding techniques, Pedigree analysis, anticipation,Lod Score,Complex traits, Quantitative traits,Threshold traits.Analysis of quantitative traits:The MultipleFactor Hypothesis, Broad sense heritability, Narrow sense heritability. Artificial selection,Correlations between Relatives.

The theory of allele frequencies and allelic natural selection,

Applications of Molecular Genetics

Identification of human genes and diagnosis of human diseases.Uni parental Disomy, Huntington's disease, Fragile X syndrome, Cystic fibrosis. Gene therapy-SCID-Autosomal disease of immune system, DNA profiling, Micro RNA, Si RNA and their control in Genetic disorders. Mitochondrial gene in Aging and Human Disease

(Prerequisite: Sex chromosome and sex determination, Sex-linked genes in humans, Dosage compensation of X-linked genes, Sex limited and sex influenced characters in man.)

Epigenetics (4 hrs)

Epigenetics,Histone code hypothesis.Chromatin modifications and their mechanisms of action:Modification of histone proteins-Acetylation, phosphorylation,methylation,ubiquitylation,sumoylation.Chromatin remodeling,Genomic imprinting,Xchromosome inactivation, Gene Silencing.
Epigenetics in Drosophila:Position effect variegation(PEV),
Gene silencing - Polycomb Group Genes(PcG) - Yeast and Drosophila models

BIOINFORMATICS **18hrs**

Module V
Biological Databases **(6 hrs)**

Primary databases - Nucleotide sequence databases: GenBank, EMBL, DDBJ; Protein sequence databases: SWISSPROT, PIR; steps involved in use and interpretation of results

Structure databases: PDB, NDB; Secondary databases: PROSITE, Pfam, CATH; Composite databases: OWL; Literature database: PubMed; Database searching – Entrez; Database sequence submission – BankIt.

Sequence Analysis **(6hrs)**
Types of sequence alignment, methods of sequence alignment, scoring schemes, gaps and gap penalties, Phylogenetic trees – CLUSTAL W and CLUSTAL ω, PHYLIP

Genomics and Proteomics and Systems Biology **(6hrs)**

Structural genomics, functional genomics, comparative genomics, data mining, proteomics – Microarrays.Protein modeling and drug designing.

System Biology - metabolomics, gene network, synthetic biology.

Recommended Text Books/Reference Books

Concepts of Genetics, Pearson (Global Edition), 11 edition , William S Kug, Micheal R Cummings, Charlotte A Spenser, Machael A Palladino
Principles of Genetics, Wiley, 8th Edition, Eldon JohnGardner, Michael J Simmons, D Peter Snustard
Genetics: Principles and Analysis, DanielHartel and Elizabeth W Jones
Lewin's Genes X , Jones and Bartlett, 10 Edition Jocelyn E Kreb, Elliott S Goldstein Stepen T Kilpatrik
Epigenetics CSH Press, Second Edition, C David Allis, Marie-Laure Capparros, Thomas Jenuwein, Danny Reinberg (E
Main references:*Principles of Genetics*, Gardner,Simmons,Snustad.
*Principles of Genetics,*Snustad,Simmons. *Genetics,A Conceptual Approach,*Benjamin A. Pierce

Bioinformatics
Alberghina,L and H.V. Westerhoff (Eds).2008. *Systems Biology-Definitions & Perspectives*. Springer-Verlag, Berlin.
Attwood T.K. and Parry Smith, D. 2006. *Introduction to Bioinformatics*. Pearson Education.
Bourne P. E and Weissig H, 2003. *Structural Bioinformatics*.Wiley -Liss. USA
David W. M. 2004. *Bioinformatics, Sequence and Genome Analysis* (2ndedn). CSHP, New York
Krane, D. E and M.L. Raymer. 2006.*Fundamental concepts of Bioinformatics*. Pearson Education,New Delhi
Lesk A. M, 2005. *Introduction to Bioinformatics*. Oxford Press, New Delhi
Pengcheng Fu and Sven Panke, (Eds.) 2009. *Systems Biology and Synthetic Biology*. John Wiley & Sons, Inc. NJ,USA
Tisdall J. D, 2001. *Beginning Perl for Bioinformatics*.O'Reilly Media Inc.CA,USA
Masaru Tomita and TakaaiNishioka, 2005. *Metabolomics.The Frontier of Systems Biology*. Springer Japan

ZL010204 MICROBIOLOGY AND BIOTECHNOLOGY

54 Hours (18+27) (3hrs/week) **Credit- 3**

Objectives:

- To provide an over view of the microbial world, its structure and function
- To understand the fundamental aspects of the basic biology of bacteria and viruses
- To give students an intensive and in-depth learning in the field of biotechnology
- To familiarize the student with emerging field of biotechnology
- To understand the modern biotechnology practices and approaches with an emphasis in technology application, medical, industrial, environmental and agricultural areas and nanomedicine
- To familiarize the students with public policy, biosafety, and intellectual property rights issues related to biotechnology

MICROBIOLOGY **18hrs**

Module I **(10hrs)**

General Characters and Classification of microbes **(4 hrs)**

General characters of microorganisms- bacteria, virus, fungi, Outline classification of microrganisms

Functional Anatomy of Prokaryotic Cells - Cell structure, plasma membrane, cytoskeleton, cytoplasm, nucleoid, cytoplasmic inclusions. The prokaryotic cell envelope, peptidoglycan structure, gram positive and negative cell walls.Components outside the cell wall: capsules, slime layers, pili and fimbriae, flagella and motility.

Methods in Microbiology **(6 hrs)**

Culture medium, methods of isolation, pure culture techniques, microbial strain identification – cultural and biochemical, Control of microorganism- physical, chemical and antimicrobial agents.

Module II

Microbial Growth and Interactions **(8 hrs)**

Nutrient requirements, growth factors, uptake of nutrients by the cell. Growth curve. Physical requirements for bacterial growth and influence of environmental factors on growth. Mirobes in nutrient cycling.

Symbiosis, commensalism. Mutualism between microbes, microbes and plants, microbes and animals. Cooperation, competition, predation, antagonism. Parasitism, plant parasites, animal parasites. Microbial communication system- Quorum sensing, Biofilms.

BIOTECHNOLOGY **36 hrs.**

Module III

Recombinant DNA Technology - Tools and Techniques **(12 hrs)**

Introduction – rDNA and cloning, Restriction enzymes and DNA modifying enzymes.

Vectors: cloning and expression vectors - Plasmids, Ti and Ri plasmids, cosmids, phagemids, bacteriophage, SV40, vectors with combination features; PUC19 and Bluescript vectors, shuttle vectors, viral vectors, BAC and YAC vectors. Adaptors, Linkers

Methods of gene transfer: chemical transfection methods: calcium chloride, PEG, polyplex, DEAE dextran. Physical methods: electroporation, microinjection, particle bombardment, ultrasonication, liposome mediated transfer. Biological methods: use of vectors, Selection and screening of recombinants, insertional activation- blue white screening, Generation of cDNA and genomic library.

Basic techniques in Biotechnology

Polymerase chain Reaction- different types and applications, Gene cloning, Chromosome walking, chromosome jumping, DNA foot printing.

DNA sequencing methods- Maxam and Gilberts chemical degradation method, Sanger and Coulson method, Automated DNA sequencers.

Protein sequencing methods

Module IV

Animal Biotechnology and health care (12 hrs)

Cell and Tissue culture: Basic techniques of mammalian cell culture Growth media- types, biology and characterization of cultured cells.Measurement of viability and cytotoxicity, organ culture.

Cryopreservation and maintenance of cell line

Transgenic animals – production and its applications. Gene knockout and gene knock, Site directed mutagenesis, molecular chimeras

Gene therapy:Exvivo, Invivo, Insitu- Cell and tissue engineering, Gene products in medicine – Humulin, Erythropoietin, Growth Hormone/Somatostatin, tPA, Interferon. DNA vaccine

Biosensors and Biochip.

Module VI. Biotechnology in Industry, Agriculture and Environment (5 hrs)

Fermentation technology – Stages of fermentation - Fermentation products (antibiotics, alcohol, amino acids, organic acids, vinegar, vitamins, and fuels). Enzyme engineering and applications.

Transgenic plants, Biological nitrogen fixation; Nif genes, Nitrogen fixers – Bio fertilizers (Rhizobium, Azotobacter, Azospirillum, VAM) - Bio pesticides (Bacterial, Fungal, Viral). Terminator gene technology

Module V

Nanobiotechnology (3 hrs)

Introduction, Nanobiotechnological devices, Types and applications of Nanobiosensors, Drug delivery technologies, personalized nanomedicine.

Intellectual Property Rights, Biosafety and Bioethics (4 hrs)

Introduction to Intellectual PropertyRights, Types of IP: Patents, Trademarks, Copyrights.

Basics of Patents Types of patents; Indian Patent Act 1970; Recent Amendments, Protection of New GMOs. IPs of relevance to Biotechnology and few Case Studies (Rice, Neem, Curcumin).

Introduction to History of GATT, WTO, WIPO and TRIPS.

Biosafety concepts and issues. Biosafety protocol 2000.

Bioethics: Principles of bioethics: autonomy, human rights, beneficence, privacy, justice, equity

Recommended Text Books/Reference Books

Microbiology

Ananthanarayanan, R. and Jayaram Panikar, C.K. (2013). Text Book of Microbiology. University Press, Hyderabad.
Arora,D.R. and Arora,B. (2008). *Text Book of Microbiology*. CBS Publishers and Distributers, New Delhi
Atlas RM. (2005). *Principles of Microbiology*. 4th edition. WMT.Brown Publishers.
Chakraborty, P. A. (2009). *Text Book of Microbiology*. New Central Book Agency.New Delhi
Harma and Kanika (2009). *Manual of Microbiology Tools and Techniques*. Ane Books Pvt. Ltd. New Delhi
Ingraham, J. L. and Ingraham, C. A. (2000). *Microbiology* (2ndedn). Brooks/Cole-Thomson Learning,MA,USA
Pelczar MJ, Chan ECS and Krieg NR. (2010). *Microbiology*. 8th edition. McGraw Hill Book Company.
Talaro, Park.,Kathelee, N and Talaro,Arthur. (2002). *Foundations of Microbiology*.McGraw Hill Higher Education,NY
Wheelis Mark (2010). *Principles of Modern Microbiology*. Jones and Bartlett Publishers,NY,USA.
Willey JM, Sherwood LM, and Woolverton CJ. (2008). *Prescott, Harley and Klein's Microbiology*. 8th edition. McGraw Hill Higher Education.

Biotechnology

Sathyanarayana, U. (2009), Biotechnology, Books and allied (p) Ltd
Singh, B.D. (2009). Biotechnology, Kalyani publishers.
Click, B. R. and Pasternak (2002). Molecular Biotechnology: Principle and applications of recombinant DNA. ASM Press.
Dale, Jeremy W and Schantz, Malcom V. (2002). *From Gene to Genomes*. John Wiley and SonsLtd,NY,USA
Das, H.K. (2007). *Text book of Biotechnology*.Wiley India Pvt. Ltd. New Delhi
Doyle, Alan and Griffith Bryan J. (1999). *Cell and Tissue Culture- Laboratory Procedures in Biotechnology*.WileyInternational,NY.
Freshney, Ian, R. (2006). *Culture of Animal Cell* (5th edn).Wiley- Liss publications.
Jenkins, N (Ed) (1999). Animal cell biotechnology: Methods and Protocols. Humana press, New Jersey.
Pandian, T.T. and Kandavel, D. (2008). *Text Book of Biotechnology*. I.K International Publishing House, New Delhi.

PRACTICAL 2

DIVERSITY OF LIFE: ECOLOGICAL, EMBRYOLOGICAL, HEREDITARY AND MICROBIAL METHODS & APPROACHES

180 Hours (10hrs./week) **Credit-4**

Ecology **70 Hrs**

- Study of Pond/ Wetland/ River ecosystem (any one) – Separate work book should be maintained by each student specifying objectives and methods adopted based on field study.
- Ecological analysis - Estimation of following parameters
  Water:- Salinty, Phosphates, Nitrate , pH & Conductivity
  Soil:- Organic carbon and Chlorides.
- Separation and identification of soil arthropods using Berlese funnel
  (A minimum of five specimens should be reported with the comments in practical record)
- Qualitative and Quantitative study of marine/freshwater planktons.
- Collection and temporary mounting of minimum 3 fresh water planktons (Group/Generic level identification is necessary) .
- Viva based on field study

Genetics **20 Hrs**

- Culture, sexing and etherization of *Drosophila*.
- Study of Mutants in *Drosophila*.
- Genetics problems (Di hybrid cross, test cross and sex linked inheritance)
- Gene order mapping in three point cross (Data to be provided)

Bioinformatics **30 Hrs**

- Data base search and data retrieval-using NCBI, SWISS-PROT, PDB, Expasy.
- Methods of sequence alignment-BLAST and ClustalW.
- Phylogenetic tree using MESQUITE/MEGA/ PHYLIP.
- Gene Prediction using GENSCAN/GRAI.
- Protein structure visualization using RASMOL.

Developmental Biology **30 Hr**

- Study of the developmental stages of Drosophila
- Study of the developmental stages of frog (egg, blastula, gastrula, neurula, tadpole, with external gill and internal gill) using permanent slides/Diagrams.
- Study of serial sections of embryo (tadpole/chick).
- Vital staining of early gastrula of chick - Window method.
- Blastoderm mounting and age determination of chick embryo using vital stains.
- Morphological and histological details of different types of mammalian placenta.

Microbiology **30 Hrs**

- Sterilization, disinfection and safety in microbiological laboratory.
- Preparation of culture media
  liquid media – nutrient broth , peptone water
  Solid media – Nutrient Agar, Mac Conkey' Agar.
  Semi solid agar
  Firm agar.
- Culturing of microorganism –
  broth culture
  pure culture techniques- streak plate, pour plate culture, lawn culture, stab culture
- serial dilution and standard plate count, calculation of Cfu/ml in water samples.
- Isolation and preservation of bacterial culture.
- Identification of microorganisms-
  Staining techniques- gram staining of mixed cultures, negative staining and spore staining, oxidase test, catalase test
- Oxidation/fermentation (O/F) test
- Antibiotic sensitivity (different natural fluids)
- Staining and enumeration of microorganisms:
  (a)using haemocytometer
  nephelometry/ Turbidimetry
- Environmental sample analysis.
  - Coliform count in water
  - Isolation and enumeration of soil bacteria
  - Identification of symbiotic bacterioids from root nodules of leguminous plants

  Bacteriological analysis of milk- methylene blue reductase test

THIRD SEMESTER COURSES

ZL010301	Name of the Course 1	Animal Physiology
ZL010302	" 2	Cell and Molecular Biology
ZL010303	" 3.	Biophysics, Instrumentation and Biological Techniques
ZL010304	" 4	Immunology
ZL010205	" 5	PRACTICAL 3 Molecular, Physiological and Immunological Methods and Approaches in Biosciences

ZL010301 ANIMAL PHYSIOLOGY

72 Hours. (4hrs/week) **Credit-4**

Objectives:

- To study and compare the functioning of organ systems across the animal world
- To give an over view of the comparative functioning of different systems in animals
- To learn more about human physiology

Module I

Digestion and Absorption **(8 hrs)**

Physiology of digestion and absorption (A brief account on vertebrates and invertebrates), Neural regulation of thirst and hunger, Events of absorptive and post absorptive states and their neural and endocrine regulation, , Physiology of starvation and obesity, Leptin: synthesis, secretion and its role in adipogenesis

Module II **(16hrs)**

Circulation **(8hrs)**

Circulatory mechanisms in different animal groups , Haemodynamics, Blood volume and its regulation, Comparative anatomy of heart structure in different animals, Myogenic heart- Conducting system, Cardiac cycle, Cardiac output, stroke volume, Neural and chemical regulation of cardiac activity ECG - its principle and significance.

Respiration **(8 hrs)**

Anatomy of respiratory organs and mechanism of respiration in invertebrates and vertebrates, Pulmonary ventilation, Neural and Chemical Regulation of respiration. Respiration in unusual environment – foetal and neonatal respiration, high altitude, diving.

Module III **(22 hrs)**

Nerve Physiology **(6hrs)**

Neuroanatomy of the central and peripheral nervous system, Modifications of synaptic transmission, Mechanism of excitatory and inhibitory pathway. Neuromuscular Junction- organization and properties , neuromodulators. Neural control of muscle tone and posture.

Sensory and Effector Physiology **(10 hrs)**

Classification of somatic senses and somatic receptors, modality of sensation, exteroceptors, interoceptors, Chemo receptors: Mechanism of reception.
Mechanoreceptors: Mechanism of hearing and Equilibrium
Photo receptors: Structure of invertebrate and vertebrate eye. Physiology of vision.
Pain receptors: Headache, pain suppression (analgesia).
Tactile receptors: Mechanism of transmission of signals

Muscle Physiology **(6 hrs)**

Skeletal muscle- ultra structure and molecular organization. Red and white muscles,Mechanism of muscle contraction and relaxation. Energetics of muscle contraction. Catch muscle and fibrillar muscle.

Module IV **(10hrs)**

Osmoregulation and Excretion **(6 hrs)**

Osmoregulation in fresh water, marine and terrestrial animals.
Comparative physiology of excretion in different animals, Hormonal regulation of urine

concentration, Role of kidney in maintaining homeostasis. Micturition, Dialysis, kidney transplantation.

Thermoregulaion **(4 hrs)**

Temperature compensation and temperature regulation in poikilotherms and homeotherms, Comfort zone, body temperature – physical, chemical, neural regulation,
Adaptations for extreme environments, aestivation and hibernation.

Module V **(16hrs)**

Endocrinology **(10 hrs)**

Invertebrate and vertebrate endocrine glands, Synthesis(Peptide- Insulin, Steroid hormones, Amines- Thyroid) physiological role and mechanism of hormone action. Bioamines, Ecosanoids, Chalones, Lumones, Phytohormones, Synthetic hormones, Pheromones

Reproductive physiology **(6hrs)**

Anatomy and histology of Testis and Ovary, Hormonal regulation of gametogenesis, Physiology of implantation, pregnancy, parturition, and lactation.

Recommended Text Books/Reference Books

Bentley,P.J. 1998. *Comparative Vertebrate Endocrinology* (3rd edn). Cambridge University Press
Bray, J.J., Cragg, P. A, Macknight, A.D, Mills, R.S and Taylor, D.W 1986. *Lecture Notes on human Physiology*. ELBS, New Delhi.
William. S.Hoar, General and comparative physiology
C.L. Prosser, Comparative animal Physiology
Kenneth .S. Saladin 2011, Anatomy and Physiology Sixth edition
Brijlal Gupta and J.A. Ramsay, 1977. *Transport of Ions and Water in Animals*. Academic Press, New York.
Chatterjee, C.C. 1997. *Human Physiology*. Medical allied agency, Calcutta.
Ganong, W.F 1987. *Review of Medical physiology*. Appleton and lang, Norwalk.
Guyton, A.C. 1996. *Text Book of Medical physiology*. Prism Books Pvt.Ltd.Bangalore

ZL010202 CELL AND MOLECULAR BIOLOGY

72 Hours (4 hrs/week) **Credit- 4**

Objectives:

• To help study the structural and functional details of the basic unit of life at the molecular level

• To motivate the learner to refresh and delve into the basics of cell biology

•To introduce the new developments in molecular biology and its implications in human welfare

Module I **(24hrs)**

Cell Membrane& Cell Interactions **(8 hrs)**

Membrane structure,chemistry and functions, dynamic nature of the plasma membrane, membranepotentials, ion channels.

Extracellular matrix: Basement membrane, Collagen, Proteoglycans, Fibronectin and laminin.

Interaction ofcells with extracellular matrix: Integrins. Focal adhesion and hemidesmosomes.

Interaction of cells with other cells: Selectins, Immunoglobulins, Cadherins, Adherens.

Cell Junctions:Tight junctions,Gap junctions, Desmosomes and Plasmodesmata

Prerequisite: *membrane models**,** membrane transport: Simple diffusion, Facilitated,Active&Bulk transport*

Cell Organelles **(8 hrs)**

Endoplasmic reticulum – protein insertion, protein folding, signal sequences and signal hypothesis, Golgi complex-protein glycosylation and protein sorting , mechanism of vesicular transport, Lysosomes.

Prerequisite**:** *Mitochondria, Peroxisomes, Glyoxysomes, Nucleus and Nuclear membrane.*

Cell organization and Cell movement **(8 hrs)**

Structure and organization of Microtubules, Intermediate filaments & Microfilaments, Molecular motors, Non muscle motility and musclecontractility.

Module II

Cell Signaling **12 hrs.**

Extracellular messengers (signaling molecules), role of Calcium and Nitric oxide (NO) as intracellular and intercellular messengers.

Receptors: G- Protein coupled receptors, Receptor tyrosine kinases (RTK), Ion channel receptors, Cytokinereceptors (Tyrosine kinase linked receptors).

Second messengers: Cyclic-AMP, Cyclic-GMP, Inositol1,4,5-trisphosphate (IP3), Di-acyl glycerol (DAG). Signaling pathways: G-protein coupled receptor (GPCR) and cyclic AMP pathway – role of proteinkinase A (PKA), GPCR pathway in rod cells, Receptor protein tyrosine kinase and Ras-MAP kinasepathway, JAK-STAT pathway, Calcium phosphatidyl- inositol pathway, PhosphoInositide 3-kinase (PI-3 kinase),Transforming growth factor (TGF) signaling pathway. Regulation of signaling pathways. Convergence, divergence and crosstalk among

different pathways.
Prerequisite: *Basic principles of cell communication*

Module III

Gene Expression (12 hrs)

Transcription in prokaryotes and eukaryotes, Promoter, enhancer and silencer RNA processing in prokaryotes and eukaryotes, post transcriptional modifications,Translation in prokaryotes and eukaryotes, Genome engineering by the CRISPR/ Cas system
Pre- requisite: *Gene and Genetic code*

Module IV

Gene Regulation (12 hrs)

Regulation of gene expression in *E. coli* :Catabolite repression, *Trp* operon in *E.coli*-repression and attenuation, *Ara* operon in *E.coli*-positive and negative controls. Riboswitches.
General introduction to gene regulation in eukaryotes at the level of chromatin structure, transcriptional - Transcription activators, coactivaors and repressors, Activation and repression of transcription, post transcriptional, translational and post translational levels, methods to identify post translational modification: RNA editing, RNA interference (RNAi).
Pre-requisite: *Fundamentals of gene regulation, Lac operon, Monocistronic and Polycistronic mRNA*

Module V (12hrs)

Cell Growth (5 hrs)

Cell cycle: Stages in cell cycle, Control of cell cycle, Checkpoints in cell cycle. Control of cell division and cell growth.Apoptosis- extrinsic and intrinsic pathways, significance.
Prerequisite: *Mitosis, meiosis*

Cancer (7 hrs)

Basic properties of a cancer cell: Metastasis, interaction of cancer cells with normal cells, Types of cancer, Causes of cancer, Genetics of cancer, Tumor suppressor gene, Oncogene.
New strategies for combating cancer: Immunotherapy, Gene therapy, inhibiting cancer promoting proteins,inhibiting formation of new blood vessels.
Pre- requisite: *benign and malignant tumour*

Recommended Text Books/Reference Books

Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K. And Walter, P. 2017. *Molecular Biology of the Cell*. (6thedn). Garland Science.- Taylor and Francis group, USA.
Clark, D.P. 2010. *Molecular Biology*. Elsevier Publishers, London.
Cooper, G.M. and Hausman, R.E. 2018. *The cell: A Molecular Approach* (8thedn). Sinauer Associates,Inc, ASM Press, Washington DC.
Griffiths, A.J.F., Wesler, S.R., Carroll, S.B. and Doebley, J. 2008. *Introduction to Genetic Analysis.* W H Freeman and Company,USA
Hardin, J., Bertoni, G. 2018. *Becker's World of the Cell*. (9thedn). Pearson, England.
Hyde, D.R. 2010.*Genetics and Molecular Biology*. Tata McGraw Hill Education Private Ltd., NewDelhi.

Karp, G. 2013. C*ell and Molecular Biology* (7thedn). John Wiley and Sons, Inc.NJ, USA.
Klug, W.S. and Cummings, M.R. 2004. *Concepts of Genetics*. Pearson International, New Delhi.
Krebs, J.E., Goldstein, E.S. and Kilpatrick, S.T. 2017. *Lewin's Genes XII*. Jones and Bartlett publishers,NY.
Lodish, H., Berk, A., Kaiser, C.A., Krieger, M., Bretscher, A., Ploegh, H.,Amon, A.and Martin,K.C. 2016. *Molecular Cell Biology* (8th edn). W H Freeman & Company, U.S.A.
Pierce, B.A. 2008. *Genetics: A conceptual approach*. W H Freeman and Company.

Pollard, T.D. and Earnshaw, W.C. 2008. *Cell Biology*. Saunders Elsevier.
Snustad, D.P. and Simmons, M.J. 2010. *Principles of Genetics*. John Wiley and Sons.
Watson, J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M. and Losick, R. 2013. *Molecular Biology of the Gene*(7th edn). Pearson.

ZL010303 BIOPHYSICS, INSTRUMENTATION AND BIOLOGICAL TECHNIQUES

72Hours (18 + 54)4hrs/week **Credit – 4**

Objectives:
To understand the biological system and processes based on physical principles
To provide and insight on the tools and techniques of various instruments available for biochemical and biophysical studies
To train the learner the operational skills of different instruments required in Zoology

BIOPHYSICS 18hrs

Module 1

Diffusion and Osmosis (6hrs)
Diffusion – Kinetics of diffusion. Fick's law and diffusion coefficient.Gibb's Donnan equilibrium. Application of diffusion processes in biology: haemolysis. Vant Hoff's laws. Osmotic concentration, Osmotic pressure and osmotic gradient.
Biological significance of osmosis in animals and plants.

Bioenergetics (6hrs)
Reversible thermodynamics and irreversible thermodynamics; Systems – open, closed and isolated. Photo bioenergetics. Photosynthesis – light and dark reactions, Redox couple and redox potential. Chemo-bioenergetics: electron transport and oxidative phosphorylation, Chemiosmotic theory and binding change mechanism of ATP synthesis.

Radiation Biophysics (6hrs)
Interaction of radiation with matter – Photoelectric effect, ion pair production, absorption and scattering of electrons. Biological effects of radiation: effect on nucleic acids, proteins, enzymes and carbohydrates. Cellular effects of radiation: somatic and genetic. Nuclear medicine: Internally administered radioisotopes. Radioiodine in thyroid function analysis.

INSTRUMENTATION & BIOLOGICAL TECHNIQUES 54hrs

Module II

Microscopy and Histological Techniques (18hrs)

Microscopy (10hrs)
Differential Interference contrast (Nomarsky) microscopy, Fluorescence microscopy,Confocal microscope, Scanning Tunnelling, Electron microscope - TEM, SEM,Specimen preparation-Shadow casting, Freeze fracturing, Freeze etching,Negative staining. Microphotography, Atomic force microscope

Histological Techniques (8hrs)
Types of microtomes and microtomy.Fixation, preparation of temporary and permanent slides, whole mounts, smears, squashes and sections.Cytochemical and histological method, Histochemistry of nucleic acids, detection of carbohydrates, proteins and lipids.

Module III

Separation Techniques (20hrs)

Centrifugation (2hrs)
Basic principle and application. Differential, density and ultracentrifugation.

Chromatography (10 hrs)
Basic principles, working and applications of Thin-layer chromatography, Ion – exchange and Affinity chromatography; High performance liquid chromatography (HPLC), Fast protein liquid chromatography (FPLC),Gel permeation chromatography.

Electrophoresis (8 h rs)
Gel electrophoresis– PAGE, SDS and non SDS,2D Gel electrophoresis, Isoelectric focusing,Density gradient gel electrophoresis, Disc electrophoresis, High voltage electrophoresis, Capillary gel electrophoresis, Electrophoretic mobility shift assay (EMSA).

Module IV

Advanced Techniques and Applications (12hrs)
Colorimetry (2 hrs)
Principle and applications of colorimetry and spectrophotometry- Beer Lambert law

Spectroscopy (10hrs)
Fourier-Transform infrared spectroscopy (FTIR), Raman spectroscopy, Circular dichroism spectroscopy,Flame emission spectroscopy, Atomic absorption spectroscopy, Nuclear Magnetic-resonance spectroscopy (NMR)and Electron Spin Resonance (ESR) spectroscopy, Mass spectroscopy- Different types and applications: MALDI-TOF, LCMS, Tandem Mass Spectrometry.

Module V (4hrs)

Radioisotope Detection and Measurement (2hrs)
Dosimetry: Ionization chamber, GM counter, Solid and liquid scintillation counters, Autoradiography.

Biomimetics technology (2 hrs)
Principles and applications-Bio-Nanorobotics,Artificial muscles using Electroactive polymers, Multifunctional materials

Recommended Text Books/Reference Books

Alonso, A., and Arrondo, J.L.R.2006. *Advanced Techniques in Biophysics*.Springer,UK

Arora, M. P. 2007. *Biophysics*. Himalaya Publishing House, New Delhi

Bar-Cohen, Yoseph. *Biomimetics: Biologically-Inspired Technologies*. 2006. CRC Press.

Das, D. 1991. *Biophysics and Biophysical Chemistry*. Academic Publishers, Calcutta

Edward, A.L. 1997. *Radiation Biophysics*. Academic Press,NewYork,USA

Ernster, L. (Ed.). 1985. *Bioenergetics*. Elsevier, NewYork,USA

Ghatak K.L. 2011.*Techniques and Methods in Biology*. PHI Learning Pvt. Ltd. New Delhi

Gupta A. 2009. *Instrumentation and Bio-Analytical Techniques*.PragatiPrakashan, Meerut

Hoope, W. et.al. 1983. *Biophysics*. Springer Verlag, Berlin

Keith Wilson and John Walker. 2010. *Principles and techniques of Biochemistry and Molecular Biology*.7th Edition.

Lehninger, A.L.1971. *Bioenergetics*. W.A. Benjamin, London,UK

Narayanan, P. 2000. *Essentials of Biophysics*.New Age International (P) Ltd. Publishers, New Delhi

Nelson D.L. & Cox, M.M., 2006. *Lehninger's Biochemistry*, W.H. Freeman and company, USA

Pradeep T. 2007. *NANO: The Essentials. Understanding Nanoscience and Nanotechnology*.Tata McGraw Hill Education Pvt. Ltd., New Delhi

Roy, R.N. 1996. *A Textbook of Biophysics*. New Central Book Agency (P) Ltd. Calcutta

Sandhu, G.S. 1990. *Research Techniques in Biological Sciences*. Anmol Publications, New Delhi

Srivastava,P.K. 2006. *Elementary Biophysics.AnIntroduction*.Narosa Publishing House, New Delhi

Trunk Dung Ngo. 2015. *Biomimetic Technologies: Principles and Applications.*Woodhead Publishing

Varghese, T. and Balakrishna, K.M.2012. *Nanotechnology-An Introduction to Synthesis, Properties and Applications of Nanomaterials*. Atlantic Publishers and Distributors. (P) Ltd. New Delhi

ZL010304 IMMUNOLOGY

Total: 54 Hours. (3hrs. /week). **Credit- 3**

Objectives:

- To provide an intensive and in-depth knowledge to the students in immunology
- To help the learner to understand the role of immunology in human health and well-being
- To familiarize the students the new developments in immunology

Module I **(12hrs)**

Overview of the Immune System

(4 hrs)

- Cells, tissues and organs involved in immune system.
- Haematopoiesis- B-cell and T-cell maturation and differentiation.
- Haematopoietic growth factors.
- B-Cell receptors.
- T-Cell receptors
- Toll-like receptors

Immunogenicity and Antigenicity **(8 hrs).**

- Factors that influence immunogenicity
- Haptens, Adjuvants, Epitopes.
- Properties of B-cell and T-cell epitopes
- Immunoglobulins-structure, classes and functions.
- Antigenic determinants of immunoglobulin - (a) Isotype (b) Allotype (c) Idiotype.
- Immunoglobulin genes- Multigene organization.
- Generation of antibody diversity.
- Monoclonal antibodies and clinical uses.
- Antibody engineering.

Module II **(19hrs)**

Antigen –Antibody Interactions **(6 hrs)**

- Strength of antigen-antibody interaction- antibody affinity and avidity.
- Types of antigen-antibody reactions - Cross-reaction, Precipitation, Agglutination.
- **Immunological Techniques** - Immunoprecipitation. Immunofluorescence. Flow cytometry and fluorescence. Immunoelectron microscopy. Radio-allergosorbent Test (RAST). ELISA and RIA .

The Complement System **(4 hrs)**

- Complement activation-Classical, Alternate and Lectin Pathways.
- Terminal sequence of complement activation (MAC).)
- Regulation of complement system.
- Biological consequences of complement activation.
- Complement deficiencies .

Module III **(9hrs)**

Immune Effector Mechanisms **(5 hrs).**

- Types of Inflammation- acute and chronic.
- Chemokines.
- Role of cytokines in immune system (Placed as independent topic).
- Properties and functions of Cytokines.

- Cytokine antagonists.
- Therapeutic uses of cytokines.

Hypersensitivity **(4 hrs)**

- Types of Hypersensitivity- IgE- mediated (type- I) hypersensitivity.
  Antibody- mediated cytotoxic (type- II) hypersensitivity.
  Immune complex- mediated (type- III) hypersensitivity.
  Delayed type (type- IV) hypersensitivity.
  Stimulatory (type V) hypersensitivity

Module IV **(18hrs)**

Major Histocompatibility Complex **(8 hrs)**

- General organization and inheritance of MHC.
- MHC genes. Genomic map of H-2 Complex in the mouse.
- HLA Complex in humans. MHC-peptide interaction.
- Expression of MHC molecules on different cell types.
- Biological significance of MHC. HLA typing
- Antigen processing and presentation

Immunity in Health and Disease (**10 hrs)**

- Congenital immunodeficiency diseases (SCID, WAS, CVI, Ataxia, CGD, LAD).Acquired Immunodeficiency Disease (AIDS).
- Autoimmunity. Organ- specific autoimmune diseases. Systemic auto-immune diseases.
- Immune response during bacterial (Tuberculosis), parasitic (Malaria) and viral (HIV) infections (include).

Vaccines –Whole organism vaccines, Purified macromolecules as Vaccines, Recombinant vector vaccines, DNA vaccines. Synthetic peptide vaccines, Multivalent subunit vaccines.

Module V

Transplantation immunology **(5 hrs)**

- Immunologic basis of graft rejection.
- Clinical manifestation of graft rejection.
- General and specific immunosuppressive therapy.
- Clinical transplantation.

Recommended Text Books/Reference Books

Abbas, A.K., Lichtman,A.K and Pober , J.S. 1997. *Cellular and Molecular Immunology*. W.B. Saunders Co. New York

Ashim K. Chakravarthy. 1998. *Immunology*. Tata McGraw-Hill, New Delhi.

Chakraborty, A.K. 2006.*Immunology and Immunotechnology*. Oxford University Press,New Delhi

Darla,J, Wise &Gordeon,R.Carter. 2004. *Immunology- A Comprehensive Review*. Iowa State University Press. A Blackwell Science Co,USA

David Male,JonathanBrostoff, David Roth and Ivan Roitt. 2006. *Immunology*. Mosby, Edinburgh,UK

Goldsby, R.A.,Kindt, T.J. and Osborne, B.A.2000. *Immunology* (4thedn.). W.H. Freeman and Co. NY,USA.

Hannigan, B. M., Moore, C. B. T. and Quinn, D. G. 2010.*Immunology*. Viva Books, New Delhi.

Helen Chappel and Maused Harney, 2006.*Essentials of Clinical Immunology* (5thedn.) Blackwell Scientific Publications

Ivan M. Roitt, 2002. *Essential of Immunology*. ELBS, New Delhi.

Khan.F.H. 2009.*The Elements of Immunolgy*.Pearson Education.New Delhi.

Kuby J, 2000. *Immunology* (7thedn.). WH Freeman & Co. New York.

Richard Coico and Geoffrey Sunshine. 2009. *Immunology: A short course*. Wiley-Blackwell,CA,USA

ZY3CP03: PRACTICAL 3

MOLECULAR, PHYSIOLOGICAL AND IMMUNOLOGICAL METHODS & APPROACHES IN BIOSCIENCES

180 Hours (10hrs./week) Credit-4

Cell & Molecular biology and Biotechnology 72hrs

- Squash preparation of grasshopper testis to study meiotic stages.
- Squash preparation and identification of salivary gland chromosomes in *Drosophila* / *Chironomus* larva.
- Determination of mitotic index in the squash preparation of onion root tip.
- Effect of drugs on cell division (Colchicine or any other inhibitor)
- Live staining of cells using vital stains and viability study
- Cell fractionation and Differential Centrifugation to isolate mitochondria and nuclei
- Preparation of Microtome section & spreading
- Histochemical staining of carbohydrates (PAS), Protein (Bromophenol blue), lipids (Sudan Black), DNA (Fuelgen stain
- Gel electrophoresis of protein and nucleic acid (Demonstration)
- Isolation of genomic and Plasmid DNA.

Biophysics/Instrumentation/Biological Techniques 36 hrs

- Micrometry- principle and measurement of microscopic objects: Low power and high power
- Camera Lucida – Diagrammatic representation of specimen using camera lucida

- Principle and working of phase contrast microscope, Micro-photographic equipment,
- Identification of absorption maxima of the given sample by colorimetry
- TLC using amino acids from purified samples and calculation of RF values
- Analysis of biological materials (Arthropodan perilymph) using TLC

Animal Physiology 72 hrs

- Rate of salivary amylase activity on starch (colorimetry)
- Effect of different pH on salivary amylase activity (colorimetry)
- Influence of temperature on salivary amylase activity – Calculation of Q10
- Effect of drugs on the heartbeat of cockroach (Result with graphical representation corresponding to different concentration and time intervals expected)
- Oxygen consumption in fish (normal and stressed).
- Kymograph: working principle and applications.
- Virtual Practicals in Physiology
  (Use of PhysioEX 9.0 : *Laboratory Simulations in Physiology* by P.Zao.,T.Stabler., L.A.Smith and E .Griff. 2011.is suggested) for muscle and nerve physiology practical for class room training and for practical examination in order to replace Frog as per UGC guidelines). Any four of the following:
  Muscle Twitch and the Latent Period, The effect of stimulus Voltage on Skeletal Muscle Contraction, Tetanus, Fatigue, Receptor Potential, The Action Potential Threshold, Importance of Voltage –Gated Na+ Channels

- Differential count of Human WBC
- Haematocrit and ESR of Human blood
- Feeding activity of paramecium
- Effect of different concentration of NaCl solution (0.1%-2%) on the diameter of RBCs (preferably human) and determination of the concentration , which is isotonic to the blood from a plot of diameter of RBC against concentration of NaCl

Immunology

- Separation of lymphocytes from whole blood.
- Separation of T and B lymphocytes
- Blood Typing in Man.
- WIDAL Test and Western Blotting –Demonstration
- ELISA -Demonstration
- Rocket Immuno electrophoresis- Demonstration

Note:

Good laboratory practices and green protocol should be practiced in the lab. Virtual Practical developed by the Ministry of Human Resources, Govt. of India and available in the web site:**www.vlab.ac.in** can be availed for demonstration.

FOURTH SEMESTER COURSES

ELECTIVE A: FISHERY SCIENCE

ZL800401	Name of the Course 1 Nutrition, Growth and Physiology of fishes
ZL800402	" 2 Fishery Resource Management
ZL800403	" 3. Fishery Science and Technology
ZL800404	" 4 Practical : Fishery Science – Methods and Approaches

ZL800401 NUTRITION, GROWTH AND PHYSIOLOGY OF FISHES

90 Hours (5 hrs./Week) **Credit-4**

Objectives:

- To impart knowledge on various aspects of fish biology
- To understand the basic principles of fish nutrition and the function of individual nutrients.
- To learn functional physiology of fishes.

Module 1 **S** **(14hrs)**

Food and feeding biology **(4 hrs)**

Components of balanced food, classification of fish food organisms, ingestion of food and feeding mechanism. Feeding adaptations.

Digestive system and physiology of digestion **(10 hrs)**

Digestive system in fin fish and shell fish. Anatomy, histology and functions of different parts of gastro-intestinal tract in herbivores and carnivores. Modification of digestive system in relation to age and growth.
Physiology of digestion, absorption and assimilation. Role of hormone in the regulation of digestion. Factors affecting digestion and transport of nutrients.

Module II **(27hrs)**

Fish Nutrition **(20 hrs)**

Energy nutrition – Definition, energetics, expression of energy value of feed – gross energy, digestible energy, metabolizable energy, net energy. Partitioning of energy, protein energy ratio. Protein nutrition of fish– source, function and deficiency symptom. Lipid nutrition – source, function and deficiency symptom. Carbohydrate nutrition – source and function.
Vitamin and mineral nutrition –source, functions, deficiency symptoms.
Larval nutrition – Importance of live feed and artificial feed, different types of feed available for larvae, larval gut morphology and mode of nutrition.
Brood stock nutrition – Nutrients required for reproduction, egg and sperm quality.
Feed additives – classification, function, specific use for economic and quality fish and shellfish production.

Growth **(7 hrs)**

Concept of growth, determination of age and growth, growth curve, length weight relationship. Metabolism (anabolism and catabolism) and growth. Biotic and abiotic factors affecting growth. Role of nutrients and hormones in the regulation of growth.

Module III

Reproductive physiology and endocrinology (20 hrs)

Sexual dimorphism, primary and secondary sexual characters, bisexual reproduction, inter-sexes, hermaphroditism, sex differentiation and factors affecting sex differentiation. Sex reversal in fish and factors affecting sex reversal.

Development of gonad, oogenesis, Mechanism of oocyte maturation and ovulation, spermatogenesis, metabolic changes during oogenesis and spermatogenesis, vitellogenesis and gonadal steroidogenesis.

Modes of reproduction – oviparity, aplacentalviviparity and placental viviparity.

Annual reproductive cycle and breeding patterns in male and female, pheromones and reproductive behaviour, nest building and parental care. Hormonal and environmental regulations of reproduction.

Regulation of seasonal reproduction – Role of environment: temperature, photoperiod, rainfall. Role of hypothalamo-hypophyseal system and pineal gland, role of peripheral endocrine system.

Module IV (19hrs)

Sensory Organs (7hrs)

Structure and function of sense organs. Visual, chemoreception, statoacoustic, mechanoreceptors, thermoreceptors, electroreceptors.

Specialised Characters (12hrs)

Gill structure and physiology of respiration. Accessory respiratory organs, mechanism of air breathing. Swim bladder, structure and function. Weberianossicle. Electric organs, Luminescent organs. Sound production and detection. Acoustic communication. Venomous fishes.

Adaptations to special conditions of life – hill stream, cave, deep sea.

Chromatophore pigments and colouration. Physiology of colour change.

Module V

Physiology of behaviour (10 hrs)

Concepts on fish behaviour and regulatory mechanism. Alarm reaction transduction mechanisms.

Domestication processes in communicative behaviour. Locomotive behaviour. Behaviour due to environmental partition.

Chemical signals to evoke feeding behaviour. Aestivation and hibernation. Migrations and orientation.Predatory avoidance. Adaptation mechanism in altered environment.

Recommended Text Books/Reference Books

Brown C, Laland KN & Krause J. 2006. *Fish Cognition and Behaviour***.** Blackwell**.** Pitcher TJ. 1993. *Behaviour of Teleost Fishes*. Springer.

Chandrasekhar, Y.S. 2013. *Fish Nutrition in Aquaculture*. Swastick Publications, Delhi.

Cyrino EP & Bureau D & Kapoor BG. 2008. *Feeding and Digestive Functions in Fishes.* Science Publ.

Evans, D.H and Claiborne, J.D 2006. *The physiology of fishes*. Taylor and Francis group, CRC Press, UK
Guillame J, Kaushik S, Berqot P &Metallier R. 2001. *Nutrition and Feeding of Fish and Crustaceans*. Springer Praxis.
Holt, G.J. 2011. Larval Fish N*utrition*. Springer-Verlag, New York
Halver JE & Hardy RW. 2002. *Fish Nutrition*. Academic Press.
Hoar WS & Randall DJ.1988. *Fish Physiology*. Academic Press.
Lovell, T. 2009. *Nutrition and Feeding of Fish*. Springer-Verlag, New York
Lynwood S Smith, 1999. *Introduction to fish Physiology*. Narendra Publishing house, Delhi
Rankin JC & Pitcher TJ.1983. *Control Processes in Fish Physiology*. Springer.
Raghunath, M.R. 2013. *Nutrition and Feeding of Fishes*. Swastik Publishing House, Delhi.
Smyth & Lynwood. 2003. *Introduction to Fish Physiology*. Narendra Publishing House, Delhi, 352pp.
SurendraNath. 2002. *Food, Feeding habits and Alimentary canal of fishes*. Vinod Publishers and Distributors, India.

ZL800402 FISHERY RESOURCES AND MANAGEMENT

90 Hours (5 hrs./Week) **Credit – 4**

Objectives:

- To impart knowledge in inland and marine fishery resources of India
- To educate the students on the oceanographic concepts related to fisheries
- To impart theoretical knowledge on application of remote sensing and GIS in fisheries
- To impart theoretical knowledge of benthic ecology.
- To impart knowledge on interactions between aquaculture and the environment.

Module I **(30hrs)**

Inland Fishery Resources **(10 hrs)**

Categorization of different fresh water and brackish water resources – Ponds, lakes, tanks, rivers, reservoirs, estuaries, brackish water lagoons, wetlands, mangroves and derelict water bodies.Important economically important fin and shell fish resources of Kerala. Scope of inland fishery in Kerala.

Riverine fishery resources – major riverine fisheries in India. Penninsularrivers and its fishery diversity with special reference to endemic species in Kerala. Present status of riverine fishery in Kerala.

Reservoir fisheries – Classification of reservoirs. Reservoir fishery of Kerala. Methods for enhancement of productivity.

Estuarine fisheries – Classification of estuaries. Status and potential of estuarine fisheries in Kerala. Status of mangrove fishery in India.

Inland Fishery – Problems, conservation and management **(20 hrs)**

Direct and indirect effects of human intervention and management challenges in riverine fishery. Present trend of dwindling riverine fishery resources. Habitat modification and improvement – restoration, rehabilitation of channels and flood plain. Stock enhancement strategies.

Methods for conservation, management and enhancement of productivity in reservoirs.

Effect of dam on riverine fishery. Protection and restoration of fish movements – different types of fish passes and enhancement of fish migration.

Strategies for the conservation and management of estuarine system.

Mangrove ecosystem – degradation and its problems on fisheries.

Derelict water bodies – problem and fishery management aspects.

Riverine sand mining and its effect on benthic biodiversity and fisheries.

Invasive species and its effect of indigenous species and fishery.

Activities of FIRMA. Matsyafed – objectives and different activities for the development of fishery of Kerala.

Module II **(15hrs)**

Marine fishery resources **(7 hrs)**

Major fishing regions of the sea. Important finfish and shellfish resources in demersal and pelagic system. Sea weeds.
Issues and challenges of managing multi-gear fisheries.
Mud bank formation and significance. Mud bank fishery in Kerala.

Marine Biodiversity and conservation **(8 hrs)**

Marine biodiversity – threats, planning and management aspects.
IUCN criteria – Red list, Wild life Protection Act, International treaties and conventions, Marine protected areas, Sanctuaries and Biosphere reserves. Establishment of National marine parks, *in situ* and ex *situ* conservation. Coastal tourism.

Module III
Fisheries Oceanography **(20 hrs)**

Oceanographic factors in fisheries – effects of physicochemical (Salinity, temperature, pH, light, pressure, dissolved gasses and nutrients) and biological oceanographic factors on adaptation, behaviour, abundance and production of organisms.
Synoptic oceanographic analysis – currents, waves, tides, amplitudes, stratification, related chemical factors, upwelling and circulation patterns.
Fisheries forecasts – Remote sensing, Global positioning system (GPS). Application of remote sensing in fisheries. Eco-sounders and Sonar – applications in fishery. Interpretation and use of thermal structure in fisheries.
Factors affecting coastal marine fishery – environmental factors influencing the seasonal variations in fish catches in the Arabian Sea. Potential fish zones (PFZ). Fishery trawling ban in Kerala.

Module IV
Aquaculture and Management Aspects **(20 hrs)**

Fresh water fish farm – survey of site, layout, soil and water quality requirements. Pond fertilization. Different kinds of fertilizers and manures. Bio-fertilizers, use of treated sewage for pond fertilization.
Methods of culture fishes of Indian major Carps, exotic Carps, Catfishes, Murrels, Tilapiaand Prawns.
Methods of culture of grey mullet, milk fish, crabs, shrimps. Traditional (Bheries, Pokkali) and modern methods of prawn culture. Culture of pearl oyster, edible oyster and sea mussels.
Integrated fish culture. Composite fish culture. Integrated farming and aquaponics. Benefits of aquaponics.
Ornamental fishery and its export from India. Aquarium fishes. Setting up and maintenance of an aquarium.
Management of hatcheries and farms. Methods for control and management of aquatic weeds in the system.Role of microorganisms in fish production, microbial load and algal bloom. Algal bloom control.

Module V

Fisheries Education **(5 hrs)**

Objectives and functions of Fisheries Institutes – Central Institutes of Fisheries Education (CIFE), Central Inland Capture Fisheries Research Institute (CICFRI), Central Marine Fisheries Research Institute (CMFRI), Central Institute of Fisheries, Nautical and Engineering Training (CIFNET), Central Institute of fisheries technology (CIFT), National Institute of Oceanography (NIO), National Institute of Fisheries Post Harvest Technology and Training (NIFPHATT).Central Institute of Brackish water Aquaculture (CIBA), Fishery survey of India (Brief account only).

Recommended Text Books/Reference Books

Aravind Kumar, 2004. *Fishery Management*. APH Publ. Corpn., New Delhi, 371 pp

Badapanda, K.C. 2012. *Aquaculture*Vol.1 .Narendra Publishing House, Delhi, 496pp.

Balakrishnan Nair N and Thampi D M 1980. *A text book of marine ecology*. Publisher Macmillan

Carter RWG. 1998. *Coastal Environments: An Introduction to the Physical, Ecological and Cultural Systems of Coastlines*. Academic Press.

Dholakia A D 2001. *Fisheries and Aquatic Resources of India*. Daya Publishing House, New Delhi.

De Silva SS & Anderson TA. 1995. *Fish Nutrition in Aquaculture*. Chapman & Hall.

Jhingran VG. 1991. *Fish and Fisheries of India*. Hindustan Publ. Corp.

Laevastu T & Hayes ML. 1981. *Fisheries Oceanography and Ecology*. Fishing News Books.

Lalli CM & Parsons TR. 1993. *Biological Oceanography: An Introduction*. Elsevier.

Long, A.C. 2012. *Fish feeding and integrated fish farming*. Cybertech Publications, Delhi.

Miller CB. 2004. *Biological Oceanography*. Blackwell.

Patro&Lingaraj. 2012. *Fisheries & Aquaculture*. Sonali Publication, Delhi, 473pp

Pillay TVR &Kutty MN. 2005. *Aquaculture: Principles and Practices*. 2nd Ed. Blackwell.

Pillai N.G.K 2011. *Marine fisheries in India*, ICAR, New Delhi

Pandey N &Davendra SM. 2008. *Integrated Fish Farming*. Daya Publ. House.

Reddy MPM. 2007. *Ocean Environment and Fisheries*. Science Publ.

Sakhare, V.B. 2012. *Inland fisheries*. Daya publishing house, Delhi, 326pp.

Sharma A.P. 2012. *Management issues in Inland Fisheries and Aquaculture.*Narendra Publishing House, Delhi, 243pp.

Sugunan, V.V. 1995. *Riverine Fisheries of India*. FAO Publication, 423 pp.

Sugunan V.V. 1997. *Reservoir Fisheries of India*. Daya Publ. House.

Welcomme RL. 2001. *Inland Fisheries: Ecology and Management*. Fishing News Books.

Society of Fisheries Technology (India), 2000. *Riverine and Reservoir fisheries of India*. Proceedings of the National Seminar on Riverine and Reservoir Fisheries – Challenges and Strategies, 2001, Cochin.

ZL800403 Fishery Science and Technology

90 Hours (5 hrs./Week) **Credit-4**

Objectives:

- To understand the advances in aquaculture
- To outline an overview on the potential marine resources for bioactive compounds and pharmaceuticals
- To give detailed insight into various aspects of freezing of fish and thermal/heat processing.
- To understand various aspects of quality assurance system, quality management and national/international certification system.
- To learn factory sanitation and hygiene, water quality and standard
- To provide information on various fish by-products and fishing methods

Module I **(27hrs)**

Aquaculture Biotechnology **(20 hrs)**

Fish breeding – Induced breeding and hypophysation: synthetic and natural hormones, cryopreservation of gametes and artificial fertilization. Application of biotechnology for accelerating gonadal growth and manipulation of the duration of spawning.
Transgenesis – methods of gene transfer in fishes, screening for transgenics, applications, regulation of GMOs, IPR, evaluation of GFP transgenics.
Gene bank and conservation – conservation of gametes and embryos.
Algal technology – microalgae: indoor and mass culture methods, biotechnological approaches for production of important microalgae, single cell protein from Spirulina, raceway system of micro algae culture, vitamins, minerals and omega3 fatty acids from micro algae, enrichment of micro algae with micronutrients.
Post harvest biotechnology – delaying spoilage, detection of toxic substances and pathogenic microbes, biosensors for toxins.

Marine Biotechnology **(7 hrs)**

Marine resources – biodiversity, marine natural products, valuable chemicals, biomedical and bioactive compounds from marine organisms, commercial bio-products from marine organisms, green fluorescent protein form jelly fish and its application, marine organisms as a sources of polysaccharides, antiviral, anticancer and anti-inflamatory compounds. Commercially important enzymes-xylanase, agarase, proteaess, chitinases, lipases, cellulae and phytase.

Module II

Advances in Feed Technology **(15 hrs)**

Feed formulation – least cost formulation, linear programming. Quality of feed ingredients and their biochemical composition. Protein and energy supplements. Premixes of vitamins and

minerals. Antioxidants in diets. Toxins in feeds. Exogenous enzymes. Feed probiotics and their role. Feed additives. Water stability of diets.
Feed technology – micro encapsulated feeds, micro coated feeds, micro particulate feeds and bio capsulated feeds, mycotoxins and their effects on feeds.
Feed manufacture – processing of feed mixtures, steam pelleting. Stability of nutrients. Factors affecting feed manufacture. Effects of processing on the nutritional value of feeds. Process of reducing anti-nutritional factors. Feed mills. Quality control of feed. Storage of feed and feed deterioration.

Module III

Technology of fish freezing (12 hrs)

Crystallization, homogeneous and heterogeneous nucleation, super cooling, crystal growth eutectic point, location of ice crystals in tissue, physical changes during freezing.
Technological aspects of freezing: slow and rapid freezing, methods of freezing, comparison of various freezing methods, selection of a freezing method, product processing, packaging and different types of freezers.
Chemical treatments prior to freezing: antioxidants, cryoprotectants and other addictives, theories of cryopreservation, glazing
Frozen storage: physical and chemical changes, freezer burn and recrystallization, different types of recrystallization.
Different methods of thawing frozen fish, advantages and disadvantages. Recent advances in fish thawing.

Module IV (21hrs)

Thermal processing of fishery products (8 hrs)

Principles of thermal processing. Mechanism of heat transfer: conduction, convention, radiation and dielectric and microwave heating, heat resistant of bacteria and spores. Thermal death time. Significance of thermal death curve. Heating equipment.
Canning process, steps involved, process flow, addictives, HTST processing and aseptic canning, principles and process details, canning machinery and equipment.
Spoilage of canned food, physical, chemical and microbial. Thermo bacteriology, death of bacteria, auto sterilisation bacteriology of canned/heat processed fishery product, examination of canned and seams.

Fishery By-products (5 hrs)

Traditional fishery by-products: fish meal and fish oil – preparation and uses. Processing of wastes – prawn heads, chitin, chitosan, fish protein concentrate (FPC) preparation. Uses of shell, isinglass, glue, guano, fins and leathers. Packaging, storage and transport of fish products.

Quality control in processing industry (8 hrs)

Plant sanitation and hygiene. Water quality and standard. Inspection system.

Quality assessment of fish and fishery products – physical, organoleptic and microbiological quality standards. National and International standards. Integrated food law.
Sensory evaluation of fish and fish products, basic aspect, different methods of evaluation.

Module V

Fishing Methods **(15 hrs)**

Crafts and gears used for fishing in inland and marine waters. Gears – types and designs, operation and efficiency. Destructive and prohibited fishing practices. Recent advances in fishing method. Fishing using electricity, light. Bycatch reduction devices: definition, types of bycatch reduction devices and the principles of operation. Fish finders – ecosounders and sonar and their use. Different type of turtle excluder devices (TEDs). Advanced communication systems – VHF, SSB, Inmarsat system. Vessel monitoring systems (VMS): Important uses, role in fisheries management.
Fishing harbours – classification, facilities, layout of a typical fishing harbour. Fishing harbours of Kerala coast.

Recommended Text Books/Reference Books

Balachandran KK. 2001. *Post-harvest Technology of Fish and Fish Products*. DayaPubl.House.
Fingerman M, Nagabushana M & Thompson R. 1998. *Recent Advances in Marine Biotechnology*. Vol.II. Science Publ.
Fingermann, Milton, Nagabhushanam&Rachakonda. 2000. *Recent Advances in Marine Biotechnology*. Oxford & IBH publishing Co. Pvt. Ltd., Delhi, 382pp
Fusetani N. 2000. *Drugs from Sea*. Karger Publ.
Gopakumar K. (Ed.) 2002. *Text Book of Fish Processing Technology*. ICAR
Huss HH, Jakobsen M & Liston J. 1991. *Quality Assurance in the Fish Industry*. Elsevier.
Lakra WS, Abidi SAH, Mukherjee SC &Ayyappan S. 2004. *Fisheries Biotechnology*. Narendra Publ. House.
Nair PR. 2008. *Biotechnology and Genetics in Fisheries and Aquaculture*. Dominant Publ.
Nagabhushanam R, Diwan AD, Zahurnec BJ &Sarojini R. 2004. *Biotechnology of Aquatic Animals*. Science Publ.
Nambudiri DD. 2006. *Technology of Fishery Products*. Fishing Chimes.
Ninawe A. S &Khedkar G D, 2009. *Nutrition in Aquaculture*. Narendra Publishing house, Delhi
Pandian TJ, Strüssmann CA & Marian MP. 2005. *Fish Genetics and Aquaculture Biotechnology*. Science Publ.
Reddy PVGK, Ayyappan S, Thampy DM &Gopalakrishna. 2005. *Text Book of Fish Genetics and Biotechnology*. ICAR.
Sen DP. 2005. *Advances in Fish Processing Technology*. Allied Publ.
Venugopal V. 2006. *Seafood Processing*. Taylor & Francis.
Vincent K &Omachonu JER. 2004. *Principles of Total Quality*. CRC Press.
Zeathen P. 1984. *Thermal Processing and Quality of Foods*. Elsevier.
Training Programme on Seafood quality Assurance. Central Institute of Fisheries Technology (ICAR).
Quality Assurance in seafood processing, 2000. Published by CIFT and Society of Fisheries Technology.

PRACTICAL 4

FISHERY SCIENCE: METHODS &APPROACHES

180 Hours (10 hrs/week) **(Credit – 4)**

Taxonomy

Study of distinguishing features (morphometric and meristic)

- Identification of bony and cartilaginous fishes using manuals (marine and freshwater – any 10 fishes)
- Identification and classification of distinguishing features of commercially important shell fishes (crustaceans and molluscs – any 5 shell fishes)

Anatomy **54 Hrs**

Study of anatomy of a teleost fish

- Studies on gills, scales, pharyngeal teeth and brain of fishes (Mounting and/or spotters)
- Dissection and display of
  - Digestive system, (Minor)
  - Urinogenital system (Minor)
  - Swim bladder (Minor)
  - Weberian ossicles, (Minor)
  - Branchial Blood vessels and Blood supply to air breathing organs
  - Cranial nerves – V, VII, X
- Study of skeletal system – skull and vertebrae

Physiology **36 Hrs**

- Determination of haemoglobin content in fish blood
- Identification of blood cells in teleost fish
- Determination of the rate of ammonia excretion in fish
- Estimation of total protein in fish muscles
- Identification of amino acids in fish muscles by TLC

Fishery biology **36 Hrs.**

- Study of feeding habits of fish through qualitative and quantitative analysis of gut contents of herbivore, carnivore and omnivore species.
- Determination of gonadosomatic index
- Estimation of fecundity
- Measurement of ova diameter
- Length – weight relationship

Fishery technology **18 Hrs.**

Fishing crafts and gears –

- identification of various components of a mechanized fishing craft from actual specimen/model/drawing (Inland and Marine)
- Study of principal types of fishing gears from actual specimen/model/drawing
- Identification of fishing gear materials: twine, ropes, floats, sinkers, buoys and anchors.
- Identification of fishery by-products
- Formulation and preparation of artificial fish food

Fishery Resources **18 Hrs.**

- Identification of exotic and indigenous aquarium fishes (any 10 fishes)
- Setting up an aquarium tank – fresh water
- Identification of aquarium plants (any 5)
- Breeding trials on selected aquarium fishes: Breeding and rearing of any three ornamental fishes (one each from live bearer, egg scatterer and bubble nest builder)
- Collection and identification of aquatic weeds and aquatic insects.
- Identification of pathogenic organism or parasites
- Treatment of fish diseases

Group activity **18 Hrs.**

- Setting up a freshwater aquarium by 4 or 5 students (Individual evaluation during practical).

Field work and study tour

- Two to three days tour to study various fishery activities at selected centres/sites. Visit to a fish seed production farm. Fresh water and brackish water aquaculture. Fishing operations, fish landing centres, packing, and transport. Fish preservation and processing chain. Boat building yard and net making plant. CMFRI, CIFT, CIFNET, NIFPHATT, NIO, KUFOS.
- Report the study conducted and submit a 10 page write up/printout giving dates, methodology, results and references including photographs of the field study.
- Viva

FOURTH SEMESTER COURSES

ELECTIVE B: ENVIRONMENTAL SCIENCE

ZL810401	Name of the Course 1 Environmental Science: Concepts and Approaches
ZL810402	" 2 Environmental Pollution and Toxicology
ZL810403	" 3. Environmental Management and Development
ZL810404	" 4 Practical : Environmental Science

Objectives:

•To provide a broad and deep understanding on environment and influence of man on environment
•To equip the students to use various tools and techniques for the study of environment
•To enable the learner to understand, think and evolve strategies for management and conservation of
environment for sustaining life on earth
•To take up further studies and research in the field

ZL810401 ENVIRONMENTAL SCIENCE: CONCEPTS AND APPROACHES

90 Hrs. (5hrs./week) **Credit- 4**

Module I **(26hrs)**

Earth System and Biosphere **(4 hrs)**

Concept of life and life supporting systems. The origin and structure of earth, primary differentiation and formation of core, mantle, crust, atmosphere and hydrosphere.

The Physical Environment **(22 hrs)**

Lithosphere - Weathering and soil formation, - soilcolloids, adsorption and exchange of anions andcations, role of microbes in soil, types of soil, soil profile, classification of rocks, folds, faultsanddykes and other geological formations and their environmental significance. Geomorphologicalprocesses-plate tectonics, sea floor spreading, mountain building, evolution of continents and structural deformation.

Atmosphere -Physico-chemical characteristics, divisions, composition and significance of atmospheric components.

Hydrosphere -Visible and invisible hydrosphere, Range of aquatic habitats, water cycles betweenearth and the atmosphere, Global water balance, ice sheets, origin and composition of sea water, sealevel changes, River basins and watershed. Physico-chemical characteristics of water- diffusion ofoxygen from the atmosphere to surface waters. Influence of pH, turbidity and light on aquatic life.

Module II **(18hrs)**

Weather, Climate and Microclimate **(12 hrs)**

Definitions and scope of climatology, weather, climate and microclimate, components of climate system, earth's thermal environment, earth intercepts solar radiation, seasonal variation in intercepted solar radiation, air temperature in relation to altitude, global circulation of air masses, wind and earth's rotation onocean currents, influence of temperature on moisture content of air, global pattern of precipitation,influence of topography on regional pattern of precipitation. Classification of climate-Koeppen's classification and Thornthwaite's scheme.Climatic types and zones.

Climate Change **(3hrs)**

Global climatic phenomena-El Nino and La Nina. Causes and factors of climate change. Effect ofClimate change on ecosystems and human welfare. Global climate models.

Climate of India **(3 hrs)**

Climatic regions of India, tropical monsoon climate-onset, rain bearing systems, break in the monsoon, retreat of monsoon. Monsoon in Kerala : Western Ghats, oceanic and continental influence.

Module III

Landscape Ecology (10 hrs)

Ecological principles at work with Landscapes ; Land Use in agro-ecosystems, urban ecosystems, rangelands, riparian and wetland systems, coastal and estuarine systems.

Concept of ecological land degradation, desertification, water logging, salinisation and soil erosion.

Integrated analytical techniques- land suitability analysis and carrying capacity studies; Use of soil survey, aerial photos, topographic maps and other resource data in landscape management; corridor selection problems.

Module IV

Biodiversity and Conservation (20 hrs)

Biodiversity-concepts and patterns. Types of biodiversity-wild biodiversity, agro-biodiversity, domesticated biodiversity. Values of biodiversity, ecosystem functions and biodiversity, mobile links and valuating ecosystem services. Drivers of biodiversity loss.

Tools and techniques for biodiversity estimation- biodiversity indices.

Strategies for biodiversity conservation- In-situ conservation: sanctuaries, biospheres reserves, national parks, nature reserves, preservation plots.

Ex-situ conservation: botanical gardens, zoos, aquaria, homesteadgarden; herbarium; In-vitro Conservation: germplasm and gene bank; tissue culture: pollen and spore bank, DNA bank. GEF-World Bank initiatives. Biodiversity hotspots and their characteristics, global distribution.

CBD, National and international programmes for biodiversity conservation. CITES and TRAFFIC.

Indian Biodiversity Act 2002 and laws, National Board of Biodiversity, State Board of Biodiversity. Ecosystem people and traditional conservation strategies; People's participation in conservation-PFM, community reserve and People's Biodiversity Register (PBR). Biodiversity Management Committee (BMC). Wildlife values and eco-tourism, wildlife distribution in India, problems in wildlife protection-Policies and programmes. Threatened animals of India, Project Tiger

Module V (16hrs)

Biological Invasions (12 hrs)

Introduction Elton's hypothesis – Invasion patterns and process biological attributes for invasion: Reproductive potential, Allelopathy, Phenotypic plasticity, fitness to the new environment. Hypotheses for invasion success: Natural enemy hypothesis, evolution of invasiveness hypothesis, empty niche hypothesis, novel weapon hypothesis, disturbance hypothesis and Propagule pressure hypothesis. Invasive alien species of India (plants and animals). Databases of biological invasions. Impacts and management of invasions:

impacts of exotics on biodiversity, productivity, nutrient cycling.Management: Bio-control programmes, mechanical and chemical control Positive utilization Quarantine and EIA of biological invasion.

Environmental Economics (4 hrs)

Origin and scope of environmental economics, Green Economy: sustainable utilisation of natural resources.

ZL810402 ENVIRONMENTAL POLLUTION AND TOXICOLOGY

90 Hrs (5hrs/week) **Credit – 4**

Module I **(15hrs)**

Introduction **(3 hrs)**

Definition of pollution, Different types of pollution- Air, Water and soil and their local, regional and global aspects.

Air Pollution **(12 hrs)**

Sources and classification of air pollution; particulates and gaseous pollutants in the atmosphere(GHG). Primary and secondary pollutants. Effects of air pollutants on human health, animals, vegetation, materials and structures. Air pollution monitoring - methods, air quality standards; ISI, EPA.Sampling and measurement of particulate matters (SPM) - gaseous pollutants, C02, CO, NOx, S02, H2S, oxidants, ozone and hydrogen fluoride.Control of gaseous emission: adsorption by liquids,adsorption by solids, combustion and condensation.
Control of S02, NOx, CO, CO2and hydrocarbons. Carbon sequestration,Carbon Credit,Carbon foot print and carbontrade,Case study:Air pollution in Delhi.

Module II

Water Pollution **(15 hrs)**

Sources of water Pollution-Domestic (municipal sewage), industrial and agricultural. Ground water pollution. Water quality standards for potability:BIS,WHO,Pollution parameters:BOD, COD, Coliform bacteria. Effects of water pollution on human health and aquatic systems. Traditional water purification techniques. Treatment of water for potable purpose (mixing, sedimentation, coagulation, filtration and disinfection).
Waste water treatment: Primary and Secondary treatment, Biological treatment: Kinetics of Biological growth - activated sludge treatment - trickling filters - anaerobic digestion, combined aerobic and anaerobic treatment process, aerobic process.Sludge disposal
Advanced waste water treatment - removal of dissolved organics and inorganic - precipitation, iron exchange, reverse osmosis, electro dialysis, adsorption and oxidation. Removal of nutrients. Removal of heavy metals. overall waste water treatment for sewage water. Sewage treatment and Sewage treatment plants. Water pollution treatment using constructed wetlands. Ganga action plan.

Soil Pollution **(10 hrs)**

Sources of soil pollution; - agricultural, industrial and domestic. Hazardous waste compounds, formulations and classes of substances, chemical classification of hazardous waste. Soil factors affected by pollution – physico-chemical and biological impacts. Case study on soil pollution in wetland and Highland soils in Kerala. Control of soil pollution. Soil quality parameters.

Module III
Solid Waste Management **(15 hrs)**

Municipal solid wastes (MSW) - quantities and characteristics, waste collection and transport, waste processing and resources recovery and recycling. Aerobic and anaerobic systems-composting, vermicomposting; Bio digesters (Biogas plants); incineration, pyrolysis, plasma pyrolysis; sanitary y landfills and open dumping yards. Management of plastic and e-waste.

Treatment process for unsegregated waste, fixation of hazardous solid waste prior to disposal, hazardous waste in land fill. Hazardous waste (Management and Handling) Rules 1989 - the Manufacture Storage and Import ofHazardous Chemicals Rules 1989 - Biomedical Waste (Management and Handling) Rules 1998 -Plastic Act 1999.
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Module IV **(15hrs)**

Noise, Thermal and Oil Pollution **(7 hrs)**

Definition: sound and noise. Assessment and measurement of sound, National and International Standards, Effects of noise on People and ecosystem. Basic principles of noise control.
Thermal Pollution-causes and consequences.
Oil pollution – causes and consequences (any two case studies).

Radiation Pollution **(8 hrs)**

Radiation pollution- Definition, Sources and effects
Radioactive pollution: Radioactivity, Radioactive decay and build up, Radionuclide, Radiation emissions, safety standards. Radioactive waste management. Nuclear reactor disasters (Any one case studies), Impacts radiation pollution on ecosystem.

Module V

Toxicology **(20 hrs)**

Acute and chronic toxicity, Selective toxicity, dose, synergism and antagonism.
Dose – Response relationships – Graded response, quantal response, Time action curves, Threshold Limit value (TLV); LC50; Margin of safety; Toxicity curves; Cumulative toxicity and LD50and CTF.
Toxic chemicals in the Environment – Biochemical aspects of As, Cd, Pb, Hg, Cu, O3, PAN, pesticides, MIC and other carcinogens.
Bio accumulation and bio magnification.
Occupational toxicology- hazardous chemicals, disorders from chemical exposure at work, assessment of occupational hazards.

Toxicity testing and Bioassay – Definition, purpose, criteria for selection of test organism, methodology, estimation of LC50, acute toxicity (single); sub-acute toxicity; chronic toxicity; teratogenicity, carcinogenicity and mutagenicity.Limitation and importance of bioassay.

Bio-monitoring of toxic chemicals, concepts of bio indicators.Bio-transformation of Xenobiotics, Bioremediation

ZL810403 ENVIRONMENTAL MANAGEMENTAND DEVELOPMENT

90Hrs (5hrs/week) **Credit - 4**

Module I

Environmental Management **(20 hrs)**

Basic principles: Management of physical, social, and economic environment. Concepts and scope of environmental planning, regional planning and management. Cost-benefit analysis and Resource economics. Environmental modelling- simulation modelling, input-output modelling, Linear programming

SEA, Ecological Economics, Eco funds.

Environmental auditing and standards, Eco labelling and certification, accreditation – need, objectives and benefits; Corporate social responsibility and Corporate environmental responsibility, ISO standards for environmental management systems (EMS) ISO 14000, 14001 and 26001; OHSAS 18001.

Module II

Ecosystem Management **(20 hrs)**

An overview Population, Resources and ecosystem management Exponential growth in human numbers and the implications.

Major management concepts and methodologies The five basic laws of Ecology and their relevance for ecosystems management;

Management practices for various ecosystems: grasslands, forests, mountains, wetlands and coastal areas. Environmental planning and management of – waste lands, reclaimed lands, mining areas, human settlements, industrial lands and agricultural lands.

Eco restoration/remediation; the common property resources and their management; local knowledge and management systems; environment management through Biotechnology; Green revolution-environmental impacts

Module III

Environmental Impact Assessment (EIA) **(20 hrs)**

Introduction- Definition, history, Aim, principles, concept and scope. Baseline data collection, Methods and steps - Adhoc method, checklist method, matrices, Map overlays method, network method, index method.

Impact assessment and impact evaluation-E1A Processes, Stages, E1A Statement Environment management plan- Risk assessment. National Policy on EIA and Regulatory Framework:

Environmental Impact Assessment Notification 2006 and Coastal Zone Notification 1991; and its amendments. Environmental Clearance Process in India; Legislative requirements (discharge requirements and area restrictions); Environmental Appraisal procedure. Central and state pollution control boards for environmental protection. EIA case studies. Life Cycle Assessment (LCA) and its significance.

Module IV **(22hrs)**

Remote Sensing and GIS* (**17 hrs)**

Principles and concepts of Remote Sensing, Electromagnetic spectrum; spectral characteristics of surface features (rocks, soils, vegetation, water).

Space Imaging Landsat, SPOT, IRS, NOAA, Seasat, ERS, RADARSAT, INSAT. Geometry and radiometry,

Digital Image Processing: Principles, Image Rectification and restoration, Image enhancement and Mosaicing. Image classification. Supervised, Unsupervised, Ground truth data and training set manipulation

Geographical Information System (GIS): Basic principles, Raster and vector data, Map projection, Topology creation, overlay analysis, Data structure and Digital cartography; Software used in GIS, Geodetic survey;

Global Positioning System (GPS) Basic principles, Applications to environmental studies.

Module V.Disaster management (**5hrs)**

Disaster management-definition and classification: floods, droughts, earthquakes; Tsunami, cyclones and landslides; Nuclear hazards. Mitigation Measures.

Module V

Sustainable Development (**10 hrs)**

Environment Vs Development. The idea of Sustainable Development - concepts and dimensions. Basic needs-Imperatives relating to sustainable development. Johannesberg Conference 2002 and follow up Conference on sustainable development. Securing Sustainable futures, Millennium Development Goals and Strategies (MDG & S); the earth charter; need and scope for evolving participatory, community based environmental management strategies. . Ecological Foot Print analysis and its significance. Environmental concerns in traditional societies, Gandhian environmentalism.

**** Note:***

Students and faculty can avail of the facility RS & GIS Division of School of Environmental Sciences of the MG University for technical support and guidance for Module IV.

Recommended Text Books/Reference Books

Agarwal, N.K. 2004. *Essentials of GPS*. Spatial Networks Pvt. Ltd., Hyderabad.

Agarwal, S.K. 2002. *Eco informatics*. APH Publishing Corporation, Hyderabad.

Asit K. Biswas *et.al.*, 1987. *EIA for Developing Countries*. United Nations University, Tokyo. Carter,L.1996. Environmental Impact Assessment. McGraw Hill,New Delhi

Coronel, C., Morris, S. and Rob, P. 2009. Database Systems: Design, Implementation and Management.9th edn., Course Technology.

Eagles, P.F.J.1987. *The planning and Management of Environmentally Sensitive areas*. Longman Group Ltd., USA.

Elachi, C. 1978. *Introduction to Physics and Techniques of Remote sensing.* John Wiley Pub., N.Y.

Ewing B., D. Moore, S. Goldfnger, A. Oursler, A. Reed, and M. Wackernagel. 2010.

Floyd F., and SabinsJr.,W.H. 1987.*Remote Sensing, Principles and Interpretation*. Freeman & Company, New York, 2nd Ed., 1987.

Gadgil, M. and Guha, R. 1995. *Ecology and Equity- The Use and Abuse of Nature in ContemporaryIndia,*.Penguin India.

Gadgil, M. and Guha, R.1998. *The Fissured Land; An Ecological History of India*; Oxford University Press, New Delhi.

Goldsmith, B. 1992. (Ed.) *Monitoring for Conservation and Ecology*. Chapman and Hall, London.

Jorgensen, S.E. 1996. *Applications of ecological modeling in environmental management.* Elsevier Sci. Co., London.

Jorgensen, S. E., Chon, T S. and Recknage, F. A., 2009. *Handbook of Ecological Model inand Informatics.* WIT Press

Kang-tsung, C. 2000. *Introduction to GIS*. Tata Mc Graw Hill, New Delhi.

Knight, R L and White, L. 2009. *Conservation for a New Generation Redefinig Natural ResourcesManagement*. Island Press, USA

Kurian Joseph and Nagenddran, R. 2004. *Essentials of Environmental Studies*. Pearson Education (Singapore) Pvt.Ltd. New Delhi.

Lawrence, D.P. 2003. *Environmental Impact Assessment: Practical Solutions to Recurrent Problems.*John Wiley and Sons, New Delhi.

Lillesand, T.M.and Kiefer, R.F. 1994. *Remote Sensing and Image interpretation*. John Wiley & Sons, New York.

Maguire, D., Batty, M., Goodchild, M., (Eds.) 2005. *GIS, Spatial Analysis,and Modeling*, Esri Press, USA

Meadows, D., Randers, J. and Meadows, D. 2004.*Limits to Growth: The 30 Year Update* London, Earthscan.

Meffe, G. K., L. ,Nielsen, R. ,KnightandSchenborn. 2002. *Ecosystem Management: Adaptive, CommunityBased Conservation*.Plenum Press.

Miller. G.T., Jr. 2004. *Environmental Science*. Thomson, California.

Milner Gulland,E.J. and J Marcus Rowcliffe, 2007. *Conservation and Sustainable Usea handbook of Techniques.* Oxford University Press

Muralikrishna, I.V. 2001. *Spatial Information Technology- RS and GIS*. Vol.I and II BS

Peter Calow. 1998. (Ed.) *Handbook of Environmental Impact Assessment*. Mc Graw Hills Inc., New Delhi

Pullin, A.S. 2002. *Conservation Biology*. Cambridge University Press, UK.

Rao,D.P (Ed).1998. *Remote Sensing for Earth Resources*. Association of Exploration Geophysicist,Hyderabad

Simon Dresner 2008. The Principles of Sustainability Solutions. Earthscan paperbacks, *The Ecological Footprint Atlas 2010*. Oakland: Global Footprint Network.

Tyler Miller, G Jr, 2005. *Advantage Series: Sustaining the EarthAn Integrated Approach* (with CD ROM and Info Trac). 7th Edition., Thomson/Brooks Cole, USA

UN General Assembly.2010. *Keeping the promise: a forward-looking review to promote an agreedaction agenda to achieve the Millennium Development Goals by 2015.* Report of the SecretaryGeneral.

Westman W.E 1995. *Ecology, Impact Assessment and Environmental Planning*. John Wiley and sons.NY,USA.

World Commission on Environment and Development.1987. '*Our Common Future'*, New York: Oxford University Press

Web Resources

www,moef.gov.in (of Ministry of Environment and Forests, Govt. of India) www.millenniumassesment.org. (for Millennium Ecosystem Assessment Synthesis Reports) www.unep.org

ZL810404 ENVIRONMENTAL SCIENCE

180 Hours (10hrs/week) **Credit - 4**

Soil texture using micrometry from two different sites.

Determination of moisture content.

Determination of soil pH from at least three different locations and correlate it with the soil type.

Determination of Chloride, Calcium, Magnesium, Potassium and Phosphorous.

Determination of Calcium Carbonate in Egg shell- (Three different types of egg.

Identification of trophic levels from gut analysis (Fish or insect)

Analysis of soil enzymes : Cellulase, Phosphatase and Urease

Air Quality Analysis:
Air samplers - Simple, Handy and High volume air samplers.
Monitoring of the following pollutants in ambient and polluted air:
1. Dust fall
2. Suspended particulate matter
3. Sulphation rate using lead peroxide candle.
4. Sulphur dioxide
5. Nitrogen dioxide
6. Ammonia

Water Quality Analysis:

a. Determination pH, Electrical conductivity, Alkalinity, Hardness, Phosphate and Silica

b. Determination of total dissolved salts (TDS)

Toxicity Analysis of Water: For Chlorine, H_2 S, Ammonia, Copper and Chromium Estimation of BOD and COD of polluted water

Study of histo-pathological changes in any two of the tissues (Liver/Kidney/ Gonad) using CCl_4 or NH_3 (five stained permanent slides [normal and affected] to be submitted for the examination).

Field Study Report:
An internship/training/field study of not less than 10 days related to environment/ environmental pollution/environmental management. Submit a detailed report with a minimum of 10 pages giving the dates, day wise itinerary, methodology, results/activity and references. Include photographs of the activity. Group and individual assignments shall be preferred.

FOURTH SEMESTER COURSES

ELECTIVE C: ENTOMOLOGY

ZL820401	Name of the Course 1 Morphology and Taxonomy
ZL820402	" 2 Anatomy and Physiology
ZL820403	" 3. Applied Entomology
ZL820404	" 4 Practical Morphology, Aanatomy and Ttaxonomy Insect Physiology and Applied Entomology

ZL820401 MORPHOLOGY AND TAXONOMY

90 Hours (5 hrs/week) **Credit -4**

Objective

• To introduce the insect diversity and its significance

• Students will be able to understand the morphology of the insects, and taxonomic characters of important insects.

- To study the economical and medical importance of insects

• To learn about the insect pest , vectors and their control measures

- To provide skills for scientific study of insects

• To develop aptitude for research in entomology

Module I

Introduction **(2 hrs)**

- Origin and evolution of insects (including theories-Atelocerata hypothesis, Pancrustacea theory), phylogenomics studies.
- Fossil insects (mention importance of Amber).

Module II

Insect Morphology **(26 hrs)**

- **Segmentation and tagmosis of the body**: Primary and secondary segmentation; external and internal features of the body wall.
- **General morphology of head:** Head segmentation; Head skeleton; Tentorium; Modifications of head capsule (opisthognathus, prognathus, hypognathus).
- **Cephalic appendages**: Antennae – Structure, types and functions
- **Mouth parts:** – Structural modifications, Mechanics and control of feeding.
- **General morphology of thorax:** Thoracic segmentation, thoracic skeleton and thoracic appendages).
- **Wings**– Structure; Venation (generalized neopteran wing); Modifications, Wing articulation and coupling mechanisms.
- **Legs** - Structure and adaptive radiation of legs, Locomotion.
- **General morphology of abdomen:** Structure; abdominal appendages.
- **External genitalia**: Basic structural features; complexity and diversity of male and female genitalia. eg. Odonata, Orthoptera, Diptera, Dictyoptera. Mention sexual dimorphism.
- **Sense organs (morphology):** Structure and classification of sense organs (Mechanoreceptors- sensory hairs, chordotonal organs, proprioceptors- trichoid and campaniform sensilla; photoreceptors - compound eyes, simple eye, stemmata, Chemoreceptors- sensilla, Soundreceptors: Johnston's organ, tympanal organs, subgenual organs).
- **Light producing organs:** –Structure.

- **Sound producing organs:** -. Stridulatory organs in various insects.

Module III

Insect Classification **(38hrs)**

Introduction to classification of insects. Mention Apterygota, Exopterygota,Endopterygota

- **General characters**, **Biology, Habits** and **Classification** up to family of the following orders of insects with special emphasis on economically important insects
  Earliest Insects: Archaeognatha, Dicondylia, Zygentoma.
  Pterygota:
  Palaeoptera: Ephemeroptera,
  Metapterygota: Odonata
  Neoptera:
  - **Polyneoptera (Orthopteroid–Plecopteroid assemblage):** Plecoptera, Mantodea, Blattodia, Isoptera, Grylloblattodea, Mantophasmatodea, Orthoptera, Phasmatodea, Embiidina, Dermaptera, and Zoraptera.
  - **Paraneoptera (Acercaria or Hemipteroid assemblage)**: Psocoptera, Phthiraptera, Thysanoptera, and Hemiptera
  - **Endopterygota (=Holometabola)**: Coleoptera, Raphidioptera, Megaloptera, Neuroptera, Mecoptera, Siphonaptera, Strepsiptera, Diptera, Hymenoptera, Trichoptera, Lepidoptera.

Module IV

Social Organization and Behaviour **(16 hrs)**

- **Social organization and behaviour** in termites, ants and honeybees.
- **Study of Gall forming insects**: Gall formation - cecidogenesis, Types of galls – open and closed, common gall pests, adaptations for gall making habit, economic impact of galls.**Leaf mining insects** – Types of leaf mines, feeding habits, frass disposal.
- **Communication –** Acoustic, visual, tactile and chemical methods.
- **Adaptations of parasitic and predatory insects**
- **Study of aquatic insects**: Aquatic insect habits, factors influencing the aquatic life, food capture – modifications, anchorage, locomotion, respiration, oviposition and adaptations of swimming forms.
- **Insect plant interactions:** Host plant resistance. Insect pollinator – plant interaction.

Module V

Insect Development **(8 hrs)**

- General pattern of embryonic development, Polyembryony, Parthenogenesis, Paedogenesis.
- **Egg** - Types, structure, egg cases and adaptations of eggs, diapause.

- Types of metamorphosis, different types of larvae and pupae.

Recommended Text Books/Reference Books

Ananthakrishnan T.N. 1998. *Dimensions of Insect Plant Interactions*. Oxford and IBH Pub.Co. Pvt. Ltd. N. Delhi.

Awasthy V.B. 1998. *Introduction to General and Applied Entomology*. ELBS, London

Carde R.T. and W.J. Bell. 1995.*Chemical Ecology of Insects* (2nd edn). Chapman and Hall, NY.

Chapman R.F. 2012. *The Insects Structure and Functions*. Edited by Stephen J. Simpson, Cambridge University Press, 929 pages, ISBN 9781139035460

Essig E.O. 1982. *College Entomology*. (Indian Reprint) Satish Book Enterprises Agra.

Fenmore P.G. and A. Alkaprakash. 1992. *Applied Entomology*. Wiley Eastern Ltd. New Delhi.

Gillott, C. Entomology 2005. 3rd edition, Published by Springer, 834 pages ISBN-10 1-4020-3182-3

Grimaldi, D. and M.S. Engel. 2005. *Evolution of the Insects*. Cambridge University Press, Cambridge,. U.K. xv + 755 pp. Hardback, ISBN 0-521-82149-5

Gullan, P. J. and P. S. Cranston. 2005. *The Insects: An Outline of Entomology*, 3rd Edition. ISBN: 978-1-405-11113-3. Wiley-Blackwell. 528 pages.

Johnson, Norman F. and Charles A. Triplehorn. 2005. *Borror and DeLong's Introduction to the Study of Insects*, Publisher: Cengage Learning, 7th Edition, 888 pages. ISBN: 9780030968358

Mani M.S. 1974. *Modern Classification of Insects*. Satheesh Book Enterprise, Agra.

Mani M.S. 1982.*A General Text Book of Entomology*. Oxford and IBH, New Delhi.

Metcalf C.L. and Flint W.P. (revised by Metcalf R.L.) 1962. *Destructive and Useful Insects*. McGraw-Hill Book Co. NY,USA

Nayar K.K., Ananthakrishnan T.N. and David B.V. 1976.*General and Applied Entomology*. TATA Mc Grew Hill New Delhi.

Oster G.F. and Wilson E.O. 1978. *Caste and Ecology in the Social Insects*. Princeton University Press Princeton.

Pathak S.C. Ed. 1986. *Recent Advances in Insect Physiology, Morphology and Ecology.* Today and Tomorrow Printers and Publishers, New Delhi.

Richards O.W. and Devis R.G. 1993.*Imm's General Text Book of Entomology*, 10th Edn. Vol I and II. (Indian reprint). B.I. Publications Pvt. Ltd. New Delhi.

Ross H. H. *et.al*. 1982. *A General Text Book of Entomology*. John Wiley Son's, N. York.

Snodgrass R.E. 1935. *Principles of Insect Morphology*. McGraw Hill Book Co. N. York.

Tembhare D.B. 1997. *Modern Entomology*. Himalaya Publishing House, New Delhi

ZL820402 ANATOMY AND PHYSIOLOGY

90 Hours (5 hrs/week) **Credit -4**

Module I **(14hrs)**

Integumentary System **(4 hrs)**

- Anatomy and histology, Physical and chemical properties
- Chemistry of the Cuticle
- Moulting and sclerotization - role of hormones.

Digestive System **(10 hrs)**

- Anatomy and histology of gut, modifications of gut (filter chamber).
- Physiology of digestion and absorption (wood, keratin, wax and silk).
- Extra intestinal digestion.
- Role of the microbes in digestion.

Module II **(18hrs)**

Circulatory System **(8 hrs)**

- Structure of the insect circulatory system: dorsal vessel, dorsal and ventral diaphragms, accessory pulsatile organs.
- Hemolymph: Plasma and Hemocytes - Composition and functions.
- Course of circulation, heartbeat and its regulation - Cardioacceleratory peptides .
- Immune mechanisms in insects: cell-mediated immunity & humoral immunity; short notes on transferrins, *Dscam.*

Respiratory System **(10 hrs)**

- Organization and Structure of the Tracheal System: trachea, trachioles, spiracles and air-sacs.
- Movement of Gases within the Tracheal System: Diffusion, discontinuous gas exchange, active ventilation.
- Respiratory pigments.
- Gas Exchange in Aquatic Insects: Closed and open tracheal systems; Gas Exchange in Endoparasitic Insects; Gas exchange in insect eggs.

Module III **(16hrs)**

Muscular System **(8 hrs)**

- Histo-morphology of muscles, skeletal muscles and visceral muscles.
- Physiology of Neuromuscular junctions.
- Excitations of muscle fibres, role of fast and slow axons.
- Flight Metabolism

Fat Body and Intermediary Metabolism **(8 hrs)**

- Fat body structure and development.
- Storage and utilization of energy and nutrients.

- Intermediary metabolism- glycolysis, glycerol phosphate shuttle, trehalose biosynthesis
- Metabolism of insecticides, diapause as a metabolic process

Module IV (22hrs)

Excretory System (10 hrs)

- Anatomy and histology of Malpighian tubules (Hemiptera, Coleoptera, Lepidoptera)
- Nephro-rectal complex and labial glands.
- Physiology of excretion.
- Salt and water balance – terrestrial, freshwater, brackish-water and saltwater
- Hormonal control

Nervous System (12 hrs).

- Basic components and anatomy of the nervous system .
- Physiology-reception and transmission of stimuli, production and conduction of nerve impulses.
- Physiology of Chemoreception
- Photoreception: Form and Movement Perception, Distance Perception, Spectral Sensitivity and Color Vision, Sensitivity to Polarized Light
- Mechanism of sound and light production in insects

Module V (20hrs)

Endocrine System (12 hrs)

- Endocrine organs: Corpora cardiaca, corpora allata, molt glands and prothoracic glands.
- Hormones and their functions, regulation of hormone titer.
- Insect semiochemicals and communication: Pheromones (types), kairomones, synomones
- Environmental, Neural, and Endocrine Interaction

Reproductive System (8 hrs)

- Anatomy of the internal reproductive organs in male and female insects.
- Spermatozoa, transfer of sperm to the female, oogenesis, ovulation, fertilization and oviposition.
- Formation of blastoderm and differentiation of germ layers.
- Viviparity, oviparity, eclosion.

Recommended Text Books/Reference Books

Beament, J.W.L., Treherne, J. E. & Wigglesworth. Advances in Insect Physiology, Academic press, London

Bursell, E 1970. An Introduction to Insect physiology, Academic Press

Chapman R.F. 2012. *The Insects Structure and Functions*. Edited by Stephen J. Simpson, Cambridge University Press, 929 pages, ISBN 9781139035460

Duntson PA. 2004. The Insects: Structure, Function and Biodiversity. Kalyani Publ., New Delhi.

Gilbert, L.I. & Kerkut. G.A. 1985. Comprehensive Insect Physiology, Biochemistry and Physiology, Vol. 1-12

Gillott, C. Entomology 2005. 3rd edition, Published by Springer, 834 pages ISBN-10 1-4020-3182-3

Pathak, S.C. (Ed) 1986. Recent advances in Insect Physiology, Morphology and Ecology. Today and Tomorrow Publishers, New Delhi.

Patnaik BD. 2002. Physiology of Insects. Dominant, New Delhi.

Patton, R. 1963. Introductory Insect Physiology, Saunders, USA.

Richards, O.W. and Davis, R.G. 1977. Imms General Text Book of Entomology.Vol.I. Chapman & Hall, London

Rockestein, M. (Ed) 1974. Physiology of Insecta Vol 1.VI. Academic press, New York

Roeder, K. D. 1953. Insect Physiology, Wiley, New York.

Simpson Stephen 2005. Advances in Insect Physiology. Elsevier

Wigglesworth, V.B. 1972. Principles of Insect Physiology, Methuen, London

ZL820403 APPLIED ENTOMOLOGY

90 Hours (5hrs/week) **Credit - 4**

Module I

Insect Pests **(8 hrs)**

- Classification of Insect pests
  Key pests, Potential pests, Occasional pests, Sporadic pests, Seasonal pests, Regular pests, Persistent pests (Based on occurrence)
  Endemic, Epidemic and Pandemic pests (Based on level of infestation)
  Migrant pests and Exotic pests
- Causes of insect assuming pest status
- Causes of pest outbreak
- Pest surveillance and Forecasting pest outbreaks (Short term and long term forecasting)
  Forecasting based on observations – climatic and empirical factors.
- Pest resurgence and replacement (secondary pest outbreak).
  Causes and management of resurgence and replacement.
- Types of damage caused by insect pest to crops
  (Injury by chewing, piercing, sucking insects, internal feeders, subterranean insects, to stored products and indirect effect of feeding)
- Concepts of Economic levels
  Economic injury level, Economic threshold level, Damage boundary
  Pest categories according to EIL, GEP AND DB
- Estimation of damage caused by insect to crops(Brief account only)

Module II

Insect Pests of Crops **(24 hrs)**

Identification, Life history, nature of damage and control measures of major pests of

PADDY: Major pests including stem borers, army worm, rice thrips, gall midge, mealy bug, BPH, green & white leaf hoppers, rice caseworm, rice leaf roller, rice hispa, rice earhead bug, root weevil, rice grass hoppers (Any ten pests).

SUGARCANE: Major pests including shoot, internode & top borers, white grub, leaf hopper, sugarcane scale, mealy bug, whiteflies, Termites, Black winged bug (Any three pests).

COTTON: Major pests - Aphid, leaf hopper, thrips, whitefly, Pink, spotted and American boll worms, stem weevil, Red and Dusky cotton bugs, leaf roller (Any three pests).

COCONUT: Rhinoceros beetle, red palm weevil, black-headed caterpillar, white grub, Scale insect, Lace wing bug, coconut skipper (Any five pests)

PULSES: Gram pod borer, plume moth, red gram pod fly, pod borer, spotted pod borer, Blue butterflies, bean aphid, white fly(Any three pests)

FRUIT TREES:

Mango- hopper, flower webber, Leaf webber, gall midges, Nut weevil,
stem borer, red tree ant (Any three pests)

Cashew-hopper, flower webber, Leaf webber, gall midges, Nut weevil,

stem borer, red tree ant(Any three pests)

Citrus - Fruit sucking moth, citrus butterfly

Banana -rhizome weevil, banana aphid

SPICES:

Pepper- pollu beetle, shoot borer, Marginal gall thrips (Any two pests)

Cardamom-cardamom thrips, rhizome borer, cardamom whitefly,

hairy caterpillars, *Eupteroteand pericallia* (Any two pests)

Turmeric and Ginger(Leaf roller, shoot borer)

OTHER CROPS: Coffee, Tea, Tapioca and Rubber (Any two pests for each crop)

VEGETABLES: Brinjal, Gourd, Tomato and Bhendi(Any three pests for each)

STORED PRODUCTS: Identification, nature of damage & control of insect pests of Rice weevil, sweet potato weevil, Lesser grain borer, tobacco beetle, Drug store beetle, Pulse beetle, Angoumois grain moth, Potato tuber moth, Red flour beetle, Rice moth.

(Any five pests)

LOCUSTS: Life history and migration, damage and methods of control

TERMITES: Life history, damage and control measures.

Module III

Principles of Insect pest management **(15 hrs)**

Ecology based pest management

Prophylactic methods

Curative methods

Cultural methods

Mechanical methods

Physical methods

Legal methods

Biological control: History of biological control, ecological basis of biological control, natural enemies (Parasites, Parasitoids, Predators), feasibility of biocontrol; Applied biological control (Conservation and enhancement, Importation and colonization, Mass culture and release); Importance of systematics in biocontrol, Important biocontrol projects undertaken in India by employing parasites and predators.

Autocidal control - Sterile male technique and other methods, Chemosterilants, Methods of sterilization, Application, Dynamics, Advantages and disadvantages Examples of autocidal control

Insect growth regulators (IGRs) – Brief note on Insect growth hormones and mimics (JH mimic & ecdysone agonists and chitin synthesis inhibitors as insect control agents)

Behavioural (pheromonal) control: Mode of application, Pest management with pheromones, Advantages and disadvantages, Examples

Insect attractants: definition, types of attractants, applications in insect pest management, examples, advantages and disadvantages

Insect repellents: definition, desirable features of good repellent, types of repellents, applications in insect pest management, examples, advantages and disadvantages

Insect antifeedants: definition, examples, applications in insect pest management, advantages and disadvantages

Microbial control of crop pests by employing Bacteria, Virus and Fungi - Classification of entomophagus Bacteria, Virus, Fungi, Mode of action, formulation, Application, Examples

Integrated Pest Management- Definition, IPM in Agroecosystem, Establishing the need to take action, Guidelines for developing IPM, Tactics in IPM, IPM of Rice.

Module IV

Chemical Control **(20 hrs)**

Insecticide formulation

(Brief note on Emulsifiable concentrates, Water-miscible liquids, Wettable powders, Water soluble powders, Oil solutions, Flowable powders, Aerosoles, Granulars, Fumigants, Ultra-low volume concentrates, Fogging concentrates, Dusts, Poison baits and Slow release insecticides)

Classification of insecticides

1. Based on mode of entry
2. Based on mode of action
3. Based on chemical nature

Chemical nature, toxicology & mode of action of following class of insecticides (mention examples for each class)

Synthetic Organic compounds

- Organochlorine insecticides (DDT, BHC, Cyclodiene group (special reference to endosulfan; examples: heptachlor, aldrin)
- Organophosphorous insecticides (examples: TEPP, Dichloros, monocrotophos, parathion) Carbamates (special mention of carbofuran and carbaryl)
- Inorganic compounds as insecticides - arsenic compounds, fluorides, sulphur compounds
- Fumigants – definition, examples, methods of fumigation, hazards of fumigation, advantages and precautions
- Botanical insecticides- chemical properties, mode of action and toxicity of the following: Nicotine, Rotenone, Pyrethrum and Neem
- Synthetic pyrethroids – definition, uses as insecticides, mode of action (examples: Pyrethrin, allethrin)
- Insecticide synergists – definition, types of synergism, mode of action & examples

Module V **(23hrs)**

Insecticide Application Technology **(6 hrs)**

- Dusting and dusters
- Spraying and sprayers – syringes, knapsack sprayers, foot pump-sprayers, rocker sprayer, pneumatic hand sprayers, pneumatic knapsack sprayers, hand atomizer, hydraulic sprayers
- Aerosols
- Other equipments (mist blower, fog generators, smoke generators, aerosol bombs)

Insecticides and Environment (5 hrs)

- Insecticide resistance -Genetic, Physiological and biochemical mechanism
- Pesticides and the environment- its impact on wildlife and human health
- Microbial and environmental degradation of pesticides

Medical and Veterinary Entomology (10 hrs)

- Identification, nature of attack & control of Insect pests of domestic animals
  Cattle (any five pests)
  Fowl (any three pests)
  Dog & Goat (any two pests)
- Ticks and Mites of Medical and veterinary importance – Morphology, biology and control measures
- Major arthropod vectors of human diseases
  (Malaria, Lymphatic Filariasis, Yellow Fever, Dengu Fever, West Nile Disease , Chickungunia,Japanese Encephalitis, Zika Kala-azar,African sleeping disease Plague, Typhus, Kyasanur Forest Disease, Scabies)

Forensic Entomology (2 hrs)

- Introduction to Forensic entomologyInsects used in forensic entomology (Dipterans and coleopterans)
- Succession of insect fauna on a cadaver.

Recommended Text Books/Reference Books

Ananthakrishnan, T.N. 1977 Insect and Host Specificity, Mc Millan Co, India LTD

Apple, J.L. and R.R. Smith .1976. *Integrated Pest Management*. Plenum Press, New York.

Atwal, A.S., Agricultural Pests of India and South East Asia. Kalyanai Publishing, New Delhi.

Awasthi, V.B. 2002. *Introduction to General and Applied Entomology* (2nd edn). Scientific Publishers (India), Jodhpur.

Brown, A.W.A. (1978): Ecology of Pesticides, John Wiley Sons, N.Y.

Byrd, J.H and J.L Castner (Eds).2000. *Forensic Entomology: The utility of arthropods in legal investigations,* CRC Press,London

D'Brien, R.D. 1967 Insectcide- action and metabolism, Academic Press, N.Y.

Dent, D.1991. *Insect Pest Management.* CAB International, UK

Edwards, C.A. 1973 Persistent pesticides in the environment, C.R.C. Press

Ghosh M.R. 1989. *Concepts of Insect Control*. Wiley Eastern Ltd. Bangalore and New Delhi

Harward, R.F. and James, M.T. 1979 Entomology in Human and Animal Health. 7th Edn. Cther Mc Millan Publishing London

Hill, D.S. and Waller, Insect Pests of Agriculture and their Control

Hill, D.S., Agricultural Entomology

Kettle, D.S.1995. *Medical and Veterinary Entomology*. CAB International.Matsumura, F. (1975): Toxicology of Insecticides – Plenum

Metcalf and Flint. Revised by Metcalf, R.L., Destructive and Useful Insects, their Habits and Control, Mc Graw Hill, N.Y.

Metcalf, R.L. and Luckman, W.H., Introduction to Insect Pest management, 3rd Edn. John Wiley & Sons

Moriarty, F., 1975 Organochlorine insecticides persistant organic pollutants, Academic Press, INC, London

Mullen, G. and Durden, L. (Eds).2002. *Medical and Veterinary Entomology*. Academic Press.

Nair, M.R.G.K.1975 Insect and Mites of Crops in India, ICAR, New Delhi

Nayar, K.K., Ananthakrishnan, T.N. and B.V. David. 1976. *General and Applied Entomology*. Tata McGraw Hill Publ. Co. Ltd New Delhi

O'Brian, R.D. and Yamanots, I. 1970 Biochemical Toxicology of Insecticides, Academic Press INC, London

Patton, W.S. and Crag, F.N. 1973. *A Textbook of Medical Entomology*. International Books and Periodicals, New Delhi

Pedigo, L.P.2002 Entomology and Pest Management. EEE. Prentice Hall India

Perry, A.S., Yamamoto, I., Ishaaya, I. and Perry, R. 1998 Insecticides in Agriculture and Environment – Retrospects and Prospects, Narosa Publishing House, New Delhi

Pradhan, S. 1969 Insect pests of Crops, National Book Trust, New Delhi

Ramakrishna Ayyer, R.V. 1963. *A Handbook of Economic Entomology of South India*. Govt of Madras Publications Service, M.W.1996.*Medical Entomology for Students.* Chapman and Hall, UK.

Rao, V.P. Ghani, M.A., Sankaran T and Mathur, K.C. 1971. *A Review of Biological Control of Insects and Other Pest in South East Asia and Pacific region.* CAB, England.

Romoser, W.S. and Stoffalano, J.G. Jr., The science of Entomology 3rd Edn. Wm. C. Brown Publishing

Smith, K.V.G.1986. *A Manual of Forensic Entomology*. British Museum Natural History.

Srivastava, K.P.1996 A Text Book of applied Entomology Vol.1, Kalyani publishers.

Vasantharaj David and Kumaraswami, Hand Book of Economoc Zoology

Wilkinson, C.F. 1976 Insecticide Biochemistry and Physiology – Plenum Press N.Y.

PRACTICAL

MORPHOLOGY, ANATOMY AND TAXONOMY, INSECT PHYSIOLOGY AND APPLIED ENTOMOLOGY

180 hours. (10 hrs./week) Credit- 4

MORPHOLOGY,ANATOMY AND TAXONOMY

- Study of various types of insect head (prognathous, hypognathous,opisthognathous
- Mouthparts in insects (Grasshopper,plantbug,mosquito,honeybee, house fly)
- Study of different types of antennae. (cockroach,grasshopper,termite,house fly,mosquito)
- Adaptive radiationof pterygote legs(ambulatorial,cursorial,saltatorial,natatorial,clapsorial, fossorial etc.)
- Sting apparatus –honeybee
- Wings and wing venation in insects of 5 pterygote orders.
- Study of sexual dimorphism in insects
- Preparation of dichotomous keys with reference to various insect orders
- Morphological studies of different castes of social insects. eg: Honey bee
- Dissection of alimentary canal and associated glands of different insects (oryctes, grasshopper.)
- Dissection of nervous system in different insects (plantbug, ,oryctes,grasshopper)
- Dissection of reproductive system in insects (cockroach, ,grasshopper,)
- Dissection of stomatogastric nervous system –cockroach
- Training for students in the various methods of collection and preservation of insects for scientific studies.

visit to entomology research institute and museum .

Field study shall be conducted to collect the insects in their natural habitat like forest, agro-ecosystem, grass lands, water bodies, sandy areas, litter, and so on with the procedures adopted . students are required to submit an insect collection belonging to 30 families of different orders- dry collection,wet collection, whole mounts and slides at the time of practical examination.

INSECT PHYSIOLOGY

•Survey of digestive enzymes –amylase,invertase,protease and lipase in different parts of the gut in cockroach,grasshopper, dragonfly

•Dye transport by Malpighian tubule using dyes

• Identification of free aminoacids (at least 3) in haemolymph by paper chromatography.

•Haemocytes –staining and identification.

•Estimation of total haemolymph proteins

APPLIED ENTOMOLOGY

COLLECTION AND IDENTIFICATION (Preserve and submit)

1. Insect pests of different crop plants,fruit trees,vegetables and stored products (3 Pests each)
2. Insect vectors of man and domestic animals (3 pests)
3. Insect damages to crops (Any 5)
4. Economically important insects, their life stages, products (any one)
5. Natural enemies of crop pests (parasitoids- Trichocard, predatory insects)

•Study of life histories of insect pests (Any 5)

•Insecticide appliances and insecticide formulations.

•Forensically important insects.

•Determination of LC50 using probit analysis.

Visit to laboratories (Any 2)

1. Parasitoids and predator breeding stations
2. Beekeeping stations
3. Sericulture institutes
4. Toxicology laboratories
5. Insect pathogen culture labs

(Report on the visit to any 2 laboratories with the dated signature of the teacher concerned and duly certified shall be submitted at the time of practical examination along with practical record. No marks shall be awarded for the record without the report)

FOURTH SEMESTER COURSES

ELECTIVE D: MEDICAL MICROBIOLOGY

ZL830401	Name of the Course 1 General Microbiology and Parasitology
ZL830402	" 2 Bacteriology, Virology and Mycology
ZL830403	" 3. Clinical Microbiology
ZL830404	" 4 Practical : Microbiology

Objectives:

To introduce the diversity of microbial world

To learn various pathogens, parasites and related diseases of man

To familiarise with various tools and techniques in the study of microbes and to manage a microbial laboratory

To provide skills and competency in the field of clinical microbiology

ZL830401 GENERAL MICROBIOLOGY AND PARASITOLOGY

90 Hours (5hrs/week) Credit -4

Module 1

History and introduction to Microbiology (25 hrs)

History(Antony Von Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Edward Jenner, Alexander Flemming), scope, relevance and future of microbiology.

General groups of microbes and their structural characteristic features - bacteria, (archae, cyanobacteria, actinomycetes), fungi (molds and yeast), virus and protozoa.

Morphological studies using different staining methods- Staining: Principle and Methods. Simple Staining and Differential staining - Gram staining, Acid fast staining (Ziehl-Neilson Method), Staining of Specific Structures - Spore staining (Schaeffer-Fulton Method), Capsule staining, staining of volutin granules, Negative staining.

Module II

Microbial Growth and Reproduction (15 hrs)

Nutritional requirements and types of bacteria - autotrophs, heterotrophs, chemotrophs - Measurement of growth: growth curve, Kinetics of Growth - Mathematical expression of exponential growth phase; Batch Culture, Continuous culture(Chemostat, turbidostat). Fungal growth requirements.Reproduction of bacteria and fungi - sexual and asexual.

Module III

Control of Microbial Growth (10 hrs)

Control of bacteria: Antibiotics- types, mechanism of action. Evaluation of antimicrobial agent effectiveness- Phenol coefficient method, Determination of MIC and MBC. Antibiotic sensitivity tests(Kirby- Bauer Method), antibiogram.

Module IV

Microbiology of air, water and food (20 hrs)

Air: Droplets, droplet nuclei, aerosol. Types of microbes in air and different methods of microbial enumeration from air.Air-borne diseases.Water: sources of contamination, methods of detection of microbial contamination in water, Microbial standards of drinking water, water-borne diseases.
Food: Types and sources of milk contamination, milk spoilage, milk quality testing methods (methylene blue reductase test, resazurinreductase test), Food poisoning and intoxication, major food- borne diseases.

Module V

Parasites and Vectors (**20 hrs)**

Structure, life cycle, pathogenesis, diseases, laboratory diagnosis, treatment and prevention of the following parasites: Protozoan parasites-*Entamoeba histolytica, Plasmodium vivax, Lieshmania donovani, Trypanosoma brucei, Trypanosoma cruzi, Trichomonas vaginalis, Giardia lambli.*

Helminthes :Nematodes- *Ascarislumbricoides*(Giant round worm), *Ancylostomaduodenale (*Hook Worm), *Enterobiusvermicularis* (Pin worm), *Wuchereriabancrofti*.

Helminthes :Cestodes -*Taeniasolium*

A brief study of the following insects, the major diseases they transmit, epidemiology of such diseases, control and preventive measures: Mosquito, Sand fly, House fly, Tse-Tse fly, Fleas, Louse, Bed bug, Ticks, Mites.

Recommended Text Books/Reference Books

Ananthanarayanan R. and C.K. JayaramPanicker, 2006. *Text book of Microbiology*. Orient Long Man,New Delhi

Case T.F, *et al.*, 2011. *Microbiology an Introduction* (9th edn.). The Benjamin/Cummings Publishing Company.Inc. NY, USA.

Davis, D. and E. Ginsberg, 1990.*Microbiology* (4 edn.).Harper and Row Publishers, Singapore.

England P.T. and A.Sher. (eds). 1988. *The Biology of Parasitism- A Molecular and Immunological Approach*. Alar. R. Liss.New York

Ketchum P.A. 1988. *Microbiology -Concepts and Applications*.Oakland University Press.NZ.

Markell, E.K., Voge, M and D.T. John. 2002. *Medical Parasitology*. W.B. Saunders, Philadelphia.

Prescott M.C, J.P.Hardley and D.A. Clean.2001.*Microbiology.* ASM, USA

Ross,N.E. and J.D.Mclaren (eds). 1986. *Pathophysiological Responses to Parasites*. British Society for parasitology, London.

ZL830402 BACTERIOLOGY, VIROLOGY AND MYCOLOGY

90 Hours (5hrs/week) **Credits- 4**

Module I

Pathogenesis and Epidemiology (15 hrs)

Mechanism of pathogenesis- bacterial and viral. Epidemiology -Factors predisposing to microbial pathogenicity, Sources of infections, Mode of transmission of infections. Prophylaxis of communicable diseases.

Module II (25hrs)

Pathogenic Bacteria (15 hrs)

Study of important properties, pathogenicity and laboratory identification of: *Staphylococci, Streptococci, Pneumococcus, Corynebacterium diphtheriae, Bacillus anthracis, Clostridium tetani Neisseria, E.coli, Proteus, Klebsiella, Shigella* and *Salmonella*, *Vibrio*, *Pseudomonas, Brucella.*

Study of important properties, pathogenicity and laboratory identification of: *Mycobacterium, Treponema, Leptospira, Mycoplasma*, Rickettsiae and Chlamydiae. A brief study of bacteria *viz*. *Borrelia, Listeria, Campylobacter* and *Legionella.*

Module III. Bacterial Infections of Human Body (10 hrs)

Bacterial infections of respiratory tract, Bacterial infections of gastro intestinal tract, Bacterial urinary tract infections, Bacterial infections of genital tract and reproductive organs, Bacterial infections of central nervous system, Skin and soft tissue infections, Bone and joint infections, Eye ear and sinus infections, Cardiovascular infections, Zoonotic infections, Pyrexia of unknown origin.

Module III (30hrs)

Virology (15 hrs)

Study of properties, replication and pathogenesis of Alpha virus, Pox, Herpes Virus, Orthomyxo virus and Papova virus.

Study of properties, pathogenesis and symptomsof Polio, Influenza, Rabies, and Hepatitis viruses.

Oncogenic viruses, Slow viruses and Prion diseases

Emerging Viruses and Control of viral infections (15 hrs)

Emerging viruses: Structure, genomic organization, pathogenesis and control of Human immunodeficiency virus. H1N1 viruses.

Control of viral infections through vaccines, interferons and chemotherapeutic agents. Immunological and non immunological response of viral infections.

Module IV

Bacteriophages (10 hrs).

Structure and life cycle patterns of T-even phages; one step growth curve and burst size; Bacteriophage typing; Structure of Cyanophages, Mycophages. Growth cycle studies of RNA and DNA phages.

Module V

Mycology (10 hrs)

Classification of fungi, General techniques used in mycology: Cultivation- slide culture technique, Staining of fungi - Lactophenol cotton blue staining.

Mycosis in man-Classification, pathogenesis and clinical findings in superficial, cutaneous and systemic fungal infections. Oppurtunistic mycoses. Antifungal agents and their mode of action.

Recommended Text Books/Reference Books

Ananthanarayan and JayaramPanicker. 2002. *Text Book of Microbiology.* Orient Longman.

Belsche, R.B., 1991. *Text Book of Human Virology* (2nd edn.). Mosby, St.Louis.

Dimock, N and L.Primrose.1987.*Introduction to Modern Virology* (3rdedn.).Oxford Blackwell.

Duerdon, D.L.and Dresser, B.S. (eds).1991.*Anaerobes in Human Disease*.London Arnold.

Emmons *et al.,* 1997.*Medical Mycology*.Lea and Febiger ,Philadelphia.

Goodfellow, M and R.G. Board (ed).1989. *Microbiological Classification and Identification.*

Grady F.O, H.P. Lambert, R.G. Finch, G. Greenwood.1997. *Antibiotic and Chemotherapy; Antiinfective Agents and their Use in Therapy* (7thedn).Churchil Livingstone, NY.

Kwon-Chung, K.J and J.E. Bennet.1992.*Medical Mycology*. Lea &Febiger,Philadelphia,

Larone,D.H.1980. *Laboratory Handbook of Medical Mycology*.Academic press New York.

Mims C.A. and D.O. White,1994.*Viral Pathogenesis and Immunology.* Oxford Blackwell.

Monica Cheesbrough 1991. *Medical Laboratory Manual for Tropical Countries.*Vol.2.ELBS

Szaniszlo,P.J. (edn) 1985.*Fungal Dimorphism; with Emphasis on Fungi Pathogenic for Humans.* Plenum, NY.

Topley W.W.C. and G. Wilson. 2002. *Principles of Bacteriology, Virology and Immunity. Systematic Bacteriology*: (8th edn.). BWW Publishers.

White, D.C. and F.J. Fenner.2004.*Medical Virology.* (4rdedn.) Academic Press, New York.

ZL830403 CLINICAL MICROBIOLOGY

90 Hours (5hrs./week) **Credit-4**

Module I

Safetyand Basic Laboratory Techniquesin Microbiology (12hrs)

Safety in Clinical Microbiology laboratory. Good laboratory practices. Microbiological safety cabinets-Types.WHO safe code of practice for a clinical microbiology laboratory.

Cleaning of glassware.Sterilization of glassware and media. Isolation techniques- serial dilution, standard plate count, pure culture and enrichment culture methods. Preservation of microbes.

Module II

Sample processing for Microbiology (20 hrs)

Collection, transport, processing and microscopical examination of Blood, Sputum, stool, urine, Cerebrospinal fluid, genital specimens, throat and mouth specimens, nasopharyngeal swabs and aspirates, ear discharges, eye specimens, pus from wounds, abscesses, burns.

Module III

Diagnosis of bacterial Diseases (18 hrs)

Different methods of cultural, biochemical, serological and molecular analysis of microbial pathogens.

Module IV (20hrs)

Diagnosis of Viral Diseases (10hrs)

Viral isolation and growth- Cell culture for viral detection
Detection of viral proteins and viral genetic material, viral serology.
Antiviral agents and their mode of action

Diagnosis of Fungal Diseases (10hrs)

Diagnostic procedures: Microscopical examination of spore structures, Superficial, Cutaneous and Systemic mycosis.

Module V (20hrs)

Diagnostic methods in Parasitology (10hrs)

Diagnostic procedures: Examination of faeces and blood, culture methods, animal inoculation, immunological diagnosis and molecular diagnosis.

Handling of Laboratory Animals (10 hrs)

Legal requirements for animal experiments. General aspects of organization of animal experiments- Preparation of animals, common experimental procedures, Humane methods of killing animals. Care and handling of common laboratory animals: Rabbit, guinea-pig, mouse and rat.

Recommended Text Books/Reference Books

Baron E.J, L.R.Peterson and S.M. Finegold.1994.*Bailey and Scott'sDiagnostic Microbiology.*ASM, Washington,DC

Cowan, S.T. and K.J.Steel.1985. *Manual for the Identification of Medical Bacteria.*Cambridge University Press, London.

Chandrashekhar J Hiware, Babasaheb V Jadhav, Ashok D Mohekar, 2002. Applied Parasitology, A Practical Manual

D.C. Kloss, W.E., and T.L. Bannermann.1995. ..*Manual of Clinical Microbiology* (6th edn.), American Society for Microbiology, Washington,USA

Goodman and Guilman's Pharmacological Basis of Therapeutics, 2000.Tenth Edition.

Gradwohl's clinical laboratory methods voII.1981.Academic Books, London.

Howard B.J, J.F.Keiser. T.F.Smith, A.S. Weissfeld, R.C. Tolton, .2002.*Clinical and Pathogenic Microbiology.*

Koneman E.W. D.Stephen, William A, Janda 2008. *Color Atlas and Textbook of Diagnostic Microbiology*. Tata McGraw Hill, NY.

Mackie and Mccartney, 2008.*Practical Medical Microbiology* (14thedn). Churchill Livingstone,UK.

Monica Cheesbrough, .*Medical Laboratory Manual For Tropical Countries.*Vol.II. Microbiology. ELBS.

P.R.Murray, E.J.Baron, M,Patrick R. M,K.S.Rosenthal, G.S. Koayashi and M.A.Ptaller,1997. *Medical Microbiology.*

Panicker, CKJ.1998.*Text book of Medical Parasitology,* Jaypee, New Delhi.

Sherris Jc.,1990.*Medical Microbiology, An Introduction to Infectious Diseases*. Ed.2. New York.

Tille, Patricia M. 2014. Bailey & Scott's diagnostic microbiology. St. Louis, Missouri :Elsevier

ZL830404 MICROBIOLOGY

180 Hours (10hrs./week) **Credit-4**

General Microbiology and Bacteriology

• Cultivation of bacteria – pure culture techniques – streak, lawn, stab, spread plate technique

• Staining procedures- Simple stain, Gram's,stain, Spore stain, Negative,staining

•Microscopic examination of bacteria in living conditions - Testing of motility- Hanging drop method/ wet mount method

•Antibiotic sensitivity test- Kirby Bauer method

• Identification of bacteria- cultural characteristics and biochemical reaction of bacteria- Colony morphology, staining, motility test, catalase, oxidase test, IMVIC test

•Serological Diagnosis – RA, ASO, CRP, Widal test

Mycology

Culture methods for isolation and identification of fungi- Lactophenol cotton blue staining, Slide culture technique.

• Germ tube test of *Candida albicans*

Applied Microbiology

• Bacteriological analysis of milk- methylene blue reduction test

• Identification of fungi from mouldy/spoiled food sample

• Bacteriological examination of water- MPN technique, Standard Plate Count Method

• Enumeration of soil microbes by plate count method methods

• Isolation of *Rhizobium* from nodules of leguminous plants

Spotters - Slide Identification- *Neisseria, Mycobacterium, Clostridium, Aspergillus, Penicillium, Candida, Ascaris, Ancylostoma, Trichuris, Enterobius*

MODEL QUESTION PAPERS

M Sc.Zoology Degree (C.S.S) Examination

First Semester

Faculty of Sciences

ZL010101ANIMAL DIVERSITY: PHYLOGENETIC AND TAXONOMIC APPROACHES

(2019 admissions onwards)

Time: Three hours Max. Weight: 30

Section- A

(Answer any **eight**questions. Each question carries a weight of 1)

1.Stromatolites
2.Cambrian explosion
3.Advantages of bone in vertebrate phylogeny
4.Significance of paedomorphosis in chordate phylogeny
5.Endothermy in dinosaurs
6.Evolutionary significance of Sarcopterygians.
7.What are the threats to the modern amphibian?
8.List out the endangered mammals of India
9.Phylocode
10. E-taxonomy

(8 x 1 = 8)

Section B

(Answer any **six** questions. Each question carries a weight of 2)

11.Comment on the different hypothesis of metazoan origin
12. What are the evolutionary advantages of symmetry and metamerism?
13.Comment on adaptive radiation in annelids
14.Discuss the affinity of invertebrates and protochordate in vertebrate evolution
15. Explain the importance of skull in reptilian classification
16. Comment on the significance of jaws and hearing in mammalian phylogeny
17.Briefly explain the taxonomic procedure
18. Give an account on the cladistics analysis in systematics

(**6 x 2 = 12**)

Section C

(Answer any **two** questions. Each question carries a weight of 5.)

19.Comment on the phylogenic relationship amongmollusca, annelida and arthropoda
20.Write an essay on reptilian phylogeny and adaptive radiation
21.Explain about the different types of taxonomic publications
22. Write an essay on the use of biomolecules in molecular phylogeny

(**2 x 5 =10)**

M Sc Zoology Degree (C.S.S) Examination

I Semester

Faculty of Science

ZL010102 EVOLUTIONARY BIOLOGY AND ETHOLOGY

(2019 admissions onwards)

Time: Three hours Max. Weight: 30

Section- A

(Answer any **eight** questions. Each question carries a weight of 1)

1. What is meant by punctuated equilibrium?
2. Comment on RNA World.
3. Define heterochrony.
4. What is co-evolution?
5. Define key stimuli.
6. What is goal oriented drive?
7. Explain lunar periodicity.
8. Comment on pheromones.
9. Define sociobiology.
10. Differentiate avoidance from tolerance behaviour

(8 x 1 = 8)

Section B

(Answer any **six** questions. Each question carries a weight of 2)

11. Write down the contributions of Margulis.
12. Explain evolution of prokaryotes
13. Comment on gene pool, gene frequency and Hardy Weinberg law.
14. Give an account on molecular evolution
15. Describe Lorenz's Psycho-hydraulic model of motivation
16. Explain conditioning with example
17. Give an account of navigation cues employed by animals during migration.
18. Discuss about hormones and behaviour.

(**6 x 2 = 12**)

Section C

(Answer any **two** questions. Each question carries a weight of 5.)

19. Write an essay on isolating mechanisms and speciation.
20. Give an account on various stages in primate evolution.
21. Explain the social organisation in primates.
22. Explain different modes of communication in ants and mammals.

(**2 x 5 = 10)**

M Sc. Zoology Degree (C.S.S) Examination

Second Semester

Faculty of Sciences

ZL010201 FIELD ECOLOGY

(2019 admissions onwards)

Time: Three hours Max. Weight: 30

Section- A

(Answer any **eight** questions. Each question carries a weight of 1)

1. Effect of global warming in species phenologies
2. Circadian rhythm and biological clock
3. Comment on mutualistic relationship of human with crops
4. Distinguish between deterministic extinction and stochastic extinction
5. Territoriality
6. Competitive exclusion principle
7. Different types of niches
8. Intraguild predation
9. Risk-sensitive foraging
10. Green technology

(8 x 1 = 8)

Section B

(Answer any **six** questions. Each question carries a weight of 2)

11. What are the effect of cold and hot temperature on organisms?
12. Comment on the response of animals to drought and flood
13. Comment on social parasitism
14. Discuss about the hunting tactics and adaptations
15. Write an account on different types of mutualism
16. Explain about antipredator adaptations
17. Comment on water scarcity and water conservation measures
18. What are the sources and effect of soil pollution?

(**6 x 2 = 12**)

Section C

(Answer any **two** questions. Each question carries a weight of 5.)

19. Discuss the characteristic properties of population
20. Write an essay on animal prey defense in natural ecosystem
21. Give an account on the responses of host to parasitism
22. Explain the biotechnological approaches to waste management

(**2 x 5 =10)**

M Sc Zoology Degree (C.S.S) Examination

III Semester

Faculty of Science

ZL010204 MICROBIOLOGY AND BIOTECHNOLOGY

(2019 admissions onwards)

Time: Three hours Max. Weight: 30

Section- A

(Answer any **eight** questions. Each question carries a weight of 1)

1. What is Slime layer?
2. Comment on culture medium.
3. Define quorum sensing.
4. What is YAC?
5. Define microinjection.
6. What is chromosome walking?
7. Explain cell culture.
8. Comment on Nif genes
9. Define nanobiosensors.
10. What is TRIPS.

(8 x 1 = 8)

Section B

(Answer any six questions. Each question carries a weight of 2)

11. Give the general characters and outline classification of bacteria.
12. Describe the bacterial cell wall.
13. Give an account on pure culture techniques.
14. Explain the role of microbes in nutrient cycling.
15. Describe the different methods of gene transfer.
16. Explain the types of PCR. Add a note on its applications.
17. Give a brief account on gene therapy.
18. Discuss about terminator gene technology.

(**6 x 2 = 12**)

Section C

(Answer any **two** questions. Each question carries a weight of 5.)

19. Write an essay on the various methods of sterilization.
20. Give an account on microbial interactions.
21. Explain the various sequencing methods.
22. Describe any four fermentation products.

(**2 x 5 = 10)**

M Sc. Zoology Degree (C.S.S) Examination

Fourth Semester

Faculty of Sciences

ZL800401 NUTRITION, GROWTH AND PHYSIOLOGY OF FISHES

(2019 admissions onwards)

Time: Three hours Max. Weight: 30

Section- A

(Answer any **eight** questions. Each question carries a weight of 1)

1. Balanced food of fishes
2. Classify fish food organism
3. Metabolizable energy in fish nutrition
4. Feed additives
5. Sex reversal in fishes
6. Luminescent organs
7. Aplacentalviviparity
8. Acoustic communication in fishes
9. Hill stream fishes
10. Venomous fishes

(8 x 1 = 8)

Section B

(Answer any **six** questions. Each question carries a weight of 2)

11. What are the feeding adaptations of fishes?
12. Comment on the modifications of digestive system with reference to growth
13. Give an account on the vitamin and mineral nutrition in fishes
14. Comment on protein nutrition in fishes
15. Discuss the role of nutrients and hormones in the regulation of growth
16. Comment on brood stock nutrition
17. Explain role ofstatoacoustic and mechanoreceptorsin fishes
18. What are the adaptive mechanisms of fishes in an altered environment?

(**6 x 2 = 12**)

Section C

(Answer any **two** questions. Each question carries a weight of 5.)

19. Give an account on larval nutrition in fishes
20. Write an essay on anatomy and functions of gastro-intestinal tract in carnivore and herbivore fishes
21. Discuss the role of endocrine system in the reproduction of fishes
22. Explain the communicative and locomotive behavior in fishes with examples

(**2 x 5 =10)**

M Sc. Zoology Degree (C.S.S) Examination

Fourth Semester

Faculty of Sciences

ZL800402 Fishery Resource and Management

(2019 admissions onwards)

Time: Three hours Max. Weight: 30

Section- A

(Answer any **eight** questions. Each question carries a weight of 1)

1. List out the endemic fishes of inland waters in Kerala
2. Fish passes
3. Seaweed fishery
4. Mud bank fishery
5. FIRMA
6. NIFPHATT
7. Composite fish culture
8. Pokkali field
9. Potential fish zone
10. Trawling ban

(8 x 1 = 8)

Section B

(Answer any **six** questions. Each question carries a weight of 2)

11. Comment on the scope of inland fishery in Kerala
12. What are the methods for the enhancement of fishery productivity in reservoirs?
13. Comment on the status of mangrove fishery in India
14. What are the threats and management aspect of marine biodiversity?
15. Write down the application of remote sensing fishery
16. Give an account on pond fertilization
17. What are the methods of prawn culture?
18. Explain the importance of aquaponics and its benefits

(**6 x 2 = 12**)

Section C

(Answer any **two** questions. Each question carries a weight of 5.)

19. Write an essay on the estuarine fishery of Kerala
20. Comment on the objectives and activities of Matsyafed
21. Discuss the role of oceanographic factors in fishery production
22. Explain the management aspects of hatcheries and farms

(**2 x 5 =10)**

M Sc. Zoology Degree (C.S.S) Examination

Fourth Semester

Faculty of Sciences

ZL800403 Fishery Science and Technology

(2019 admissions onwards)

Time: Three hours Max. Weight: 30

Section- A

(Answer any **eight** questions. Each question carries a weight of 1)

1. GFP transgenic
2. Feed probiotics
3. Freezer burn
4. Bio capsulated feeds
5. Chitin and chitosan
6. Feed mills
7. Recrystallization
8. Aseptic canning
9. Auto sterilization bacteriology
10. Classify fishing harbours

(8 x 1 = 8)

Section B

(Answer any **six** questions. Each question carries a weight of 2)

11. Comment on the application of biotechnology in gonadial growth and spawning
12. Explain the significance of gene bank in fishery science
13. Discuss the quality of feed ingredients and their biochemical composition
14. Give an account on biomedical and bioactive compounds of marine organisms
15. Explain bycatch reduction devises
16. Comment on the recent advances in fish thawing.
17. What are the various freezing methods?
18. Discuss the plant sanitation and hygiene in processing industry

(**6 x 2 = 12**)

Section C

(Answer any **two** questions. Each question carries a weight of 5.)

19. Write an essay on the recent trends and approaches in algal technology
20. Explain the principle and mechanism in thermal processing of fishery products
21. Give an account on quality assessment of fish and fishery products
22. Comment on the crafts and gears used for fishing

(**2 x 5 =10)**

M Sc. Zoology Degree (C.S.S) Examination

Fourth Semester

Faculty of Sciences

ZL830401- General Microbiology and Parasitology

(2019 admissions onwards)

Time: Three hours Max. Weight: 30

Section- A

(Answer any **eight** questions. Each question carries a weight of 1)

1. List contributions of Edward Jenner
2. What is the role of sand fly in parasitic infection?
3. What is called as ray fungi? Explain its salient features.
4. Mycolic acid
5. What are chemotrophic bacteria? Give two examples
6. Mode of action of Penicillin
7. Droplet nuclei
8. Exponential phase
9. Antibiogram
10. Blue milk

(8 x 1 = 8)

Section B

(Answer any **six** questions. Each question carries a weight of 2)

11. Phenol coefficient method
12. Chemostat
13. Air borne diseases
14. Difference between gram positive and gram negative bacteria
15. Pathogenesis and disease caused by *Ascaris lumbricoides*
16. Explain different milk quality testing methods.
17. What are the contributions of Louis Pasteur?
18. Explain differential staining technique with respect to acid fast staining.

(**6 x 2 = 12**)

Section C

(Answer any **two** questions. Each question carries a weight of 5.)

19. Different methods of enumeration of microbes from air
20. Explain the structure, life cycle and pathogenesis of *Entamoeba histolytica*
21. Explain in detail the structure of Cyanobacteria
22. Explain both the sexual and asexual reproduction of fungi.

(**2 x 5 = 10)**

M Sc. Zoology Degree (C.S.S) Examination

Fourth Semester

Faculty of Sciences

ZL830402- Bacteriology, Virology and Mycology

(2019 admissions onwards)

Time: Three hours Max. Weight: 30

Section- A

(Answer any **eigh t**questions. Each question carries a weight of 1)

1. Prophylaxis of communicable diseases
2. General properties of *Neisseria*
3. Pyrexia
4. Chikungunya virus
5. Prion diseases
6. Zoonotic infections
7. Interferons
8. Burst size
9. Cyanophages
10. Lactophenol staining blue technique

(8 x 1 = 8)

Section B

(Answer any **six** questions. Each question carries a weight of 2)

11. Bacteriophage typing
12. Genomic organization of HIV virus
13. Antifungal agents and their mode of action
14. Pathogenesis and disease caused by *Streptococcus*
15. Immunological and non immunological response of virus infection
16. Bacterial infections of respiratory and gastrointestinal tract
17. Pathogenesis and laboratory infections of *Treponema*
18. Sources and mode of transmission of bacterial infections

(**6 x 2 = 12**)

Section C

(Answer any **two** questions. Each question carries a weight of 5.)

19. Control of virus infections
20. Pathogenesis of bacterial infections
21. Pathogenesis and diseases caused by oncogenic viruses
22. Systemic mycosis

(**2 x 5 = 10)**

M Sc. Zoology Degree (C.S.S) Examination

Fourth Semester

Faculty of Sciences

ZL830403- Clinical Microbiology

(2019 admissions onwards)

Time: Three hours Max. Weight: 30

Section- A

(Answer any **eight**questions. Each question carries a weight of 1)

1. Good Laboratory Practises
2. Enrichment culture
3.Lyophilization
4. Nasopharyngeal swab
5. Standard plate count method
6. Different colony morphology of bacteria
7.Imvic test
8. CPE
9. Superficial mycosis
10. Collection and transport of sputum sample

(8 x 1 = 8)

Section B

(Answer any**six** questions. Each question carries a weight of 2)

11.Explain the detection of viral proteins and viral genetic material
12. Describe the different microbiological safety cabinets
13. Explain the cleaning and sterilization of glassware
14. Explain the processing and microscopical examination of blood, stool and CSF samples
15. Explain the serological diagnosis of viral infections
16. Explain molecular diagnostic methods of microbes
17. Explain the biochemical tests for bacterial infections
18. Explain the legal requirements and humane method of killing animals

(**6 x 2 = 12**)

Section C

(Answer any **two** questions. Each question carries a weight of 5.)

19.Explain any 2 diagnostic methods of parasitic infection in detail
20. Explain the culturing of viruses
21. Explain the diagnosis of fungal infection
22. Explain the different techniques in the preservation of microbes

(**2 x 5 = 10)**

PG DEPARTMENT OF ZOOLOGY

TIME TABLE 2021-2022

		I	II	III	IV	V
MONDAY	SEM I	Dr.Meera Menon	Ms.Linta Joseph	Ms. Princy Varghese	Ms. Princy Varghese	Ms.Meenu Raju
	SEM III	Ms. Princy Varghese	Ms.Meenu Raju	Dr.Meera Menon	Dr.Meera Menon	Ms.Linta Joseph
TUESDAY	SEM I	Ms.Linta Joseph	Ms.Meenu Raju	Dr.Meera Menon	Ms. Princy Varghese	Ms.Meenu Raju
	SEM III	Dr.Meera Menon	Ms. Princy Varghese	Ms.Linta Joseph	Dr.Meera Menon	Ms.Linta Joseph
WEDNESDAY	SEM I	Dr.Meera Menon	Ms.Meenu Raju	Ms.Linta Joseph	Ms.Meenu Raju	Ms. Princy Varghese
	SEM III	Ms.Linta Joseph	Ms. Princy Varghese	Dr.Meera Menon	Ms.Linta Joseph	Ms.Meenu Raju
THURSDAY	SEM I	Dr.Meera Menon	Ms.Meenu Raju	Ms. Princy Varghese	Dr.Meera Menon	Ms.Linta Joseph
	SEM III	Ms.Meenu Raju	Ms. Princy Varghese	Dr.Meera Menon	Ms. Princy Varghese	Ms.Meenu Raju
FRIDAY	SEM I	Ms. Princy Varghese	Ms.Meenu Raju	Ms.Linta Joseph	Dr.Meera Menon	Ms.Linta Joseph
	SEM III	Dr.Meera Menon	Ms.Linta Joseph	Ms.Meenu Raju	Ms. Princy Varghese	Ms.Meenu Raju

NAME OF TEACHER	Semester 1 No of Hours/Week or paper	Semester 3 No of Hours/Week or paper	Total
Dr.Meera Menon	6 (EVOLUTIONARY BIOLOGY AND ETHOLOGY)	7 (ANIMAL PHYSIOLOGY)	13
Ms.Princy Varghese	6 (BIOSTATISTICS AND RESEARCH METHODOLOGY)	6 (BIOPHYSICS AND IN INTRUMENTATION)	12
Ms. Meenu Raju	7 (ANIMAL DIVERSITY)	6 (CELL & MOLECULAR BIOLOGY)	13
Ms.Linta Joseph	6 (BIOCHEMISTRY)	6 (IMMUNOLOGY)	12

The Cochin College PG Department of Zoology KOCHI-02

Dr. Meera Menon
Head, PG Department of Zoology
The Cochin College
Kochi - 2

Kochi - 2

		I	II	III	IV	V
MONDAY	SEM II	Dr.Meera Menon	Ms.Meenu Raju	Ms.Linta Joseph	Ms.Linta Joseph	Ms.Meenu Raju
	SEM IV	Ms. Princy Varghese	Ms. Princy Varghese	Ms.Meenu Raju	Ms. Princy Varghese	Ms.Linta Joseph
TUESDAY	SEM II	Dr.Meera Menon	Ms.Linta Joseph	Ms.Meenu Raju	Ms.Meenu Raju	Ms.Meenu Raju
	SEM IV	Ms. Princy Varghese	Ms. Princy Varghese	Ms.Linta Joseph	Dr.Meera Menon	Ms.Linta Joseph
WEDNESDAY	SEM II	Dr.Meera Menon	Dr.Meera Menon	Ms. Princy Varghese	Ms.Meenu Raju	Ms.Linta Joseph
	SEM IV	Ms. Princy Varghese	Ms. Princy Varghese	Ms.Meenu Raju	Ms. Princy Varghese	Dr.Meera Menon
THURSDAY	SEM II	Dr.Meera Menon	Ms.Linta Joseph	Dr.Meera Menon	Ms.Linta Joseph	Ms.Meenu Raju
	SEM IV	Ms.Linta Joseph	Ms. Princy Varghese	Ms. Princy Varghese	Ms.Meenu Raju	Dr.Meera Menon
FRIDAY	SEM II	Ms. Princy Varghese	Dr.Meera Menon	Ms.Linta Joseph	Ms.Linta Joseph	Ms.Linta Joseph
	SEM IV	Dr.Meera Menon	Ms. Princy Varghese	Ms.Meenu Raju	Dr.Meera Menon	Ms.Meenu Raju

NAME OF TEACHER	Semester 2 No of Hours/Week or paper	Semester 4 No of Hours/Week or paper	Total
Dr.Meera Menon	7 (DEVELOPMENTAL BIOLOGY)	5 (PARASITOLOGY)	12
Ms.Princy Varghese	2 (MICROBIOLOGY AND BIOTECHNOLOGY)	11 BACTERIOLOGY,VIROLOGY & MYCOLOGY,CLINICAL MICROBIOLOGY)	13
Ms. Meenu Raju	7 (GENETICS AND BIOINFORTMATICS)	5 (GENERAL MICROBIOLOGY)	12
Ms.Linta Joseph	9 (ECOLOGY)	4 (GENERAL MICROBIOLOGY)	13

The Cochin College ★ PG Department of Zoology ★ KOCHI 682

Dr. Meera Menon
Head, PG Department of Zoology
The Cochin College
Kochi - 2



MAHATMA GANDHI UNIVERSITY

Priyadarshini Hills, Kottayam 686 560

CURRICULUM OF

CHOICE BASED CREDIT SYSTEM

FOR

UNDERGRADUATE

ZOOLOGY PROGRAMME

2017 ADMISSION ONWARDS

PREPARED

BY

BOARD OF STUDIES

AND

FACULTY OF SCIENCE

ACKNOWLEDGEMENT

The unstinted support provided by some profound personalities and their guidance has immensely contributed to the successful completion of this syllabus restructuring venture.

The initiative taken by the Hon.Vice Chancellor of Mahatma Gandhi University towards restructuring the curriculum of the undergraduate courses of this university is gratefully acknowledged here. Under his leadership, this restructuring effort by a team of Professors has been successfully completed.

The relentless support by the Hon. Pro Vice Chancellor and the Registrar of M. G. University, for the successful completion of the syllabus restructuring is also gratefully acknowledged.

The gratitude felt towards the Syndicate members for their encouragement and continuous support right through the entire exercise is to be mentioned here with gratitude.

The hospitality shown by the M. G. University staff and the assistance provided by them in various stages of this endeavor of restructuring is also acknowledged here.

Any venture of this magnitude requires the whole hearted support of several individuals in their official capacity or otherwise, directly or indirectly associated with the process.The magnanimity of each and every such person is being etched here in golden words.

Dean – Faculty of Science

M G University, Kottayam.

CONTENTS

1. Introduction

2. Aims and objectives

3. Duration of course

4. Programme structure

5. Evaluation

6. Consolidated scheme for I to VI Semesters

7. Scheme of distribution of instructional hours for B.sc Zoology Programme – Model I (Core courses)

8. Scheme of distribution of hours and credits for B.Sc Zoology Programme- Model I (Core course)

9. Scheme of distribution of hours and credits for Open course & Elective courses

10. Scheme of examinations:

- **a. Scheme of Theory examination(Core course)**
- **b. Scheme of practical examination(Core course)**
- **c. Total credits for core course**
- **d. Scheme of field study, research institute visit, group activity, project and viva(Core course)**

11. Scheme of distribution of hours and credits for Complimentary Zoology courses

12. B.Sc Zoology programme Model I (Core course):

Syllabus – Theory and Practical

13. B.Sc Zoology Complementary course:

Syllabus for Model I, II &III:

Model I – B.Sc Botany / B.Sc Home Science

Model II - B.Sc Botany

ModeI II - B.Sc Vocational Courses:

B.Sc Aquaculture,

B.Sc Food Microbiology,

B.Sc Medical Micrbiology

Model III - B.Sc Biological Techniques,

B.Sc Industrial Microbiology

14. Model II B.Sc Vocational Courses

a. Different subjects for Vocational Courses

1. Aquaculture

2. Food Microbiology

3. Medical Microbiology

b. Consolidated distribution of hours for Vocational courses

c. Scheme of examination– Theory & Practical

d. Scheme of distribution of hours & credits

e. Syllabus – Theory & Practicals:

1. Aquaculture

2. Food Microbiology

3. Medical Microbiology

15. Model III B.Sc Zoology programme

I. Biological Techniques & Specimen preparation

a. Scheme of distribution of hours, credits

& examination: i. Theory

ii. Practical

b. Syllabus – Theory and Practicals

2. Industrial Microbiology

a. Scheme of distribution of hours, credits

&examination: i. Theory

ii. Practical

b. Syllabus – Theory and Practical

1. INTRODUCTION

Curriculum restructuring is the responsibility of any University that offers different courses. As per U.G.C guidelines it should be revised every three years. Accordingly the authorities of M.G University have taken the initiative to restructure the syllabus of each course for the benefit of the students.

According to Altman and Cashin "the primary purpose of a syllabus is to communicate to one's students what the course is about, why the course is taught, where it is going, and what will be required of the students, for them to complete the course with a passing grade. Claire Johnson says "the syllabus functions as a major communication device that provides details of how student learning will be assessed and about the roles of both Students and Instructors in the learning and assessment process. The syllabus is a "description" and "plan" for a course and if well written may be a tool that improves student learning, facilitates faculty teaching, improves communication between faculty members about their courses and assists with monitoring program quality says Claire Johnson (2006). Additionally Parke,Fix and Harris suggest that " the syllabus serves as a contract between the Instructor and the learner".

The M.G. University is well recognised among Universities for their quickness in updating technologies. It is the recipient of the award for computerization among the Universities. Ever since its inception, the M.G.University has had the history of updating its syllabi for the various courses offered. Presently, this exercise has resulted in the syllabus of Zoology, for the undergraduate students undergoing model I, II and III courses, reaching successful updation.

India, a mega biodiversity nation stands out as a fascinating destination, exhibiting an incredible diversity in its fauna and flora. Innumerable species of organisms live here contributing to India's most beautiful natural topography.. All round development becomes possible only by exploring the vast potential of the still unknown resources of nature. Zoology undergraduate students are therefore made to go through the realities like Biota,anatomy and physiology of living organisms, DNA biotechnology, diseases, pathogens and parasites, environment, resources, protection of endangered organisms and their conservation, the "right to live" of all organisms in this world, and finally scientific knowledge about cottage industries, prompting students to involve in self employment programs.

The constant and unstinted efforts of the entire faculty of Zoology within M.G.University has been instrumental in framing this syllabus for the subject Zoology in this form. The faculty of Zoology proudly and sincerely submit herewith this updated syllabus in Zoology for its implementation in the coming three years.

2. AIMS & OBJECTIVES

The BSc. Zoology programme is designed to help the students to:

1. Acquire basic knowledge of various disciplines of Zoology and General Biology meant both for a graduate terminal course and for higher studies.
2. Inculcate interest in nature and love of nature.
3. Understand the rich diversity of organisms and their ecological and evolutionary significance
4. Imbibe basic skills in the observation and study of nature, biological techniques, experimental skills and scientific investigation
5. Create awareness on the internal harmony of different body systems and the need for maintaining good health through appropriate lifestyle.
6. Acquire basic knowledge and skills in certain applied branches for self employment
7. Impart awareness of the conservation of the biosphere.

3. DURATION OF THE COURSE

The duration of U.G. programmes have 6 semesters.There shall be two Semesters in an academic year, the odd semester commences in June and on completion, the even Semester commences after a semester-break of three days with two months vaccation during April and May. (The commencement of first semester may be delayed owing to the finalization of the admission processes.)

A student may be permitted to complete the Programme,onvalid reasons, withinaperiod of 12 continuous semesters from the date of commencement of the first semester of the programme.

4. PROGRAMME STRUCTURE - B.Sc Model I

a	Programme Duration	6 Semesters
b	Total Credits required for successful completion of the Programme	120
c	Credits required from Common Course I	22
d	Credits required from Common Course II	16
e	Credits required from Core course and Complementary courses including Project	79
f	Open course	3

g	Minimum attendance required	75%

B.Sc Model II

A	Programme Duration	6 Semesters
B	Total Credits required for successful completion of the Programme	120
C	Credits required from Common Course I	16
D	Credits required from Common Course II	8
E	Credits required from Core + Complementary + Vocational Courses including Project	93
F	Open course	3
G	Minimum attendance required	75%

B.Sc Model III

A	Programme Duration	6 Semesters
B	Total Credits required for successful completion of the Programme	120
C	Credits required from Common Course I	8
D	Credits required from Core + Complementary + Vocational Courses including Project	109
E	Open course	3
F	Minimum attendance required	75%

5. EVALUATIONS:.

The evaluation of each paper shall contain two parts:

(i) Internal Assessment

(ii) External Assessment

The internal to external assessment ratio shall be 1:4.

EXTERNAL EXAMINATION AND INTERNAL EVALUATION

The external theory examination of all semesters shall be conducted by the University at the end of each semester. Internal evaluation is to be done by continuous assessment

ASSIGNMENTS

Assignments are to be done from 1st to 4th Semesters. At least one assignment should be done in each semester for all papers.

INTERNAL ASSESSMENT TEST PAPERS

The test papers & evaluations of all components are to be published and are to be acknowledged by the candidates. All documents of internal assessments are to be kept in the college for two years and shall be made available for verification by the University. The responsibility of evaluating the internal assessment is vested on the teacher(s), who teach the paper.

EXTERNAL EXAMINATION

The external theory examination of all semesters shall be conducted by the University at the end of each semester. Students having a minimum of 75% average attendance for all the courses only can register for the examination. Condonation of shortage of attendance to a maximum of 10 days in a semester subject to a maximum of 2 times during the whole period of the programme may be granted by the University on valid grounds. This condonation shall not be counted for internal assessment. Benefit of attendance may be granted to students attending University/College union/Co-curricular activities by treating them as present for the days of absence, on production of participation/attendance certificates, within one week, from competent authorities and endorsed by the Head of the institution. This is limited to a maximum of 10 days per semester and this benefit shall be considered for internal assessment also. Those students who are not eligible even with condonation of shortage of attendance shall repeat the **semester** along with the next batch after obtaining readmission.

All students are to do a **project in the area of core course.** This project can be done individually or in groups (not more than three students) which may be carried out in or outside the campus. Special sanction shall be obtained from the Vice Chancellor to those **new generation programmes** and programmes on **performing arts** where students have to take projects which involve larger groups. The projects are to be identified during the fifth semester of the programme with the help of the supervising teacher. The report of the project in duplicate is to be submitted to the department at the sixth semester and are to be produced before the examiners appointed by the University. External Project evaluation and Viva / Presentation is compulsory for all subjects and will be conducted at the end of the programme. There will be no supplementary exams. For reappearance/ improvement, the students can appear along with the next batch.

6. CONSOLIDATED SCHEME FOR BSC ZOOLOGY PROGRAMME

MODEL-1 (1-VI SEMESTERS)
(TOTAL CREDITS 120)
(TOTAL HOURS 150 Hrs.)

Semester 1

No	Course Code	Course Title	Course Category	Hrs per week	Credits	Marks ratio	
						Intl	Extl
1		English - 1	Common Course I	5	4	1	4
2		English - 2	Common Course II	4	3	1	4
3		Second Language – 1	Common Course III	4	4	1	4
4	ZY1CRT01	General perspectives in Science & Protistan Diversity	Core Course I : Theory	2	2	1	4
5		Practical : General perspectives in Science & Protistan Diversity	Core Course I : Practical	2	0	0	0
6		Chemistry 1/ Biochemistry 1	Complementary Course I : Theory	2	2	1	4
7		Chemistry 1	Complementary Course I : Practical	2	0	0	0
8		Botany 1	Complementary Course II : Theory	2	2	1	4
9		Botany 1	Complementary Course II : Practical	2	0	0	0
Total				**25 hrs**	**17**		

Semester 2

No	Course Code	Course Title	Course Category	Hrs per week	Credits	Marks ratio	
						Intl	Extl
1		English 3	Common Course	5	4	1	4

			IV				
2		English 4	Common Course V	4	3	1	4
3		Second Language -2	Common Course VI	4	4	1	4
4	ZY2CRT02	Animal Diversity- Non Chordata	Core Course II : Theory	2	2	1	4
5	ZY2CRP01	Animal Diversity – Non Chordata	Core Course II : Practical	2	2	1	4
6		Chemistry – II / Biochemistry - II	Complementary Course I : Theory	2	2	1	4
7		Chemistry – II / Biochemistry - II	Complementary Course I : Practical	2	2	1	4
8		Botany – II	Complementary Course II : Theory	2	2	1	4
9		Botany – II	Complementary Course II : Practical	2	2	1	4
Total				**25 hrs**	**23**		

Semester 3

No	**Course Code**	**Course Title**	**Course Category**	**Hrs per week**	**Credits**	**Marks ratio**	
						Intl	**Extl**
1		English 5	Common Course VII	5	4	1	4
2		Second Language 3	Common Course VIII	5	4	1	4
3	ZY3CRT03	Animal Diversity - Chordata	Core Course III : Theory	3	3	1	4
4	ZY3CRPO3	Animal Diversity- Chordata	Core Course III : Practical	2	0	0	0
5		Chemistry – III / Biochemistry - III	Complementary Course I : Theory	3	3	1	4
6		Chemistry – III / Biochemistry - III	Complementary Course I : Practical	2	0	0	0

7		Botany III	Complementary Course II : Theory	3	3	1	4
8		Botany III	Complementary Course II : Practical	2	0	0	0
Total				**25 hrs**	**17**		

Semester 4

No	**Course Code**	**Course Title**	**Course Category**	**Hrs per week**	**Credits**	**Marks ratio**	
						Intl	**Extl**
1		English - 6	Common Course IX	5	4	1	4
2		Second language - 4	Common Course X	5	4	1	4
3	ZY4CRT04	Research methodology, Biophysics & Biostatistics	Core Course IV : Theory	3	3	1	4
4	ZY4CRP02	Research methodology, Biophysics & Biostatistics	Core Course IV : Practical	2	2	1	4
5		Chemistry – IV / Biochemistry - IV	Complementary Course I : Theory	3	3	1	4
6		Chemistry – IV / Biochemistry - IV	Complementary Course I : Practical	2	2	1	4
7		Botany - IV	Complementary Course II : Theory	3	3	1	4
8		Botany - IV	Complementary Course II : Practical	2	2	1	4
Total				**25 hrs**	**23**		

Semester 5

No	Course Code	Course Title	Course Category	Hrs per week	Credits	Marks ratio	
						Intl	Extl
1	ZY5CRT05	Environmental Biology & Human rights	Core Course V : Theory	3	3	1	4
2	ZY5CRPO5	Environmental Biology & Human rights	Core Course V : Practical	2	0	0	0
3	ZY5CRT06	Cell Biology & Genetics	Core Course VI : Theory	3	3	1	4
4	ZY5CRPO6	Cell Biology & Genetics	Core Course VI : Practical	2	0	0	0
5	ZY5CRT07	Evolution, Ethology & Zoogeography	Core Course VII : Theory	3	3	1	4
6	ZY5CRPO7	Evolution, Ethology & Zoogeography	Core Course VII : Practical	2	0	0	0
7	ZY5CRT08	Human Physiology, Biochemistry & Endocrinology	Core Course VIII : Theory	3	3	1	4
8	ZY5CRPO8	Human Physiology, Biochemistry & Endocrinology	Core Course VIII : Practical	2	0	0	0
9	ZY5OPT01	1 – Vocational Zoology (Apiculture, Vermiculture, Ornamental fish culture)	Open Courses for other streams *(Select any one out of three)*	4	3	1	4
	ZY5OPT02	2 – Public health and Nutrition					
	ZY5OPT03	3 – Man, nature & Sustainable Development					
10	ZY6CRPRP	Project work (Credit 2 will be given in 6th semester with investigatory project).	Project	1	0		
Total				**25 hrs**	**15**		

Semester 6

No	Course Code	Course Title	Course Category	Hrs per week	Credits	Marks ratio	
						Intl	Extl
1	ZY6CRT09	Developmental Biology	Core Course IX : Theory	3	3	1	4
2	ZY6CRP09	Developmental Biology	Core Course IX : Practical	2	2	1	4
3	ZY6CRT10	Microbiology & Immunology	Core Course X : Theory	3	3	1	4
4	ZY6CRP10	Microbiology & Immunology	Core Course X : Practical	2	2	1	4
5	ZY6CRT11	Biotechnology, Bioinformatics and Molecular Biology	Core Course XI : Theory	3	3	1	4
6	ZY6CRP11	Biotechnology, Bioinformatics and Molecular Biology	Core Course XI : Practical	2	2	1	4
7	ZY6CRT12	Occupational Zoology (Aquaculture, Apiculture, Vermiculture & Quail farming)	Core Course XII : Theory	3	3	1	4
8	ZY6CRP12	Occupational Zoology (Aquaculture, Apiculture, Vermiculture & Quail farming)	Core Course XII : Practical	2	2	1	4
9	ZY6CBT01	Elective 1: Ecotourism & Sustainable Development	Choice Based Core Elective Courses *(Select any one out of four)*	4	3	1	4
	ZY6CBT02	Elective 2: Agricultural pest management					
	ZY6CBT03	Elective 3: Vector & Vector borne Diseases					
	ZY6CBT04	Elective 4: Nutrition, Health & life style management					
10	ZY6CRPRP	Project Work	Project	1	2		
Total				**25 hrs**	**25**		

7. SCHEME OF DISTRIBUTION OF INSTRUCTIONAL HOURS

B.Sc. ZOOLOGY PROGRAMME : CORE COURSES –MODEL I

Name of semester	Theory	Practical
First semester	2	2
Second semester	2	2
Third semester	3	2
Fourth semester	3	2
Fifth semester	16	8
Field study & group activity	1	
Sixth semester	16	8
Project work (in sixth sem.), Visit to research institute	1	
Total	**44**	**24**

RECORDS

1. General perspectives in Science & Protistan Diversity
2. Animal Diversity –Non Chordata
3. Animal Diversity - Chordata
4. Research Methodology, Biophysics and Biostatistics
5. Environmental Biology & Human rights
6. Cell Biology & Genetics
7. Evolution and Ethology & Zoogeography
8. Human Physiology, Biochemistry & Endocrinology
9. Developmental Biology
10. Microbiology and Immunology
11. Biotechnology, Bioinformatics & Molecular Biology
12. Occupational Zoology

Each Record will be having external and internal evaluation. A total of 1 credit will be allotted for each record and respective practical.

FIELD STUDY/ (STUDY TOUR)

Study tour/ field study, visit to research institute and various places of zoological Importance

A study tour is compulsory**.** Field study/study tours should be conducted for not less than 6 days (completed during the entire programme), preferably spreading the study in the first to sixth semesters. Students are expected to visit research institutes and various places of zoological importance.

GROUP ACTIVITY

Students are expected to do one group activity in the fifth semester and submit the report in the sixth semester for external practical examination, along with study tour report.

A maximum of ten students can choose any one group activity like aquarium management, vermicomposting, bee keeping, and conduct of zoological exhibitions, designing of posters of zoological importance, surveys related to disease outbreaks, community health programmes or any matter of zoological interest.

A brief report on any two activities mentioned in each elective paper should be submitted as a component of assignment for internal evaluation.

8. SCHEME OF DISTRIBUTION OF HOURS AND CREDIT

B.Sc. ZOOLOGY PROGRAMME : MODEL -1 CORE COURSE

Semester	Title of the Course	Hrs	Inst Hrs/week	Credit
1	General perspectives in Science & Protistan Diversity	36	2	2
1	General perspectives in Science & Protistan diversity (Practical)	36	2	0
2	Animal Diversity – Non Chordata	36	2	2
2	Animal Diversity – Non Chordata (Practical)	36	2	2
3	Animal Diversity - Chordata	54	3	3
3	Animal Diversity - Chordata (Practical)	36	2	0
4	Research Methodology, Biophysics and Biostatistics	54	3	3
4	Research Methodology, Biophysics and Biostatistics (Practical)	36	2	2
5	Environmental Biology & Human rights	54	3	3
5	Environmental Biology & Human rights (Practical)	36	4	0
5	Cell Biology & Genetics	54	3	3
5	Cell Biology & Genetics (Practical)	36	2	0
5	Evolution, Ethology & Zoogeography	54	3	3
5	Evolution, Ethology & Zoogeography (Practical)	36	2	0
5	Human Physiology, Biochemistry & Endocrinology	54	3	3

5	Human Physiology, Biochemistry & Endocrinology (Practical)	36	2	0
6	Developmental Biology	54	3	3
6	Developmental Biology (Practical)	36	2	2
6	Microbiology & Immunology	54	3	3
6	Microbiology & Immunology (Practical)	36	2	2
6	Biotechnology, Bioinformatics & Molecular biology	54	3	3
6	Biotechnology, Bioinformatics &Molecular Biology (Practical)	36	4	2
6	Occupational Zoology (Aquaculture, Apiculture,Vermiculture & Quail farming)	54	3	3
6	Occupational Zoology(Aquaculture, Apiculture,Vermiculture & Quail farming) (Practical)	36	2	2

9. SCHEME OF DISTRIBUTION OF HOURS AND CREDITS :

OPEN COURSES (FOR OTHER STREAMS) & ELECTIVES

Seme ster	Course No	**Title of the Course (Select any one from each group)**	**Hrs**	**Inst Hrs/ week**	**Cre dit**
5	Open course - 1	Vocational Zoology (Apiculture,Vermiculture & Ornamental Fish Culture)	72	4	3
5	Open course-2	Public Health & Nutrition			
5	Open course-3	Man, Nature & Sustainable Development			
6	Choice Based Core Elective - 1	Ecotourism & Sustainable Development	72	4	3
6	Choice Based Core Elective - 2	Agricultural Pest Management			
6	Choice Based Core Elective - 3	Vector & Vector Borne Diseases			
6	Choice Based Core Elective - 4	Nutrition, Health & Life Style Management			

10. SCHEME OF EXAMINATIONS

a. SCHEME OF EXAMINATION - THEORY (CORE COURSE)

Theory Examinations will be conducted by the University at the end of the respective semester in which the course is conducted. Duration 3 Hrs (Internal External ratio =1:4)

Sem	Course Code	Course Title	Course Category	Duration	Marks ratio		Credits
				Hrs	Internal (I)	External (E)	
1	ZY1CRT01	General perspectives in Science & Protistan Diversity	1	2	1	4	2
2	ZY2CRT02	Animal Diversity – Non Chordata	2	2	1	4	2
3	ZY3CRT03	Animal Diversity-Chordata	3	3	1	4	3
4	ZY4CRT04	Research Methodology, Biophysics and Biostatistics	4	3	1	4	3
5	ZY5CRT05	Environmental Biology & Human rights	5	3	1	4	3
5	ZY5CRT06	Cell Biology & Genetics	6	3	1	4	3
5	ZY5CRT07	Evolution, Ethology & Zoogeography	7	3	1	4	3
5	ZY5CRT08	Human Physiology, Biochemistry & Endocrinology	8	3	1	4	3
6	ZY6CRT09	Developmental Biology	9	3	1	4	3
6	ZY6CRT10	Microbiology and Immunology	10	3	1	4	3
6	ZY6CRT11	Biotechnology, Bioinformatics & Molecular Biology	11	3	1	4	3
6	ZY6CRT12	Occupational Zoology (Aquaculture, Apiculture,Vermiculture	12	3	1	4	3

		& Quail farming)					
Zoology Open Course Sem 5 *(Select any 1 from 3)*	ZY5OPT01	Vocational Zoology (Apiculture, Vermiculture, & Ornamental Fish Culture)	Open course (for other streams)-1	4	1	4	3
	ZY5OPT02	Public Health & Nutrition	Open course -2				
	ZY5OPT03	Man, Nature & Sustainable Development	Open course -3				
Sem 6 *(Select any 1 from the four)*	ZY6CBT01	Ecotourism & Sustainable Develpoment	Choice Based Course-1	4	1	4	3
	ZY6CBT02	Agricultural Pest Management	Choice Based Course-2				
	ZY6CBT03	Vector & Vector Bourne Diseases	Choice Based Course-3				
	ZY6CBT03	Nutrition,Health & Life Style Management	Choice Based Course -4				

b. SCHEME OF PRACTICAL EXAMINATIONS

University Practical Examinations will be conducted at the end of even semester 2,4 and 6.

Semester	**Code**	**Practical No.**	**Course Title**	**Duration**	**Marks ratio**		**Credits**
				Hrs	**Internal (I)**	**External (E)**	
2	ZY2CRP01	I	General Perspectives in Science, Protistan Diversity Biodiversity & Animal Diversity – Non Chordata	3 Hrs	1	4	2
4	ZY4CRP02	II	Animal Diversity – Chordata, Research methodology, Biophysics &	3 Hrs	1	4	2

			Biostatistics				
6	ZY6CRP03	III	Environmental Biology, Toxicology, Cell Biology & Genetics	3 Hrs	1	4	2
6	ZY6CRP04	IV	Evolution, Ethology, Zoogeography, Human Physiology, Biochemistry & Endocrinology	3 Hrs	1	4	2
6	ZY6CRP05	V	Developmental Biology, Microbiology & Immunology	3 Hrs	1	4	2
6	ZY6CRP06	VI	Biotechnology, Bioinformatics, Molecular Biology & Occupational Zoology	3 Hrs	1	4	2

c. Total Credits for Core Course

Theory	
Core + Choice Based Core (Elective)	37
Open course	3
Practical	12
Project	2
Total	**54**

d. SCHEME OF FIELD STUDY, RESEARCH INSTITUTE VISIT, GROUP ACTIVITY, PROJECT AND VIVA-CORE COURSE (Credit 2)

Marks Maximum 100

	Internal Assessments (I)	External Assessments (E)
Project:- Log book showing the progress of project work duly signed by the supervising teacher & HOD	**20**	**Project report – 50 marks** Title- 2 Marks Abstract- 3 Marks Introduction & Review of literature- 10 Marks Methodology- 10 Marks Results- 10 Marks Discussion & Conclusion - 10 Marks Neat presentation and Novelty- 5 Marks **Presentation & Viva- 30Marks** (Student can present the project using OHP or LCD, in 7 Minutes) Viva Voce.
Total	**20**	**80**

11. COMPLEMENTARY ZOOLOGY COURSES OFFERED BY ZOOLOGY DEPARTMENT FOR - MODEL I – BSc BOTANY / BSc HOME SCIENCE
MODEL II – BSc BOTANY / VOCATIONAL SUBJECTS
MODEL III – BSc (BIOLOGICAL TECHNIQUES AND SPECIMEN PREPARATION)

Semester	Code	Title of the Course	Hrs	Inst Hrs/week	Credit
1	ZY1CMT01	Non Chordate Diversity	36	2	2
1		Non Chordate Diversity (Practicals)	36	2	0
2	ZY2CMT02	Chordate Diversity	36	2	2
2		Chordate Diversity (Practicals)	36	2	0
2	ZY2CMP01	**Practical 1** Non Chordate Diversity + Chordate Diversity (Practicals)			2
3	ZY3CMT03	Physiology and Immunology	54	3	3
3		Physiology and Immunology (Practicals)	36	2	0
4	ZY4CMT04	Applied Zoology	54	3	3
		Applied Zoology (Practicals)	36	2	
4	ZY4CMP02	**Practical 2** Physiology and Immunology + Applied Zoology (Practical)			2

12. SYLLABUS:

B.Sc ZOOLOGY PROGRAMME

MODEL – I

THEORY & PRACTICALS

SEMESTER 1. ZY1CRT0I. CORE COURSE 1.

GENERAL PERSPECTIVES IN SCIENCE & PROTISTAN DIVERSITY

36 Hrs

Credits 2

Objectives:

- To create an awareness on the basic philosophy of science, concepts and scope
- To understand different levels of biological diversity through the systematic classification
- To familiarize taxa level identification of animals
- To make interest in Protistan diversity
- To impart knowledge on parasitic forms of lower invertebrates.

PART I PERSPECTIVES IN SCIENCE 8Hrs

Module I Introduction to Scientific Studies 4Hrs

Types of knowledge: practical, theoretical, and scientific knowledge. What is science, features of science, Deductive and inductive models, scientific temper, empiricism vocabulary of science.

Module II What is Biology? 4 Hrs

Life and its manifestations, History of Biology: Biology in ancient times Landmarks in the progress of Biology. Branches of Zoology , Scope of Zoology

PART II SYSTEMATICS 10 Hrs

Module III–Taxonomical Principles and tools

Systematic, Taxonomy, Phylogeny [Brief account] , Approaches to taxonomy, Molecular taxonomy, .Bar coding. Zoological nomenclature, International Code of Zoological Nomenclature (ICZN), Law of Priority. Five Kingdom Classification; Linnaean classification, Basis for Animal kingdom classification [Levels of organization, Symmetry, Coelom]

Identification tools

Taxonomic key. Types: Single access key- Dichotomous [linked and nested] and Polytomous key, Multi access key, Computer aided Interactive Key

Advantages and Disadvantages

PART III: PROTISTAN DIVERSITY **18 Hrs**

Module IV – Kingdom Protista Type**: *Paramecium*** **5 Hrs**

Salient features of KingdomProtista **10 Hrs**

Classification of Protista up to phyla

1. Phylum Rhizopoda :Eg. *Amoeba*
2. Phylum Actinopoda : Eg. *Actinophrys*
3. Phylum Dinoflagellata : Eg. *Noctiluca*
4. Phylum Parabasalia : Eg. *Trychonympha*
5. Phylum Metamonada : Eg. *Giardia*
6. Phylum Kinetoplasta : Eg. *Trypanosoma*
7. Phylum Euglenophyta : Eg. *Euglena*
8. Phylum Cryptophyta : Eg. *Cryptomonas*
9. Phylum Opalinata : Eg. *Opalina*
10. Phylum Bacillariophyta :Eg. Diatoms
11. Phylum Chlorophyta :Eg. *Volvox*
12. Phylum Choanoflagellata :Eg. *Proterospongia*
13. Phylum Ciliophora : Eg. *Balantidium coli*
14. Phylum Sporozoa : Eg. *Plasmodium*
15. Phylum Microsporidia :Eg. *Nosema*
16. Phylum Rhodophyta :Eg. Red Alga

(Mention any five general characters for each phylum. Detailed accounts of examples are not necessary.)

General Topics: **3 Hrs**

1. Parasitic protists (diseases mode of transmission and prophylactic measures) - Entamoeba, Trypanosoma, Plasmodium (detailed account of life cycle),Leishmania .

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SEMESTER 1

CORE COURSE PAPER 1

PERSPECTIVES IN SCIENCE & PROTISTAN DIVERSITY

(PRACTICAL)

36 Hrs

2 Credits

1. Taxa, identification techniques
   Bird body parts
   Butterfly/ dragonfly body parts
2. Identification using keys
   Insect, Fish, Snake (Poisonous & Non Poisonous)
   (Any 3 specimens from each category)
3. General identification - The students are expected to identify any 6 Protiatans studied by their generic names and write the general characters of their Phylum.
4. Identification of any 4 economically important protists/parasitic protists
   (Slides/figures may be used for identification)
5. Identification of two Protistan from pond water

SEMESTER 11. ZY2CRT02

CORE COURSE 11: ANIMAL DIVERSITY - NON CHORDATA

36 Hrs

Credits 2

Objectives:

- To create appreciation on diversity of life on earth
- To understand different levels of biological diversity through the systematic classification of invertebrate fauna
- To familiarize taxa level identification of animals
- To understand the evolutionary significance of invertebrate fauna

- To instill curiosity on invertebrates around us
- To impart knowledge on parasitic forms of lower invertebrates.

MODULE I Kingdom Animalia **7 Hrs**

Outline classification of Kingdom Animalia

Three branches **- Mesozoa, parazoa and Eumetazoa**

Mesozoa: Phylum Orthonectida - eg. *Rhopalura* (mention 5 salient features)

Parazoa:

1. Phylum Placozoa – Eg. *Trycoplax adherens*

2. Phylum Porifera – Classification upto classes; Mention gemmules

Class I- Calcarea. Eg.*Sycon.*,

Class II – Hexactinellida .Eg.*Euplectella.*

Class III - Demospongia Eg.*Cliona.*

General Topics

1. Canal system in sponges.

Phylum Coelenterata -Classification upto classes

Class I - Hydrozoa Eg. *Eg. Obelia* - mention Metagenesis

Class II- Scyphozoa Eg. *Rhizostoma.*

Class III- Anthozoa Eg. *Metridium*.

General Topics:

1. Coral and coral reefs with special reference to conservation of reef fauna.

2. Polymorphism in Coelenterates

Phylum Ctenophora - Eg. *Pleurobrachia.*

MODULE II .

Phylum Platyhelminthes Salient features; classification up to classes **3 Hrs**

Class I - Turbellaria. Eg. *Planaria.*

Class II –Trematoda Eg. *Fasciola*

Class III- Cestoda Eg. *Taenia saginata.*

General Topics:

1. Life history of *Fasciola hepatica.*

2. Platyhelminth parasites of Man and Dog (*Schistosoma*, *Taenia solium, Echinococcus*).

Phylum Nemathelminthes(Nematoda) **2 Hrs**

Salient features, classification up to classes

Class: Phasmidia Eg. *Enterobius,*

Class: Aphasmidia Eg. *Trichinella*

General Topic

Pathogenic nematodes in man. (*Wuchereria bancrofti, Ascaris lubricoides, Ancylostoma duodenale, Trichinella).*

Phylum Annelida: 2 Hrs

Salient features, Classification upto classes.

Class I- Archiannelida Eg. *Polygordius*

Class II -Polychaeta Eg. *Chaetopterus*

ClassIII- Oligochaeta Eg. *Megascolex.*

Class IV- Hirudinea Eg. *Ozobranchus, Hirudinaria*

MODULE III 14 Hrs

Phylum Onychophora

Eg. Peripatus (Mention its affinities).

Phylum Arthropoda Salient features, Classification upto classes

Type: Prawn –*Fenneropenaeus (Penaeus)*

1. Sub Phylum - Trilobitomorpha

Class -Trilobita (mention the salient features).

Eg.*Triarthrus* – A trilobite (extinct)

2. Subphylum –Chelicerata

Class 1 Merostomata (Xiphosura) (Eg. *Limulus*)

Class 2.Arachnida (Eg., *Palamnaeus*- Scorpion)

Class 3 Pycnogonida (Eg. *Pycnogonum* – Sea spider)

3. Subphylum- Crustacea

Class 1 Branchiopoda Eg. *Daphnia*

Class 2 Ostracoda Eg. *Cypris* -seed shrimp

Class 3 Copepoda Eg. *Cyclops*

Class 4 Remipedia Eg. *Speleonectes* (eyeless crustacean seen in caves)

Class 5.Branchiura Eg.,*Argulus* (common fish louse)

Class 6 Cirripedia Eg. *Sacculina* (parasitic castrator of crabs)

Class 7 Malacostraca Eg. *Squilla* (spot tail mantis shrimp)

4. Subphylum- Uniramia

Class 1 Chilopoda Eg. *Scolopendra* – (Centipede)

Class 2 Symphyla Eg. *Scutigerella* – (garden centipedes or pseudocentipedes)

Class 3 Diplopoda Eg. *Spirostreptus*- (Millipede)

Class 4 Pauropoda Eg. *Pauropus*

Class 5 Hexapoda (Insecta) Eg.*Bombyx mori* – (silk moth)

MODULE IV

Phylum Mollusca **3 Hrs**

Salient features, Classification upto classes

Class I- Apalcophora Eg. *Neomenia*

Class II- Monoplacophora Eg. *Neopilina*

Class III Amphineura Eg. *Chiton*

Class IV Gastropoda Eg. *Aplysia*

Class V Scaphopoda Eg. *Dentalium*

Class VI Pelecypoda (Bivalvia) Eg. *Pinctada*

Class VII Cephalopoda Eg. *Sepia*

Phylum Echinodermata **3 Hrs**

Classification upto classes

Class I- Asteroidea Eg. *Astropecten*

Class II- Ophiuroidea Eg. *Ophiothrix*

Class III- Echinoidea Eg. *Echinus*

Class IV- Holothuroidea Eg. *Holothuria*

Class V – Crinoidea Eg.*Antedon*

General Topics

1. Water vascular system in Echinodermata

Phylum Hemichordata: **2 Hrs**

Eg. Balanoglossus

Minor Phyla

1. Chaetognatha Eg. *Sagitta*

2. Sipunculida Eg. *Sipunculus*

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PRACTICAL

ANIMAL DIVERSITY- NON CHORDATA

36 Hrs.

Credit 1

Scientific Drawing:-

Make scientific drawings of 5 locally available invertebrate specimens belonging to different phyla.

Anatomy:-

Study of sections. (Any two)

1. Hydra.
2. Ascaris(male and female)
3. Earthworm
4. Fasciola

Dissections

1. Prawn - Nervous system
2. Cockroach - Nervous system

Mounting:-

1. Prawn appendages.
2. Mouth parts - Cockroach/ Plant bug/ House fly / Mosquito. (Any Three)

Identification:-

General identification &classification - The students are expected to identify, classify and describe the following Phylum -wise number of animals by their common names, generic names and 30% of these by their scientific names. Porifera-1, Coelenterata-3, Platyhelminthes-2, Annelida-2, Arthropoda-5, Mollusca- 4, Echinodermata-3

Identification of (a) Parasitic protest – any 2 (b) larval forms of *Fasciola*- any 2 (c) Nematode parasites of man- any 3 (Slides/figures may be used for study)

Taxonomic identification with key:-

Identification of insects up to the level of Order (any Four).

SEMESTER 111. ZY3CRT03

CORE COURSE 111: ANIMAL DIVERSITY –CHORDATA

54 Hrs

3 Credits

Objectives

- To acquire in depth knowledge on the diversity of chordates and their systematic position.
- To make them aware of the economic importance of some classes.
- To understand the evolutionary importance of selected chordate groups

MODULE I

Introduction **1 Hr**

General Characters and outline classification of Chordata up to class, Origin of Chordates – mention theories in brief

Protochordates: General characters and Classification **2 Hrs**

1. Sub phylum: Urochordata

Class I Larvacea Eg. *Oikopleura*

Class II Ascidiacea Eg: *Ascidia* (Mention Retrogressive Metamorphosis)

Class III Thaliacea Eg: *Doliolum*

2. Sub phylum: Cephalochordata **2 Hrs**

Example **-** *Amphioxus* (Structure and affinities)

MODULE II

3. **Sub phylum: Vertebrata** General characters and Classification **2 Hrs**
4. **Division 1– Agnatha**

Class I Ostracodermi Eg: *Cephalaspis*

Class II Cyclostomata Eg: *Petromyzon*

Division 2 – Gnathostomata **10 Hrs**

Super class Pisces General Characters and Classification

Class: Chondrichthyes - General Characters

Sub class – ElasmobranchI Eg: *Narcine*

Sub class - Holocephali Eg: *Chimaera*

Class: Osteichthyes - General Characters

Sub class – Choanichthyes

Order 1 Crossopterigii(Coelocanths) Eg: *Latimeria*(Evolutionary Significance)

Order 2 Dipnoi Eg: *Lepidosire*n - Distribution, affinities and systematic position of lung fishes.

Sub class: - Actinopterygii

Super order 1. ChondrosteI Eg: *Acipencer*

Super order 2. Holostei Eg: *Amia*

Super order 3. Teleostei Eg: Sardine

General topics

1. Accessory respiratory organs in fishes.
2. Parental care in fishes.
3. Scales in fishes.
4. Migration in fishes

MODULE III

Super class: Tetrapoda General characters, Classification up to Orders **11 Hrs**

Class Amphibia - Type Frog (*Euphlyctis hexadactylus*)

Order I Anura Eg*: Hyla*

Order II Urodela Eg: *Amblystoma* (mention axolotl larva and Paedomorphosis /neotony)

Order III Apoda Eg: *Ichthyophis.*

Class Reptilia **4 Hrs**

Sub class I: Anapsida

Order Chelonia Eg: *Chelone*

Sub class II: Parapsida Eg: *Ichthyosaurus*

Sub class III: Diapsida

Order I Rhynchocephalia Eg: *Sphenodon*

Order II Squamata Eg: *Chamaleon*

Order III. Crocodilia Eg..*Crocodylus*

Sub class IV: Synapsida Eg: *Cynognathus*

General topic

Identification of poisonous and non-poisonous snakes

Class Aves **5 Hrs**

Sub class I: Archeornithes Eg: *Archaeopteryx* (Affinities)

Sub class II: Neornithes

Super order I: Palaeognathe Eg: *Struthio*

Super order II: Neognathe Eg: Brahminy kite

General topics

1. Migrations in birds
2. Flight adaptations in birds

MODULE IV

Class Mammalia Type: Rabbit (*Oryctolagus cuniculus*) **17 Hrs**

Brief mention of general characters and classification up to order with example. (Mention any five salient features of each order, detailed accounts of examples are not necessary)

Sub class I: Prototheria Eg: Echidna, *Ornithorhychus*

Sub class II: Metatheria Eg: *Macropus*

Sub class III: Eutheria

Order 1 Insectivora	Eg: *Talpa*
Order 2 Dermoptera	Eg: *Galeopithecus*
Order 3 Chiroptera	Eg: *Pteropus*
Order 4 Primates	Eg: *Loris*
Order 5 Carnivora	Eg: *Panthera*
Order 6 Edentata	Eg: *Armadillo*
Order 7 Pholidota	Eg: *Manis*
Order 8 Proboscidea	Eg: *Elephas*
Order 9 Hydracoidea	Eg: *Procavia*
Order 10 Sirenia	Eg: *Dugong*
Order 11 Perissodactyla	Eg:*Rhinoceros*
Order 12 Artiodactyla	Eg: *Camelus*-mention ruminant stomach
Order 13 Lagomorpha	Eg: *Oryctolagus*
Order 14 Rodentia	Eg: *Hystrix* (Porcupine)
Order 15 Tubulidentata	Eg: *Orycteropus*
Order 16 Cetacea	Eg: *Delphinus*

General topics

1. Dentition in Mammals
2. Aquatic Mammals and their adaptations.

References

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PRACTICAL

ANIMAL DIVERSITY - CHORDATA

36 Hrs

Credit 1

1. Scientific Drawing

Make scientific drawing of 5 locally available vertebrate specimens belonging to different classes

2. Dissections

Frog: Photographs/diagrams/one dissected & preserved specimen each/models may be used for study.

1. Frog Viscera
2. Frog Digestive System
3. Frog Arterial System
4. Frog 9^{th}& 1^{st} Spinal nerve
5. Frog Sciatic Plexus
6. Frog Brain

3. Mounting of placoid scales; study of cycloid and ctenoid scales

4. Osteology

Frog vertebrae - typical, atlas, 8th and 9^{th}

Rabbit – Atlas, Axis and typical vertebra

Pectoral and pelvic girdles of Frog and Rabbit

Bird - Keel and Synsacrum

Turtle/Tortoise - plastron and carapace

5. Study of sections.

Amphioxus T. S. through pharynx/T.S. through intestine

6. Identification:-

General identification-

Identify, classify and describe the following animals by their generic names and 30 % of them by their scientific names.

Protochordata-1, Pisces-5, Amphibia-5, Reptilia- 5, Aves-2, Mammalia-2.

Taxonomic identification with key:-

i) Identification of fishes up to the level of order.

ii) Identification of snakes up to family.

SEMESTER IV. ZY4CRT04

CORE COURSE IV

RESEARCH METHODOLOGY, BIOPHYSICS AND BIOSTATISTICS

54 Hrs

3 Credits

Objectives

1. To familiarise the learner the basic concept of scientific method in research process.

2. To have a knowledge on various research designs.

3. To develop skill in research communication and scientific documentation.

4. To create awareness about the laws and ethical values in biology.

5. To equip the students with the basic techniques of animal rearing collection and preservation

6. To help the student to apply statistical methods in biological studies.

RESEARCH METHODOLOGY

Module I **13 Hrs**

Basic concepts of research: Meaning, Objectives, Approaches, Types of research.
Research Process: Scientific method in research (eight steps).
Importance of literature reviewing in defining a problem,
Identifying gap areas from literature review.
Research Communication and scientific documentation: Project proposal writing,
Research report writing, (Structure of a scientific paper), Thesis, dissertation, research article.
Presentation techniques: Oral presentation, Assignment, Seminar, Debate, Workshop, Colloquium, Conference
Sources of Information: Primary and secondary sources. Library- Books, Journals, Periodicals, Reviews, Internet.
Search engines Online libraries, e-Books, e-Encyclopedia, Institutional Websites.
Plagiarism

Module II **12 Hrs**

Animal Collection – Tools &techniques

Sampling techniques
- Quadrate
- Line transect

Measurements
- Density
- Abundance
- Frequency

Biodiversity indices – concepts
- Simpson index

Collection methods, techniques and equipments
- Plankton
- Insects
- Fish

Bird

Preservation techniques – Taxidermy

Rearing techniques

Laboratory and field.

Units of measurements- units, SI system, Equivalent weight, normality, molarity

BIOPHYSICS

Module III **14 Hrs**

Basic understanding on principle and uses of the following:

Microscopy

(a) Light microscopy, Bright field (Compound Microscope), Phase contrast, Dark field microscopy, Fluorescence, Polorization microscopy, Video microscopy.

(b) Electron - Scanning (SEM), Transmission (TEM) and STEM

Micrometry – Stage and Eyepiece micrometers

Camera Lucida

Instrumentation

pH Meter

Separation Techniques: Centrifuge, Chromatography, Electrophoresis

Analytical techniques: Colorimeter, Spectrophotometer, X-ray crystallography

BIOETHICS

Module IV **5 Hrs**

Bioethics : Introduction, Animal rights and animal laws in India, Prevention of cruelty to animals Act 1960, Biodiversity Act 2003.

Concept of 3 R – conservation (Refined- to minimize suffering, Reduced – to minimize animals, Replaced – modern tools and alternate means), Animal use in research and education.

Laboratory animal use, care and welfare, Animal protection initiatives- Animal Welfare Board of India, CPCSEA, ethical commitment. Working with human: Consent,harm, risk and benefits.

BIOSTATISTICS **10 Hrs**

Module V

Sample & Sampling techniques: Collection of data, classification of data, frequency distribution tables, graphical representation: - Bar diagrams, Histogram, Pie diagram and Frequency curves - Ogives.

Measures of Central Tendency: Mean, Median, Mode (Problem - Direct method only)

Measures of dispersion: Range, Quartile Deviation, Mean Deviation, Standard Deviation, Standard error. (Merits & demerits and problems on SD).

Correlation: Definition, Types of correlation.(mention in brief)

Test of Hypothesis and Test of Significance: Basic concept, Levels of significance, test of significance, Procedure for testing hypothesis, types of hypothesis- Null hypothesis and Alternate hypothesis.

References

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CORE COURSE IV

RESEARCH METHODOLOGY, BIOPHYSICS AND BIOSTATISTICS

(PRACTICAL) 2 credits

PART A. RESEARCH METHODOLOGY

Animal collection Tools, Techniques & Estimation

1. Quadrate study
2. Transect study
3. Sampling Methods
4. Species area curve
5. Simpson index

PART B - BIOPHYSICS

1. Study of simple and compound light microscopes
2. Micrometry –calibration and measurement of microscopic objects –low power
3. Camera Lucida (draw a few diagrams using Camera Lucida)
4. Paper chromatography (demonstration only)
5. Instrumentation – demonstration (write notes on principle, equipment and its use)

pH Meter, Colorimeter/ Spectrophotometer, Centrifuge

PART C BIOSTATISTICS

1. MS Excel : To create mean and median, Construction of bar diagram, Pie diagram and Line graphs.
2. MS Access: To create grade of students
3. Internet: Access a web page on any biological topic.
4. Frequency distribution of the given samples to find out arithmetic mean, median, mode.
5. Range and standard deviation for a biological data
6. Correlation using any biological data.

7. Graphical representation of data. Construction of bar diagrams, Histograms, Pie diagram and Line graphs.

SEMESTER V. ZY5CRT05

CORE COURSE V

ENVIRONMENTAL BIOLOGY AND HUMAN RIGHTS

54 Hrs

Objectives

To instill the basic concepts of Environmental Sciences, Ecosystems, Natural Resources, Population, Environment and Society

To make the students aware of natural resources, their protection, conservation, the factors polluting the environment, their impacts and control measures.

To teach the basic concepts of toxicology, their impact on human health and remedial measures

To create a consciousness regarding Biodiversity, environmental issues & conservation strategies

To develop the real sense of Human rights – its concepts & manifestations

MODULE 1 ECOSYSTEM 12 Hrs

Basic concepts of ecosystem Components of ecosystem: Abiotic (Sunlight, temperature, soil, water, atmosphere) and Biotic components (Producers, consumers, decomposers), Ecological pyramid- number, biomass, energy, **Functions of ecosystem**: Productivity-Food chain-Food web-Energy flow-Laws of Thermodynamics.Types of Ecosystem: Terrestrial-Forest-Grassland-Desert, Aquatic-Marine-Fresh water, Wetland &Biome **Concept of limiting factors:** Liebig's and Shelford's laws of limiting factors.

Biogeochemical cycles: Concept, gaseous and sedimentary cycles, Carbon cycle, Nitrogen cycle. **Renewable resources (**solar,wind, hydroelectric, biomass and geothermal) **and Non renewable resources** (mineral and metal ore, fossil fuels)

MODULE 2 CONCEPTS OF POPULATION AND COMMUNITY 8 Hrs

Concept of population: Population attributes- Population growth forms, Basic concepts of growth rates, density, natality, mortality, growth curves

Animal interactions: Positive- Commensalism- Mutualism-Protocooperation, Negative-Predation-Parasitism-Competition-Antibiosis

Characteristics of a community: Species diversity- richness, eveness, stratification, dominance, ecological indicators, Ecotone and Edge effect, Keystone species, Concepts of Ecological Niche and Guild, Ecological succession, community evolution- climax.

MODULE 3 BIODIVERSITY AND ENVIRONMENTAL ISSUES 16 Hrs

Introduction to Biodiversity: Types of biodiversity- Alpha, Beta and Gamma diversity. **Concept and importance of Biodiversity**: Levels of Biodiversity-Species diversity, Genetic diversity, Microbial, Ecosystem diversity, India as a mega-diversity nation, Biodiversity hotspots

Global Environmental Issues: Ozone depletion, Greenhouse effect, Global warming, Climate change, Carbon trading, carbon credit; Carbon sequestration, Acid rain, Oil spills, Nuclear accidents, IPCC/UNFCC.

National Environmental issues: Deforestation, forest fire, pollution(air, water, soil, noise thermal, nuclear- brief account only) solid waste management, sewage, drinking water crisis and water logging,

Toxic products and disaster: Types of toxic substances – degradable, non degradable, Impact on human – case studies: Endosulphan tragedy, Bhopal disaster

Flood, drought, cyclone, earthquake and landslide (Management and mitigation)

Local Environmental issues: Landscape alteration, sand mining, quarrying, changing crop pattern, conversion of paddy lands,

Threats to water resources of Kerala: Degrading Mangrove and wetland ecosystems of Kerala,

RAMSAR sites, Marine ecosystem crisis- pollution, overfishing etc. Impact of tourism on Environment.

MODULE 4 CONSERVATION OF BIODIVERSITY 12 Hrs

Protected area concept – Sanctuary, National Park, Biosphere reserve, Core Zone, Buffer Zone, Corridor concept. Conservation reserves

Concept of threatened fauna – IUCN categories - extinct, extinct in the wild, critically endangered, endangered, vulnerable, near threatened, least concern and data deficient. Red and Green Data Books.

Man–animal conflict (Tiger, Elephant, Dog, Monkey) – causes and concern

Water conservation- rainwater harvestiong, watershed management

Environment education

Environmental laws (Brief account only): The Water (Prevention and Control of Pollution) Act, 1974, The Air (Prevention and Control of Pollution) Act, 1981, Indian Forests Act (Revised) 1982. The Environment (Protection) Act, 1986, Hazardous Wastes (Management and Handling) Rules, 1989, The Forest (Conservation) Act, 1980, The Wildlife Protection Act, 1972, Biodiversity Act, 2002.

MODULE 5 HUMAN RIGHTS 6 Hrs

Introduction, main concepts associated with Human Rights, Different types of human rights, Manifestations & phenomena, Role of agencies in promoting human rights, Mechanisms for checking violations of human rights, National human right commission, Constitutional provisions related to Human rights.

References

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3. Misra S.P., Pandy S.N. 2009Essential Environmental Students, Ane books Pvt. Ltd.
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9. Sharma P.D. (2005)Environmental biology and Toxicology, Rastogi publication
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PRACTICAL

ENVIRONMENTAL BIOLOGY & TOXICOLOGY

36 HRS

CREDIT 1

1. Estimation of dissolved Oxygen
2. Estimation of carbon di oxide
3. Estimation of soil organic carbon (Demonstration only)
4. Identification of marine/ fresh water planktons
5. Counting of plankton using plankton counting chamber
6. Study of equipments - Sechi disc, Plankton net
7. Study of sandy shore fauna, rocky shore fauna.
8. Study of animal Association
9. Visit to any two important areas of bio diversity: 1. Forest, 2.Sea shore, 3. Mangrove, 3.

Wet lands, 4. Bird sanctuary, 5. Wild life sanctuary, 6. Sacred groves

Field study (compulsory)

SEMESTER V. ZY5CRT06

CORE COURSE VI
CELL BIOLOGY AND GENETICS

54 Hrs

Credits 3

Objectives

1. To understand the structure and function of the cell as the fundamentals for understanding the functioning of all living organisms.
2. To make aware of different cell organelles, their structure and role in living organisms.
3. To develop critical thinking, skill and research aptitudes in basic and applied biology
4. To emphasize the central role of genes and their inheritance in the life of all organisms.

CELL BIOLOGY 22 HRS

Module I **6 Hrs**

Introduction of cell and Diversity of cells: History, Cell theory, Prokaryotes, Eukaryotes, Mycoplasmas, Virus, Virions and Viroids, Prions.

Cell membrane & Permeability: Molecular models of cell membrane (Sandwich model, Unit membrane model, Fluid mosaic model). Cell properties - permeability, Transport [Diffusion, Osmosis, Passive transport, Active transport, bulk transport], Cell coat and Cell recognition.

Module II **10 Hrs**

Cell Organelles : Structure and functions of following cell organelles: Endoplasmic reticulum - Structure and functions. Ribosomes (Prokaryotic and Eukaryotic) Golgi complex - Structure and functions. Lysosomes - Polymorphism - GERL concept, functions.

Mitochondria - Structure and functions. Nucleus: Structure and functions of interphase nucleus, Nuclear membrane, pore complex, structure and functions of nucleolus

Chromosomes – Structure & organization, Heterochromatin, Euchromatin, Nucleosomes, Polytene chromosomes-Balbiani rings, Endomitosis, Lamp brush chromosomes.

Module III **6 Hrs**

Cell Communication: Basic principles of cell communications,Cell signaling(in brief), Types of signaling, Mention signaling molecules (neurotransmitters, hormones, Growth Factors, Cytokines Vitamin A and D derivatives),

Cell Division: Cell cycle - G_1, S, G_2 and M phases,.Mitosis and Meiosis.The difference between Mitosis and Meiosis.

References

1 Zoological Society of Kerala Study material. 2002. *Cell Biology, Genetics and Biotechnology*

2. Karp, G. (2010). *Cell and Molecular Biology: Concepts and Experiments*. VI Edition. John Wiley and Sons.Inc.

3. Koshy Thomas & Joe Prasad Mathew (Editors) (2011) *Cell Biology and Molecular Biology*.

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16. James Darnell. (1998) Molecular Biology.Scientific American Books Inc.

GENETICS **32 Hrs**

Module I **10 Hrs**

MendelianGenetics: Mendel's experiments- Monohybrid Cross, Dihybrid Cross, Mendel's Laws, Test Cross, Back Cross and Reciprocal Cross. Chromosome Theory of Inheritance

Interaction of genes: Allelic: Incomplete Dominance (Four O Clock Plant).Co- Dominance (Skin colour in Cattle) Lethal Alleles: Dominant lethal gene[Creeper chicken] and recessive lethal gene
[cystic fibrosis].
Non Allelic: Complementary (Flower colour in Sweet Pea), Supplementary (Coat colour in mice), Epistasis - dominant (Plumage in poultry) and recessive (Coat colour in mice). Polygenes (Skin colour inheritance in man), Pleiotropism (Vestigial wing gene in Drosophila).

Multiple alleles – ABO Blood group system, Rh group and its inheritance. Erythroblastosis foetalis.

Module II **12 Hrs**

Sex determination: Chromosome theory of sex determination (Autosome and Sex chromosomes), male heterogamy and female heterogamy, (xx-xy, xx-xo, ZZ-ZW, ZZ-ZO), Genic Balance theory of Bridges. Barr bodies, Lyon's hypothesis, Gynandromorphism, sex

mosaics, intersex (Drosophila), Hormonal [free martin in calf] and Environmental (Bonelia) influence on Sex determination

Recombination and Linkage: Linkage and recombination of genes based on Morgan's work in Drosophila, Linked genes, Linkage groups, Chromosome theory of Linkage, Types of linkage- complete and incomplete. Recombination, cross over value, chromosome mapping. [Definition]

Sex Linked inheritance : Characteristics of Sex Linked inheritance, X Linked inheritance of man (Hemophilia), Y linked inheritance [Holandric genes] , Incompletely Sex Linked genes or pseudoautosomal genes (Bobbed bristles in *Drosophila*), Sex limited genes (Beard in man) and Sex influenced genes (inheritance of baldness in man).

Module III **10 Hrs**

Mutation: Types of mutations - Somatic, germinal, spontaneous, induced, autosomal and allosomal, chromosomal mutations, structural and numerical changes. Gene mutations. [Addition, Deletion and substitution].

HumanGenetics: Karyotyping, Normal Human chromosome Complement, Pedigree analysis, Aneuploidy and Non- disjunction. Autosomal abnormalities (Down syndrome, Cry du chat syndrome) Sex chromosomal abnormalities (Klinefelters syndrome, Turner's syndrome) Single gene disorder (Brief mention) Autosomal single gene disorder [sickle cell anaemia), Inborn errors of metabolism such as phenylketonuria, alkaptonuria, , Albinism. Multifactorial traits – polygenic disorder- cleft lip and cleft palate.

Genetic Counseling, Eugenics and Euthenics -Brief account only

References

1. Gardner, J.E., Simmons, J.M and Snustad D.P..(2007). *Principles of Genetics* (8th edn.). John Wiley and Sons, India.
2. Klug, W.S and Cummings,M.R. (2011). *Concepts of Genetics* (7th edn).Pearson Education Inc.India.
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SEMESTER V

CORE COURSE VI

CELL BIOLOGY AND GENETICS

(PRACTICAL)

36 Hrs

2 Credits

PART A: CELLBIOLOGY

1. Squash preparation of onion root tip for mitotic stages
2. Mounting of polytene chromosome (Drosophila/Chironomous.) Demonstration
3. Tissues (permanent slides of epithelial tissues, striated muscle, smooth muscle, cartilage, bone)
4. Identification of cell organelles
5. Preparation of temporary whole mount.
6. Preparation of permanent whole mount (demonstration)
7. Preparation of human blood smear and identification of Leucocytes

PART B : GENETICS

1. Genetic problems on Monohybrid, Dihybrid Crosses and Blood group inheritance
2. Study of normal male and female human karyotype (use photographs or Xerox copies)
3. Abnormal human karyotypes - Down, Edwards , Klinefelter and Turner syndromes

(use photographs or Xerox copies)

4. Sexing of Drosophila.

5. Study of Barr body in human buccal epithelium

SEMESTER V. ZY5CRT07

CORE COURSE - V11: EVOLUTION, ETHOLOGY & ZOOGEOGRAPHY

54 Hrs

Credits 3

Objectives:

- To acquire knowledge about the evolutionary history of earth - living and nonliving
- To acquire basic understanding about evolutionary concepts and theories
- To study the distribution of animals on earth, its pattern, evolution and causative factors
- To impart basic knowledge on animal behavioural patterns and their role

Prerequisite:

- Basic knowledge on principles of inheritance and variation
- Knowledge on molecular basis of inheritance
- Basic understanding on the mechanism and factors affecting evolution
- Knowledge on origin and evolution of man

PART I - EVOLUTION **30 Hrs**

Module I - Origin of life **8 Hrs**

Theories - Panspermia theory or Cosmozoic theory, Theory of spontaneous generation (Abiogenesis or Autogenesis), Special creation, Biogenesis, Endosymbiosis.

Chemical evolution - Haldane and Oparin theory, Miller-Urey experiment;

Direct evidences of evolution – Recapitulation Theory of Haeckel, Fossilization, Kinds of fossils, fossil dating, Homologous organs and analogous organs.

Module II - Theories of organic evolution **9 Hrs**

Lamarckism and its Criticism, Weismann’s Germplasm theory, Darwinism and its Criticism, Neo-Darwinism, Theory of De Vries,

Population genetics and evolution: Hardy-Weinberg Equilibrium, gene pool, gene frequency. Factors that upset Hardy-Weinberg Equilibrium, Effects of genetic drift on population: Bottleneck effect and founder effect

Module III – Nature of evolution **13 Hrs**

Species and Speciation: Species concept, subdivisions of species (sub species, sibling species, cline and deme), Speciation: Types of speciation, Phyletic speciation (autogenous and allogenous transformations), True speciation, Instantaneous and gradual speciation, allopatric and sympatric speciation

Isolation: Types of isolating mechanisms-Geographic isolation (mention examples) and Reproductive isolation. Role of isolating mechanisms in evolution

Microevolution, Macroevolution (Adaptive radiation -Darwin finches) Mega evolution, Punctuated equilibrium, Geological time scale, and Mass extinction (brief account only). Evolution of Horse

PART II- ETHOLOGY **14 Hrs**

Module IV – Introduction **1 Hr**

Definition, History and scope of ethology

Module V – Learning, imprinting and behaviour **9 Hrs**

Types of learning with examples; patterns of behaviors – types of rhythms, navigation, homing instinct, hibernation, aestivation; pheromones- types and their effect on behavior, hormones and their action on behavior (aggressive and parental behavior)

Module VI – Social organization **4 Hrs**

Social organization in insects (ants) and mammals (monkey), Courtship behaviour and reproductive strategies

PART III- ZOOGEOGRAPHY **10 Hrs**

Module VII – General Topics **4 Hrs**

Continental drift theory, Types and means of animal distribution, Factors affecting animal distribution; insular fauna – oceanic islands and continental islands,

Module VIII - Zoogeographical realms **6 Hrs**

Palaearctic region, Nearctic region, Neotropical region, Ethiopian region, Oriental region, Australian region (brief account with physical features and fauna, Wallace's line, Weber's line, Biogeography of India with special reference to Western Ghats

References:

EVOLUTION

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PRACTICAL

EVOLUTION, ETHOLOGY AND ZOOGEOGRAPHY

36 Hrs

Credit 1

1. Identification of Zoogeographical realms using map
2. Study on endemic species of each realm
3. Show the discontinuous distribution of (lung fishes, camel, elephant)
4. Providing a map trace the route of HMS Beagle
5. Providing a map mark any two continental/oceanic islands.: Greenland, Madagascar, New Zealand, New Guinea, Maldives, Iceland, Hawaii – any two
6. Contributions of scientists (showing photos) - Any four
7. Identification of different stages of horse evolution
8. Study on Homology and Analogy
9. Study on connecting links (*Peripatus*, Archaeopteryx, *Protopterus*, Echidna)

10. Pheromone traps
11. Skinner box & T Maze
12. Experiment to demonstrate phototaxis and chemotaxis using Drosophila/House fly
13. Identification of behaviour (Grooming/courtship dance of flamingos/stickle back fish/ Tail wagging dance/ Aggressive behaviour/ Auto/Allo grooming, Flehmen response) showing pictures (Any five)

SEMESTER V. ZY5CRT08

CORE COURSE VIII
HUMAN PHYSIOLOGY, BIOCHEMISTRY, AND ENDOCRINOLOGY

54 Hrs

Credits 3

Objectives:

1. This course will provide students with a deep knowledge in biochemistry, physiology and endocrinology.
2. Defining and explaining the basic principles of biochemistry useful for biological studies for illustrating different kinds of food, their structure, function and metabolism.
3. Explaining various aspects of physiological activities of animals with special reference to humans.
4. Students will acquire a broad understanding of the hormonal regulation of physiological processes in invertebrates and vertebrates.
5. By the end of the course, students should be familiar with hormonal regulation of physiological systems in several invertebrate and vertebrate systems.
6. This also will provide a basic understanding of the experimental methods and designs that can be used for further study and research.

7. The achievement of above objectives along with periodic class discussions of current events in science, will benefit students in their further studies in the biological/physiological sciences and health-related fields, and will contribute to the critical societal goal of a scientifically literate citizenry.

HUMAN PHYSIOLOGY **31 Hrs**

Module I **8 Hrs**

Nutrition: Nutritional requirements – carbohydrates, proteins, lipids, minerals (Ca, P, Fe, I), vitamins (sources and deficiency disorders). Importance of dietary fibre and antioxidants.Balanced diet, Recommended Dietary Allowance (RDA). Nutrition during pregnancy and lactation, Infant nutrition, Malnutrition(PEM).

Digestion: Anatomy and histology of digestive glands (liver, pancreas, salivary, gastric and intestinal). Digestion and absorption of carbohydrates, proteins and fats.Nervous and hormonal control of digestion.

Module II **8 Hrs**

Respiration: Phases of respiration (external respiration, gas transport and internal respiration). Respiratory pigments: Haemoglobin, Myoglobin (Structure and Function). Transport of respiratory gases - transport of oxygen, oxyhaemoglobin curve, factors affecting oxyhaemoglobin curve, transport of carbon dioxide,(chloride shift). Control of respiration.Respiratory disturbances (Hypoxia, Hypercapnia, Asphyxia).Physiological effect of smoking, carbon monoxide poisoning, Oxygen therapy and artificial respiration.

Circulation: ESR, Haemopoiesis, blood pressure, ECG. Haemostasis (blood coagulation) – clotting factors, intrinsic and extrinsic pathways, anticoagulants and its mechanism of action.Cardiovascular diseases (Jaundice, Atherosclerosis, Myocardial infarction, Thrombus, Stroke).Angiogram and angioplasty.

Module III **5 Hrs**

Excretion: **H**istology of Bowman's capsule and tubular part. Urine formation – glomerular filtration, tubular reabsorption, tubular secretion.Urine concentration – counter current mechanism. Acid – base balance, hormonal regulation of kidney function. Renal disorders (kidney stone, acute and chronic renal failure, and dialysis). Homeostasis: Definition,

concept and importance in biological system. Thermal regulation and thermal adaptation in homeotherms.

Module IV **10 Hrs**

Nerve physiology: Ultra structure of neuron. Nerve impulse production (resting membrane potential, action potential), transmission of impulse along the nerve fiber, interneuron (synaptic) transmission, neuromuscular junction and transmission of impulses.Neurotransmitters (acetyl choline, adrenalin, dopamine).EEG. Memory, Neural disorders (brief account on Dyslexia, Parkinson's disease, Alzheimer's disease, Epilepsy).

Muscle physiology: Ultra structure of striated muscle, muscle proteins (myosin, actin, tropomyosin, troponin), Muscle contraction and relaxation-Sliding Filament Theory, cross bridge cycle, biochemical changes and ATP production in muscle, Cori cycle. Kymograph, Simple muscle twitch, muscle fatigue, tetanus, rigor mortis.

BIOCHEMISTRY **15 Hrs**

Module V **5 Hrs**

Carbohydrates: Basic structure, biological importance and classification of monosaccharides, oligosaccharides, polysaccharides with examples.

Proteins: Basic structure and classification of amino acids; structure, biological importance and classification of proteins with examples.

Lipids: Structure of fatty acid, saturated and unsaturated fatty acid, biological importance and classification of lipids with examples.

Vitamins and minerals: Major fat soluble and water soluble vitamins. Important minerals and trace elements required for living organisms. Biological importance of vitamins and minerals.

Enzymes: Chemical nature of enzymes, enzyme activation, enzyme inhibition, allosteric enzymes, isoenzymes, co-enzymes. Michaelis–Menten enzyme kinetics.

Module VI **10 Hrs**

Carbohydrate metabolism: Glycogenesis, Glycogenolysis, Gluconeogenesis, Hexose monophosphate Shunt, Glycolysis, Citric Acid Cycle, Electron Transport Chain and ATP synthesis. Ethanol metabolism.

Protein metabolism: Deamination, Transamination, Transmethylation, Decarboxylation, Ornithine cycle.

Lipid metabolism: Biosynthesis of fatty acids, Beta oxidation, physiologically important compounds synthesized from cholesterol.

ENDOCRINOLOGY

Endocrinology and reproduction **8 Hrs**

Module VII **8 Hrs**

Endocrine physiology: Hormones – classification and mechanism of hormone action. Major endocrine glands(Histology is not included) their hormones, functions and disorders (hypothalamus, pituitary gland, pineal gland, thyroid gland, parathyroid gland, islets of Langerhans, adrenal gland),. Homeostasis and feedback mechanism.

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PRACTICAL

HUMAN PHYSIOLOGY, BIOCHEMISTRY, AND ENDOCRINOLOGY

36 Hrs

Credit1

HUMAN PHYSIOLOGY

1). Determination of haemoglobin content of blood

2). Total RBC count using Haemocytometer

3). Total WBC count using Haemocytometer

4). Estimation of microhaematocrit

5). Effect of hypertonic, hypotonic and isotonic solutions on the diameter of RBC.

6). Instruments: Kymograph, Sphygmomanometer and Stethoscope (principle and use)

7). Measurement of blood pressure using sphygmomanometer (demonstration only)

BIOCHEMISTRY

1. Qualitative analysis of protein, glucose, starch and lipids.
2. Chromatography – Determination of Rf value of amino acids and identification of amino acids (Identify the Amino Acids using different solvent front and solute front)

ENDOCRINOLOGY

1. Cockroach – Corpora cardiaca &Corpora allata (Demonstration)

2. Effect of adrenalin on heart beat of Cockroach (Demonstration)

SEMESTER VI. ZY6CRT09

CORE COURSE IX

DEVELOPMENTAL BIOLOGY

54 Hrs

3 Credits

Objectives:

1. To achieve a basic understanding of the experimental methods and designs that can be used for future studies and research.
2. To provide the students with the periodicclass discussions of current events in science which will benefitthem in their future studies in the biological/physiological sciences and health-related fields
3. To contribute tocritical societal goal of a scientifically literate citizenry.

Module 1 **10 Hrs**

Introduction: Definition, Scope of developmental biology, sub-divisions (descriptive, comparative, experimental and chemical), historical perspectives, basic concepts and theories.

Reproductive Physiology: Gonads- anatomy of testis and ovary, spermatogenesis, oogenesis, gonadal hormones and their functions. Hormonal control of human reproduction - Female reproductive cycles (Estrous cycle, Menstrual cycle). Structure of mammalian sperm and egg, Pregnancy, parturition and lactation.Reproductive health and importance of sex education.

.**Egg types:** Classification of eggs based on the amount, distribution and position of yolk. Mosaic and regulative, cleidoic and noncleidoic eggs.Polarity and symmetry of egg.

Fertilization: Mechanism of fertilization-(Encounter of spermatozoa and Ova, Approach of the Spermatozoon to the Egg, Acrosome Reaction and Contact of Sperm and Ovum, Activation of Ovum, Migration of Pronuclei and Amphimixis,), Significance of fertilization, Polyspermy, Parthenogenesis- Different types and significance.

Module II **14 Hrs**

Cleavage: Types, planes and patterns of cleavage, Cell lineage of Planaria. Influence of yolk on cleavage.

Blastulation: Morula, blastula formation, types of blastula with examples.

Fate maps: Concept of fate maps, construction of fate maps (artificial and natural), structure of a typical chordate fate map. Significance of fate map.

Gastrulation: Major events in gastrulation. Morphogenetic cell movements. Influence of yolk on gastrulation. Exogastrulation.Concept of germ layers and derivatives.

Cell differentiation and gene action: Potency of embryonic cells (Totipotency, Pleuripotency, Unipotency of embryonic cells). Determination and differentiation in embryonic development, Gene action during development with reference to Drosophila (maternal effect genes), Zygotic genes.

Module III **20Hrs**

Embryology of Frog: Gametes, fertilization, cleavage, blastulation, fatemap, gastrulation, neurulation, notogenesis. Differentaition of Mesoderm and Endoderm, Development of eye.Metamorphosis of frog, Hormonal and environmental onrol.

Embryology of chick: Structure of egg, fertilization, cleavage, blastulation, fate map, gastrulation. Development and role of Primitive streak, Salient features of 18hour, 24 hour, 33 hour & 48 hour chick embryo.Extra embryonic membranes in chick.

Human development: Fertilisation, cleavage, blastocyst, implantation, placenta. Gestation, parturition and lactation.Human intervention in reproduction, contraception and birth control. Infertility, Invitro fertilization (test tube baby)

Module IV **5Hrs**

Experimental embryology: Spemann's constriction experiments, Organizers and embryonic induction. Embryo transfer technology, cloning, stem cell research. Ethical issues.

Teratology / Dysmorphology, Developmental defects: Teratogenesis, important teratogenic agents.(Radiations, chemicals and drugs, infectious diseases) genetic teratogenesis in human beings,

Developmental defects: Prenatal death (miscarriage and still birth). Intrauterine Growth Retardation (IUGR).

Module V **5 Hrs**

General topics: Classification and functions of placenta in mammals. Prenatal diagnosis (Amniocentesis, Chorionic villi sampling, Ultra sound scanning, Foetoscopy, Maternal serum alpha-fetoprotein, Maternal serum beta-HCG).Regeneration in animals.

References

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Vijayakumarn Nair, K. & George, P. V. 2002. A manual of developmental biology, Continental publications , Trivandrum

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PRACTICAL

DEVELOPMENTAL BIOLOGY

36 Hrs

Credit 1

Model/Chart/ Slide may be used

1. Embryological studies- Blastula (frog, chick)
2. Embryo transfer, cloning, gastrula (frog, chick)
3. Amniocentesis
4. Embryotransfer technology, cloning
5. Study of placenta- pig and man
6. 18 hour, 24 hour, 33 hour and 48 hour chick embryo.
7. Candling method.
8. Vital staining- demonstration.
9. Male and female reproductive organs in cockroach
10. Calculate the fecundity of fish.
11. Calculate the gonado-somatic index of given fish.

SEMESTER VI. ZY6CRT10

CORE COURSE X. MICROBIOLOGY AND IMMUNOLOGY

54 Hrs

3 Credits

MICROBIOLOGY

Module I **10 Hrs**

Introduction: History and scope of microbiology. Outline classification of Microbes. (bacteria, fungus & virus)

Methods in Microbiology: Sterilization and disinfection - physical and chemical methods.

Culture media – selective media, enrichment media, differential media.Plating techniques and isolation of pure colony. Culture preservation techniques: refrigeration, deep freezing,

freezing under liquid nitrogen, lyophilization.

Module II **15 Hrs**

Morphology and fine structure of bacteria: Size, shape, cilia, pili, flagella, capsule, cell wall and its composition. Cytoplasmic membrane, protoplast, spheroplast, intracellular membrane systems, cytoplasm, vacuoles, genetic material, cell inclusions, bacterial spores.

Bacterial growth Curve, Staining techniques – gram staining.

Bacterial Reproduction Sexual – (conjugation, transduction)and Asexual (budding,, fragmentation). Virology: Structure of virus; Human, animal, and bacterial virus. Viral replication, cultivation of animal viruses.

Module III **8 Hrs**

Infections & Diseases:Types of infections – primary, secondary and nosocomial infections. (Brief Account only)Contagious diseases – epidemic, endemic and pandemic, mode of Transmission – food, water, air, vectors and carriers.

Diseases: Epidemiology, symptomology, diagnosis and treatment. Bacterial - Clostridium tetany (tetanus), Viral – HIV virus (AIDS), fungal –*Candida albicans* (candidiasis).

IMMUNOLOGY

Module IV **9Hrs**

Introduction to Immunology: Innate and acquired immunity, passive (natural and artificial) and active immunity (Natural and Artificial).Mechanisms of innate immunity - barriers, inflammation, phagocytosis.

Lymphoid organs: Primary (Thymus, Bone marrow) and secondary lymphoid organs (lymph nodes, spleen).

Lymphocytes: T and B cells, Natural killer cells, memory cells, macrophages.

Module V **9 Hrs**

Antigens, Types of antigens, haptens,adjuvants, immunoglobulin structure, classes and functions of immunoglobulins.

Types of Immunity- , humoral & cell mediated immunity Monoclonal & polyclonal antibodies

Antigen – antibody reactions, Precipitation test, Agglutination test, VDRL WIDAL, ELISA. Auto immune diseases: Pernicious Anemia, Rheumatoid Arthritis. Immunodeficiency -

AIDS. Hyper sensitivity- Type I, (E.g. Anaphylaxix) II(Transfusion reaction) , III (Arthus reaction) and IV (Mantaux Test) (in brief).

Vaccines **3 Hrs**

Introduction Types of vaccines, Current Vaccines, Recent trends in vaccine preparation

References

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PRACTICAL

MICROBIOLOGY AND IMMUNOLOGY

72 Hrs

2 Credits

1. Instruments –Autoclave, Hot air oven, Bacteriological incubator – Laminar air flow
2. Preparation of solid and liquid media for microbial cultures.
   (Ingradients, pH and method of preparation) (Demonstration)
   (a) Solid media (1) Nutrient agar (2) Mac Conkey's agar
   (b) Liquid Media(1) Nutrient broth (2) Peptone water.
3. Culture methods (Demonstration)
   (a) Streak plate technique and isolation of pure colonies.
   (b) Lawn culture (c) Pour plate culture (d) Liquid culture
4. Examination of microbes in living condition
   Hanging drop method for demonstrating motility of bacteria.
5. Gram staining – preparation, procedure, identification of Gram + ve and Gram –ve bacteria.
6. Antibiotic sensitivity test (demonstration only)
7. Streak plating (individual performance)
8. Preparation of a fungal smear – Lactophenol cotton blue staining and mounting
9. Determination of ABO blood groups and Rh factor (Antigen – antibody Reaction)
10. Study through photographs/ illustration, the primary immune (Bone marrow and thymus) and secondary immune (spleen and lymph nodes) organs in Rat/Man

SEMESTER VI. ZY6CRT11

CORE COURSE XI.

BIOTECHNOLOGY, BIOINFORMATICS AND MOLECULAR BIOLOGY

BIOTECHNOLOGY **20 Hrs**

Module I **11Hrs**

Introduction: Scope, Brief History, Scope and Importance

Tools and Techniques in Biotechnology: Enzymes (restriction endonucleases, ligases, linkers & adapters), Vectors-[Plasmids, Phage vectors, Cosmids, Artificial Chromosomes] Host cells. Basic steps & techniques in rDNA technology

Gene Libraries, Construction of genomic library and cDNA Library. PCR technique and DNA amplification, Brief description of screening methods – Probes, Nucleic Acid hydridization, In situ Hybridization, Fluorescence in situ Hybridization (FISH), Colony hybridization. Methods of transfer of desired gene into target cell.Blotting Techniques-Southern, Northern, Western blotting.DNA Finger printing (DNA Profiling) and its application. Molecular markers - RFLP

Module II **9 Hrs**

Animal Cell Culture: Brief account on methods, substrates, media and procedure of animal cell culture, Stem Cells, types and potential use, Organismal Cloning- reproductive & therapeutic- brief account only.

Applications of Biotechnology: Applications in Medicine(insulin, growth hormone, gene therapy), Agriculture(GM plants and biopesticides),Environment(bioremediation), Industry (Single Cell Protein) and applications of Fermentation Technology- lactic acid, vitamins, food and beverages.

Potential Hazards of Biotechnological Inventions: Risks related to genetically modified organisms (GMO) and biologically active products, Biological warfare & Biopiracy. Protection of biotechnological inventions.Intellectual Property Rights, Patenting and patent protection.

References

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6. Singh B.D. Biotechnolgy 2002, Kalyan Publishers New Delhi.

7. Sudha Gangal 2007. Biotechnology Principles and & practice of Animal Tissue culture, Universities Press.

BIOINFORMATICS **14 Hrs**

Module III **8 Hrs**

Introduction: Definition, importance and role of bioinformatics in life sciences. Computational Biology.

Biological databases: Nucleotide sequence databases (NCBI- GENBANK, DDBJ and EMBL). Protein databases - structure and sequence databases (PDB, SWISSPROT and UNIPROT). Introduction to Sequences alignments: Local alignment and Global alignment, Pair wise alignment (BLAST and FASTA] and multiple sequence alignment. Phylogenetic Tree construction and Analysis

Module IV **6 Hrs**

Molecular visualization software - RASMOL. Basic concepts of Drug discovery pipe line, computer aided drug discovery and its applications. Human Genome Project.

MOLECULAR BIOLOGY **20 Hrs**

Module V **8 Hrs**

Nature of Genetic Materials: Discovery of DNA as genetic material – Griffith's transformation experiments. Avery Macarty and Macleod, Hershey Chase Experiment of Bacteriophage infection, Prokaryotic genome; Eukaryotic genome.Structure and.types of DNA & RNA.DNA replication. Modern concept of gene (Cistron, muton, recon, viral genes)., Brief account of the following-- Split genes (introns and exons), Junk genes, Pseudogenes, Overlapping genes, Transposons.

Module VI **12 Hrs**

Gene Expressions: Central Dogma of molecular biology and central dogma reverse, one gene-one enzyme hypothesis, One gene-one polypeptide hypothesis Characteristics of genetic code, Contributions of Hargobind Khorana.

Protein synthesis [prokaryotic]: Transcription of mRNA, Reverse transcription, post transcriptional modifications, Translation, Post translational modifications.

Gene regulations: Prokaryotic(inducible & repressible systems) Operon concept -Lac operon and Tryptophan operon, Brief account of Eukaryotic gene regulation.

References

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2. De Robertis, E.D.P. and De Robertis, E.M.F. (2006).Cell and Molecular Biology.VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
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PRACTICAL .

BIOTECHNOLOGY, BIOINFORMATICS & MOLECULAR BIOLOGY

BIOTECHNOLOGY

1. Identify and comment on the item provided: (Western blotting / Southern blotting / Northern blotting / PCR)
2. Write down the procedure involved in DNA isolation

BIOINFORMATICS

1. Download/use print out/pictures of genome sequences of any 2 organisms. Identify and mention the characteristic features of both.
2. Download/ use print out/pictures of a protein sequence , identify it & comment on its amino acid composition
3. Download / use print out/pictures of a macromolecule. Write a brief note on the bioinformatics tool used to visualize its structure.

MOLECULAR BIOLOGY

1. Identify and comment on its molecular composition / structural orientation / functional significance (Any tissue / Cell organelles/ DNA, DNA replication, RNA different types using models or diagrams)

V1 SEMESTER. ZY6CRT12

CORE COURSE XII

OCCUPATIONAL ZOOLOGY .

(APICULTURE, VERMICULTURE, QUAIL FARMING & AQUACULTURE)

54 Hrs

Credits 3

Objectives:

1. To equip the students with self employment capabilities.
2. To provide scientific knowledge of profitablefarming.

3. To make the students aware of cottage industries.

Module 1. APICULTURE **18 Hrs**

Definition, Different species of honey bees, Organization of honey bee colony, Social life and adaptation of honey bees. Communication among honey bees. Bee keeping methods and equipments, Management and maintenance of an apiary, Growth period, honey flow period and dearth period Division of the colony, uniting two colonies, , replacing old queen with new queen, swarming management, monsoon management. Enemies of bees. Diseases of bees,.Bee pasturage. Uses of honey bees, By-products of honey bees, Honey and wax composition. Testing the quality of honey.Extraction of wax, Uses of honey and wax.Royal jelly, Propolis. Apitherapy, Agencies supporting apiculture.

Activity :Visitto an apiculture unit.
Field visit and report submission - 10 Hrs
Field visit and report submission on any two items are taken for internal evaluation.

MODULE: 2. VERMICULTURE **8 Hrs**

Introduction, Ecological classification of earth worms. Species of earth worms used for vermicultre, Reproduction & life cycle, Role of earth worm in solid waste management, in agriculture, in medicine etc. Preparation of vermibed, Maintenance & monitoring, Preparation of vermicompost, Preparation of vermiwash.

Activity : Submission of a report after preparing a vermiculture unit or visiting a vermicomposting unit.

MODULE: 3.QUAIL FARMING (*Coturnix coturnix*) **4 Hrs**

Introduction, care of quail chicks, care of adult quails, care of breeding quails, ration for quail, care of hatching eggs, health care, use of quail egg and meat.Sources of quality chicks.

MODULE: 4. AQUACULTURE. **24 Hrs**

Advantages and salient features of aquaculture, Types of Aquaculture, Biotic and abiotic features of water, Importance of algae in aquaculture, Common cultivable fishes of Kerala, Fish diseases, Composite fish culture, Integrated fish culture, Carp culture, Prawn culture Mussel culture Pearl culture. Processing & Preservation.

Aquarium management - Setting up of an aquarium, Biological filter & Aeration, Breeding of gold fish, gourami (Osphronemus), fighter and Guppy (live bearer). Nutrition and types of feed for aquarium fishes, Establishment of commercial ornamental fish culture unit. Fish Transportation - Live fish packing and transport Common diseases of aquarium fishes and their management. Aquaponics (a brief introduction only).

Activity – Setting up of an Aquarium

Field visit – Visiting an Aquaculture farm

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Addison Webb, Bee Keepingfor profit and pleasure, Agrobios Ltd.

Edwards.C.A.&Lafty, J.R.1972 Biology of earthworms(Chapman & Hall Led.London)

Applied Zoology, Study Material Zoological Society of Kerala , CMS college Campus

George cust& Peter Bird, Tropical Fresh water Aquaria, Hamlyn London.
Verreth J. Fish larval nutrition, Chapman & Hall Publ.
Bone Packer. 2014. Aquaponic system

PRACTICAL

OCCUPATIONAL ZOOLOGY

36 Hrs

Credit 1

1. General Identification, Economic importance, Morphology, scientific names and common names of the following

a) Economic important and morphology of culturable fishes (Catla, Rohu, Grass carp, Common carp, Silver carp, *Etroplus suratensis*, *Oreochromis /Tilapia*, *Mugil cephalus* and *Ana*b*as Testudineus*)

b) Identification and morphology of ornamental fishes (gold fish, fighter, Gourami, Angel fish, Guppy

c) Two species of earthworms used in Vermiculture

d) Four species of honey bees

e) Economic importance and morphology of shell fishes (Any three species of prawn, two marine mussels, two oysters one rock oyster - *Crasostria* and pearl oyster - *Pinctada fucata* and freshwater mussel - *Lamellidens marginalis*).

2. Castes of bees

3. Principle & uses of - Aquarium filters, Aquarium aerator, Aquarium plants,Oven, Pelletiser, Screw Press, die plate

4. Identification and study of fish parasites and diseases (five numbers each) using slides/pictures

5. Bee keeping equipments, Beehive, Smoker, honey extractor, Queen Cage,

6. Bees wax, Honey, Vermicompost (Identification-Uses)

7. Formulation of artificial feed for aquarium fishes – demonstration

8. Tests for determining the adulteration in honey.

9. Mounting of pollen basket

10. Mounting of mouth parts of honey bee

11. Separation of cocoon from worm castings.

SEMESTER V. OPEN COURSES (FOR OTHER STREAMS)

ZY5OPT01

1. VOCATIONAL ZOOLOGY **72 Hrs**

4 Hrs/Week, Credits 3

Objectives of the Course

- To develop critical thinking skill and research aptitude among students, by introducing the frontier areas of the biological science.
- To emphasize the central role that biological sciences plays in the life of all organisms.
- To introduce the student to some of the present and future applications of bio-sciences
- To acquire basic knowledge and skills in aquarium management, Quail farming, vermicomposting and apiculture for self-employment
- To learn the different resources available and to develop an attitude towards sustainability
- Give awareness to society about need for waste management and organic farming

Module 1 Aquarium management **12 Hrs**

General introduction to Aquarium, Aims and types of aquarium (material, size and shape), Requirements of an aquarium - filtration of waste, physical, chemical and biological; Setting an aquarium (self-sustainable with biological filters), Major indigenous aquarium fishes of Kerala.

Activity: Setting up of a freshwater aquariumand rearing of aquarium fishes

Module 2 Ornamental Fish Culture **20 Hrs**

Introduction to ornamental fishes: Present status of ornamental fish culture in India with special reference to Kerala, Breeding of Gold fish, Fighter, Gourami (*Osphroneus),* and Guppy (live bearer). Nutrition and types feed for aquarium fishes,Use of live fish feed

organisms in Ornamental fish culture. Methods and techniques involved in the formulation of fish feed. Fish Transportation: Live fish packing and transport, Common diseases of aquarium fishes and their management**.** Establishment of commercial ornamental fish culture unit,

Activity: field visit to an ornamental fish breeding Centre to understand breeding practices of various aquarium fishes.

Module 3 Quail farming (*Coturnix coturnix*) 10 Hrs

Introduction, care of quail chicks, care of adult quails, care of breeding quails ,ration for quail, care of hatching eggs, health care, use of quail egg and meat, Sources of quality chicks.

Activity: Visit to a quail farm or viewing a quail documentary to familiarize the quail farming practices

Module 5 Vermiculture and composting 12 Hrs

Introduction, ecological classification of earth worms, Life history, Species of earth worms used for vermicultre, Preparation of vermibed; Preparation of vermicompost, Preparation of vermiwash, Maintenance and management of vermicomposting unit, Role of vermiculture in solid waste management.

Activity: - Preparation of a vermiculture unit or visit to a vermicomposting unit.

Module 6 Apiculture 18 Hrs

Definition, Uses of bees, species of bees cultured, organization of honey bee colony, bee keeping methods (modern method only) and equipments, management and maintenance of an apiary-growth period, dividing the colony, uniting two colonies, replacing old queen with new queen, honey flow period, Bee pasturage, Death period, Enemies of bees, Bee diseases, uses of honey and wax, Apitherapy, Propolis, Royal jelly, Agencies supporting apiculture.

Activity: Identify different types of honey bees and rearing equipments

Field visit and report Submission

Field visit and report writing on any two items are taken for internal evaluation, instead of assignment and seminar. Conduct a workshop on various cultural practices and the preparation of byproducts.

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OPEN COURSE (FOR OTHER STREAMS)

ZY5OPT02

2. PUBLIC HEALTH AND NUTR

72 Hrs

4hrs/Week

Credits 3

Objectives:

- To inculcate a general awareness among the students regarding the real sense of health.
- To understand the role of balanced diet in maintaining health.
- To motivate them to practice yoga and meditation in day-to-day life.

PART I HEALTH, EXERCISE & NUTRITION

Module 1 Definition and Meaning of Health **10 Hrs**

Dimensions and Determination of Health

Physical Activity and Health benefits

Effect of exercise on body systems – Circulatory, Respiratory, Endocrine, Skeletal and Muscular

Programmes on Community health promotion (Individual, Family and Society) Dangers of alcoholic and drug abuse, medico-legal implications

Module 2 Nutrition and Health **10 Hrs**

Concept of Food and Nutrition, Balanced diet

Vitamins, Malnutrition, Deficiency Disease

Determining Caloric intake and expenditure

Obesity, causes and preventing measures

Role of Diet and Exercise, BMI

Module 3 Safety Education in Health promotion **8 Hrs**

Principles of Accident prevention

Health and Safety in daily life.

Health and Safety at work.

First aid and emergency care.

Common injuries and their management.

Modern life style and hypokinetic diseases.

Diabetese, Cardiovasculard disorders-Prevention and Management.

Module 4 Life Skill Education 8 Hrs

Life skills, emotional adjustment and well being,. Yoga, Meditation and Relaxation, Psychoneuroimmunology

PART II PUBLIC HEALTH AND SANITATION

Module 5 Public health and water quality. 11 Hrs

Potable water, Health and Water quality

Faecal bacteriae and pathogenic microorganisms transmitted by water. Determination of sanitary quality of drinking water, water purification techniques

Module 6 Public health and diseases 15 Hrs

Water borne dseases-Cholera and Typhoid.Prevention of Water borne diseases.

Food borne diseases and Prevention

Botulinum, Salmenellosis, Hepatitis A

Vector borne diseases & Control measures

Chikungunya , Filariasis and Dengu fever

Zoonotic disease-Leptospirosis & its control

Emerging diseases - Swine flue (H1N1), bird flue (H5N1), SARS, Anthrax

Re-emerging diseases –TB, Malaria

Health Centre visit & Report Presentation 10 Hrs

References:

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SEMESTER V.

OPEN COURSE (FOR OTHER STREAMS)

ZY5OPT03

3. MAN, NATURE AND SUSTAINABLE DEVELOPMENT

72 Hrs
4Hrs/Week
Credits 3

Objectives:

1. To understand how Man originated and attained present status
2. To learn the basic concepts of Ecosystems and its functioning
3. To study the use and abuse of nature by Man
4. To learn the different resources available on earth
5. To study global environmental problems and its impact on human well being
6. To appreciate the perspectives of Man on nature and learn the strategies for conservation
7. To familiarize with sustainable development and develop an attitude for sustainability

Module I. Man in Nature **10 Hrs**

Introduction

Evolution of Man

Out of Africa and Candelabra Model

The Fossils and the Molecular Evidences

Hunter-Gatherer and the Agriculturist

Speech and Languages

Cultural Evolution

Altruism and Morality

Module II.The Biosphere **10 Hrs**

Earth-Continents and Continental drift

Concept of Landscapes and Habitats

Lithosphere- Forest (Tropical and Temperate)

Grasslands, Deserts and Montane

The Biomes of the World

Hydrosphere- Oceans, Estuaries

Freshwater

Water the Elixir of Life

Atmosphere- Structure and stratification

Module III.Dominance of Man on Earth **7 Hrs**

Industrial Revolution

Human Population Growth

Resource Utilization

Environmental Consequences

Modern Agriculture and Green Revolution

Environmental Impacts

Imperialism and its Ecological Root

Module IV.Natural Resources **7 Hrs**

Renewable and Non- renewable

Biodiversity

Importance of Biodiversity -the Six E ^{S}

Hotspots of Biodiversity

Biotic Richness of India

Monoculture and loss of Genetic Diversity

Extinction Crisis, IUCN and Red Data Book

Module V.Global Environmental Issues Threatening Natural Resources and Human Life

10 Hrs

Deforestation, Landscape alterations, Soil erosion, Flood and Drought, Desertification, Overexploitation, Pollution (Air, Water and Soil- Pollutants and Consequences only), Acid rain, Ozone depletion, Greenhouse effect and Global Warming (use case studies to illustrate the points) Waste disposal (Biodegradable and Non-degradable eg. Plastic and E- waste), Oil spill Energy - Production, Consumption and its Impact on Environment Quality of the Environment and Human Health

Module VI.Man's Perspective on Nature **10 Hrs**

Eco Spirituality, Eco-theology and Eco-feminism

Community initiatives

Indigenous People's Perspective (tribal and traditional communities)

Native American, Amazonian, Australian Aborigines, Bishnoi Contributions of -John Muir, Aldo Leopold, Thoreau, Rachel Carson Edward Abbey, Arne Ness, Carolyn Merchant,Vandana Shiva

Module VII. **Global Strategies for Conservation** **8 Hrs**

UN conference on Man and Environment-1972

UNEP and its Contributions

The World Conservation Strategy-1980

World Commission on Environment and Development

The Earth Summit -1992

The UNFCC and IPCC

Conservation Strategies in India-MoEF

Legal System- Mention Major Conservation Acts

People's Participation in Conservation:

Chipko Movement and Narmada Bachao Andolan,

Silent Valley

Module VIII Sustainable Development **10 Hrs**

Definition and Concept

Principles and Goals

Environment versus Development Debate

Johannesburg Conference -2002

Strategies for Sustainable development

Sustainable Development in the era of Globalization

Gandhian Environmentalism

Education for Sustainable Development (UNESCO-ESD)

Building a Sustainable society

Sustainable life styles

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SEMESTER VI.

ZOOLOGY CORE CHOICE BASED COURSES

FOR B.Sc. ZOOLOGY PROGRAMME

ZY6CBT01. ELECTIVE COURSE.

1. ECOTOURISM & SUSTAINABLE DEVELOPMENT

72 Hrs

4hrs/week

Credits 3

Objectives:

1. To introduce the concepts, principles and applications of tourism and its sustainability
2. To critically analyse the cost and benefits of ecotourism, including related laws and policies, community involvement and future trends
3. To develop an appreciation among students with respect to tourism development from the

sustainability perspective

4. To equip the students with basic knowledge for the emerging ecotourism industry

Module I. Fundamentals of Tourism **12 Hrs**

Introduction- Tourism, concepts and definitions

History, types, Characteristics

The facilitating sectors

Attractions

Geography, heritage

Wildlife, nature

Quality Control

Module II. Major areas of eco-tourism **10 Hrs**

Concepts, practices and case studies for each:

Marine tourism

Wildlife tourism

Adventure tourism

Module III. Emerging trends in eco-tourism **10Hrs**

Cultural tourism

Pilgrimage tourism

Farm tourism

Backwater tourism

Health tourism

Module IV. Problems and prospects of eco-tourism **10 Hrs**

Economics and benefits of ecotourism

Cultural issues and negative aspects of ecotourism

Environmental Impacts of Tourism

Module V. Sustainable tourism **12 Hrs**

Quality, Standards

Systems of sustainable tourism: environmental, sociocultural, Economical

Environment and conservation: basic principles

Current practices of eco-conservation in tourism industry

Sustainable tourism and society

Community based ecotourism

Eco-development committee (EDC) of Periyar Tiger Rerserve

People initiatives

Module VI. Eco-tourism guides **8 Hrs**

Ecotourism guiding and case studies

Activity

Field visit to Ecologically relevant places & Report writing **10 Hrs**

References

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ELECTIVE COURSE . ZY6CBT02

2. AGRICULTURAL PEST MANAGEMENT 72 Hrs

4 Hrs/week - 3 Credits

Objectives

1. To acquire basic skills in the observation and study of nature.

2. To impart basic awareness regarding pest problem and crop loss due to their dominance.

3. To inculcate interest in adopting biological control strategies for pest control.

4. To understand various pests affecting our local crops and select the best method for their control

5. To acquire basic knowledge and skills in agriculture management to enable the learner for self-employment.

Module I **5 Hrs**

Pest and crop loss: Introduction, historical perspective-origin of pest, Evolution of pest. Causes of pest outbreak- biotic, abiotic and genetic factors.Modern agricultural practices and pest problem - high yielding varieties, monoculture, fertilizers, pesticides, irrigation, and cultural practices.

Module II **15Hrs**

Pest categories: Types of pests- insect pest and non-insect pest.

Insect pest: insect structure and function-external features (body parts), mouth parts of phytophagous insects, internal anatomy, growth, development, reproduction, life cycle and metamorphosis (one example each from ametabolous, hemimetabolous and holometabolous insect), diapause. types of insect pests-key pests, occasional pests, potential pests.

Non insect pests: General features, different types-Rodents(mention the nature of crop loss by them),Mites-Main types of mites; plant injury caused by mite, millipedes and centipedes, slugs and snails (mention the damage of invasive Giant African Snail).

Activity: Identify a minimum of 5 invasive species (plant / animal) in your locality and make a report on their ecological impact.

Module III **7 Hrs**

Pest and plants: Plant feeding insects-plant host range, types of injury, relationship of pest injury and yield.

Host plant resistance: Characterization of resistance, mechanism of resistance (antixenosis, antibiosis, tolerance), biophysical, biochemical and genetic bases of resistance.

Module IV **20 Hrs**

Pest control-principles and practices: Types of control-cultural control, biological control, chemical control, integrated pest management, miscellaneous control.

Cultural control: Water management, tillage, sanitation, plant diversity, crop rotation, planting time, harvesting practices etc

Biological control: Parasitoids and predators, control by insect pathogens. Techniques in biological control-conservation, introduction and augmentation. Biopesticides

Chemical control: Origin of chemical control, chemistry, mode of action and nomenclature (organochlorines, organophosphates, carbamates, synthetic pyrethroids, miscellaneous group) of pesticides, pesticide formulations and pesticide appliances (sprayers and dusters). Brief mention of attractants, repellents, chemosterilants and pheromones

Activity 1: Conduct a workshop on preparation of biopesticides of various types suitable for kitchen garden and agricultural fields.

Integrated Pest Management (IPM)

Miscellaneous control: Mechanical (hand picking, exclusion by screens and barriers, trapping, clipping, pruning etc), physical (hot and cold treatment, moisture, light traps etc), sterility principle

Module V **25 Hrs**

Bionomics and control of major pests of crops and stored grains: Biology, life cycle and nature of damage by different pests of following crops and their control

Pests of paddy: *Leptocorisa acuta*, *Scirpophaga incertulas*, Spodoptera mauritia, *Orseolia oryzae*, *Nilaparvata lugens*

Pests of coconut: *Oryctes rhinoceros, Rhyncophorus ferrugineus, Opisina arenosella, Aceria guerreronis*

Pests of Banana: Cosmopolites sordidus, Pentalonianigronervosa

Pests of vegetables - Brinjal: Leucinodesorbonalis, Euzopheraperticella, Henosepilachnavigintioctopunctata, Urentiushystricellus

Gourds -Bactoceracucurbitae, Anadevidiapeponis, Epilachna spp. Raphidopalpafoveicollis, Baristrichosanthis

Pest of stored grains: Sitophilusoryzae, Corcyra cephalonica Triboliumcastraneum, Trogodermagranarium, Callasobruchuschinensis

Activity 2: Conduct a poster exhibition on various types of pests of paddy, coconut, banana and vegetable varieties of Kerala.

Activity 3: Collect different types of pest of stored grains from the local provision shops or houses and make a taxonomic study and prepare a powerpoint presentation on them.

Activity 4: Visit a minimum of 5 kitchen gardens in the neighborhood and enlist the common traditional pest control measures used in them.

Activity 5: Organise awareness classes on the ill effects of chemical pesticides and manure on human health with the support of local examples.

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ELECTIVE COURSE. ZY6CBT03.

3. VECTOR AND VECTOR BORNE DISEASES

72 Hrs

3 Credits

Objectives:

Module I **10Hrs**

Introduction: Vector : mechanical and biological vector, Reservoirs, Host-vector relationship, Vectorial capacity, Host Specificity.

Insect vectors: Mosquitoes, flies, fleas, lice, ticks and bugs- General account of ecology morphology and mouth parts

Module I1 **6 Hrs**

Salient features and distribution of mosquito species:*Anopheles, Aedes, Culex, and Mansonia*.

Module II1 **25 Hrs**

Study of Vector Borne disease[Life cycle and pathology]: Mosquito-borne diseases – Malaria, Dengue, Chikungunya, Filariasis. Sand fly-borne diseases – Leishmaniasis, Phlebotomus fever. Tse- tse fly – sleeping sickness. House fly borne diseases :typhoid fever, cholera, dysentery, anthrax, Myiasis, . Flea-borne diseases – Plague, Typhus fever. Louse-borne diseases –Relapsing fever, Trench fever, Vagabond's disease, Phthiriasis.

Module IV **13 Hrs**

Introduction to Vector control: Aims, objectives and advantages.History and background, recent trends, alternatives to the use of insecticides (chemical & microbial), types of vector control - selective, integrated and comprehensive vector control.

Control measures of mosquitoes, sand fly, tsetse fly and domestic flies

ModuleV

8Hrs

Introduction to epidemiology: History, Definition, scope and uses of epidemiology. Epidemiology and public health. Achievements in epidemiology: Smallpox Methyl mercury

poisoning Rheumatic fever and rheumatic heart disease Iodine deficiency diseases Tobacco use, asbestos and lung cancer, Hip fractures. HIV/AIDS, SARS.

Field report on two case studies of epidemiology in India. **10 Hrs**

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ELECTIVE COURSE. ZY6CBT04

4. NUTRITION, HEALTH AND LIFESTYLE MANAGEMENT

72 Hrs.

3 Credits

Objectives:

1. To provide students with a general concept of health and the parameters that define health and wellness.

2. To understand principles of nutrition and its role in health.

3. To familiarize the students regarding food safety, food laws & regulations.

4. To provide knowledge and understanding regarding life style diseases.

5. To promote an understanding of the value of good life style practices, physical fitness and healthy food habits for life style disease management.

Module I **15 Hrs**

Nutrition and health: Nutritional requirements of man, classification of major nutrients

including protein,vitamins and minerals, water, role of fibre, biological value of food components, food groups and sources, balanced diet, RDA, BMI, BMR, Calorie intake and expenditure, Healthy eating pyramid, Nutrition in infancy, preschool, school, adolescent, pregnancy, lactation and old age. Nutrition in diseases and special conditions. Food safety: Nutrition education, food sanitation and hygiene, food adulteration and consumer protection.

Module II **18 Hrs**

Understanding of health: Define health, basic concepts, dimensions of health, basic parameters of health care. (Health Parameters: Individual normal standards, devices.1. Blood pressure, 2. Brain activities and sleep, 3.Focus or attention, 4.Pulse, 5. Body temperature, 6. Daily physical activities, 7. Electrocardiogram (ECG), 8.Cardiac fitness 9. Stress, 10. Haematological parameters, 11. BMI

Module III **15 Hrs**

Introduction to Life style diseases

Common life style diseases: Alzheimer's disease and other neural disorders, asthma, cancer, cardio vascular diseases - including hypertension, Atherosclerosis and stroke, chronic obstructive pulmonary disease, Diabetes Mellitus or Type 2 Diabetes, kidney disorders and chronic renal failure, constipation, depression, gastro-intestinal disturbances including diarrhoea and peptic ulcer, liver cirrhosis and other liver diseases, obesity, osteoporosis, occupational lifestyle diseases.

Modern lifestyle disorders: sleeping habits, junk food, poor eating habits, anxiety, food poisoning

Module IV **10 Hrs**

Causes of lifestyle diseases: Defects of modern food habits and unbalanced diet options, food adulteration, environmental pollution, poor life style choices, drug abuse, tobacco smoking, alcohol and drug consumption, lack of adequate exercise, wrong body posture,

disturbed biological clock, stressful environmental conditions

Module V **14 Hrs**

Prevention and control of life style diseases:

Healthy life style habits and practices, healthy eating habits, exercise and fitness, good sleep patterns, a strict no to alcohol, drugs, and other illegal drugs. Uncontrollable factors like age, gender, heredity and race.

Healthy diet: disease prevention through appropriate diet and nutrition, avoiding foods that are high in fats, salt and refined products. Avoid junk food and replace by natural food/ organic food.

Physical exercise: Moderate exercise for fitness of body, walking, stretching, right postures of sitting & standing, relaxation and cutting down of stress, sports, aerobic exercise and yoga.

Health literacy as a public health goal: Awareness programs in schools, colleges and through mass media.

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13. COMPLEMENTARY ZOOLOGY COURSES OFFERED BY ZOOLOGY DEPARTMENT FOR - MODEL I – BSc BOTANY / BSc HOME SCIENCE
MODEL II – BSc BOTANY, BSc (AQUACULTURE)
MODEL III – BSc (BIOLOGICAL TECHNIQUES AND SPECIMEN PREPARATION)

Semester	Code	Title of the Course	Hrs	Inst Hrs/week	Credit
1	ZY1CMT01	Non Chordate Diversity	36	2	2
1		Non Chordate Diversity (Practicals)	36	2	0
2	ZY2CMT02	Chordate Diversity	36	2	2
2		Chordate Diversity (Practicals)	36	2	0
2	ZY2CMP01	**Practical 1** Non Chordate Diversity + Chordate Diversity (Practicals)			2
3	ZY3CMT03	Physiology and Immunology	54	3	3
3		Physiology and Immunology (Practicals)	36	2	0
4	ZY4CMT04	Applied Zoology	54	3	3
		Applied Zoology (Practicals)	36	2	
4	ZY4CMPO2	**Practical 2** Physiology and Immunology + Applied Zoology (Practical)			2

COMPLEMENTARY COURSE : ZOOLOGY –MODEL I

SEMESTER I. ZY1CMT01.

COMPLEMENTARY COURSE 1

NON CHORDATE DIVERSITY

36 hrs
Credits 2

Objectives:

1. To study the scientific classification of invertebrate fauna.
2. To learn the physiological and anatomical peculiarities of some invertebrate phyla through type study.
3. To learn the unity of life with rich diversity of organisms & evolutionary significance of certain invertebrate fauna
4. To stimulate the curiosity of students' in the biota living around them.

Module I **10 Hrs**

Introduction: Five kingdom classification

Kingdom Protista: Salient features (any five important salient features) of each phylum with one example each (detailed account of example is not necessary).

Phylum Rhizopoda (eg: Amoeba)
Phylum Actinopoda (eg: Actinophrys)
Phylum Dinoflagellata (eg: Noctiluca)
Phylum Parabasalia (eg: Trychonympha)
Phylum Metamonda (eg: Giardia)
Phylum Kinetoplasta (eg: Trypanosoma)
Phylum Euglenophyta (eg: Euglena)
Phylum Cryptophyta (eg: Cryptomonas)
Phylum Opalinata (eg: Opalina)
Phylum Bacillariophyta (eg: Diatoms)
Phylum Chlorophyta (eg: Volvox)
Phylum Choanoflagellata (eg: Proterospongia)
Phylum Ciliophora (eg: Paramecium)
Phylum Sporozoa (eg: Plasmodium)
Phylum Microsporidia (eg: Nosema)
Phylum Rhodophyta (eg: Red algae)

General Topic: Pathogenic Protists – Plasmodium, Entamoeba

Module II **3 Hrs**

Phylum Porifera: Salient features (eg: Leucosolenia)

Phylum Coelenterata: Salient features and classification upto class.

Class 1: Hydrozoa (eg: Physalia)

Class 2: Schyphozoa (eg: Aurelia)

Class 3: Anthozoa (eg: Adamsia)

General Topic: Corals and Coral reefs.

Module III **6 Hrs**

Phylum Platyhelminthes: Salient features and classification up to class.

Class 1: Turbelleria (eg: Planaria)

Class 2: Trematoda (eg: Fasciola)

Class 3: Cestoda (eg*: Taenia solium*)

Phylum Nematoda: Salient features and classification up to class.

Class 1: Phasmida (eg: Wuchereria*)*

Class 2: Aphasmida (eg: Trichinella*)*

Phylum Annelida: Salient features and classification up to class.

Class 1: Polychaeta (eg: Nereis)

Class 2: Oligochaeta (eg: Pheretima)

Class 3: Hirudinomorpha (eg: Hirudinaria)

Module IV **11 Hrs**

Phylum Arthropoda: Salient features. Type study – ***Fenneropenaeus*** (Penaeus) **-** habitat, morphology, appendages, sexual dimorphism, digestive system, respiratory system, circulatory system, excretory system, nervous system, sense organs, reproductive system, larval stages.

Classification up to class with one example each

Subphylum Trilobitomorpha

Class 1: Trilobita (Extinct) (eg: Dalmanites*)*

Subphylum: Chelicerata

Class 1: Merostoma (eg: Limulus)

Class 2: Arachnida (eg: Spider)

Class 3: Pycnogonida (eg: Nymphon)

Subphylum Mandibulata

Class 1: Crustacea (eg: Daphnia)

Class 2: Chilopoda (eg: Centipede)

Class 3: Symphyla (eg: Scutigerella)

Class 4: Diplopoda (eg: Millipede)

Class 5: Pauropoda (eg: Pauropus)

Class 6: Insecta (eg: Butterfly)

Module V **6 Hrs**

Phylum Mollusca: Salient features and classification up to class

Class 1: Aplacophora (eg: Neomenia)

Class 2: Monoplacophora (eg: Neopilina)

Class 3: Polyplacophora (eg: Chiton)

Class 4: Bivalvia (eg: Perna)

Class 5: Gastropoda (eg: Xancus)

Class 6: Cephalopoda (eg: Sepia)

Class 7: Scaphopoda (eg: Dentalium)

Phylum Echinodermata : Salient features and classification up to class.

Class 1: Asteroidea (eg: Astropecten)

Class 2: Ophiuroidea (eg: Ophiothrix)

Class 3: Echinoidea (eg: Echinus)

Class 4: Holothuroidea (eg: Holothuria)

Class 5: Crinoidea (eg: Antedon)

Phylum Hemichordata : Salient features (eg: Balanoglossus.)

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SEMESTER I

COMPLEMENTARY COURSE 1 - PRACTCAL

NON CHORDATE DIVERSITY **36 Hrs**

Credit 1

1. Scientific drawing - 5 specimens
2. Simple identification - 10 invertebrates, out of which 5 by their scientific names
3. T.S - Earthworm, T.S Fasciola
4. Dissection - Nervous system of Prawn
5. Dissection - Nervous system of Cockroach
6. Mounting - Prawn Appendages

SEMESTER II. ZY2CMTO2.

COMPLEMENTARY COURSE 2

CHORDATE DIVERSITY

36 Hrs
Credits 2

Objectives

1. To make the student observe the diversity in chordates and their systematic position.
2. To make the a student ware of the economic importance of some chordates.
3. To learn the physiological and anatomical peculiarities of some vertebrate species through type study.
4. To stimulate the students' curiosity in vertebrates living associated with them.

Module I **4 Hrs**

Phylum Chordata: Fundamental characters and outline classification upto class.

Sub phylum Urochordata: General characters,

Classification:

Class 1: Larvacea (eg: Oikopleura)

Class 2: Ascidiacea (eg: Ascidia) , Retrogressive metamorphosis.

Class 3: Thaliacea (eg: Salpa)

Sub phylum Cephalochordata: Salient features (eg: Branchiostoma)

Module II **6 Hrs**

Sub phylum Vertebrata: Salient features

Division Agnatha : salient features and classification

Class 1: Cyclostoma (eg: Petromyzon)

Class 2: Class Ostracodermi (eg: Cephalapsis)

Division Gnathostomata: Salient features

Super class Pisces

Super class Tetrapoda.

Super class Pisces: Salient features and classification

Class 1: Chondrichthyes (eg: N

arcine)

Class 2:Osteichthyes (eg: Latimeria)

General Topic: Accessory respiratory organs in fishes.

Module III **14 Hrs**

Super class Tetrapoda: Salient features

Class 1: Amphibia : Salient features. **Type study:** ***Euphlyctis hexadactyla*** - Habitat, morphology, sexual dimorphism, coelom and viscera, skeletal system, digestive system, respiratory system, circulatory system, excretory system, nervous system, sense organs, reproductive system, development..

Classification up to order:

Order 1: Urodela (eg: Amblystoma)

Order 2: Anura (eg: Bufo)

Order 3: Apoda (eg: Icthyophis)

Module IV **6 Hrs**

Class Reptilia: Salient features and classification up to subclass

Sub class 1: Anapsida (eg: Chelone)

Sub class 2: Diapsida (eg: Chamaeleon)

Sub class 3: Parapsida (eg: Icthyosaurus)

General Topics: Poisonous and non poisonous snakes of Kerala.

Class Aves: Salient features and classification up to subclass

Sub class Archeornithes (eg: Archaeopteryx)

Sub class Neornithes (eg: Struthio)

General Topics: Flight adaptation of birds

Module V **6 Hrs**

Class Mammalia: Salient features and classification up to subclass

Sub class 1: Protheria (eg: Echidna)

Sub class 2: Metatheria (eg*:* Macropus)

Sub class 3: Eutheria (eg: Elephas*)*

General Topic: General adaptation of aquatic mammals with example.

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SEMESTER II

COMPLEMENTARY COURSE 2- PRACTCAL

CHORDATE DIVERSITY

36 Hrs
Credit I

1. Simple identification of 10 chordates, out of which 5 by their scientific names
2. Osteology - Vertebrae and girdles of Frog
3. Snake identification - 3 poisonous and 3 non poisonous snakes with key
4. Mounting of placoid scales of shark
5. Dissections: Frog: Photographs/Diagrams/ models may be used for the study.
   1. Frog - Viscera
   2. Frog - Digestive System
   3. Frog - Arterial System
   4. Frog - Brain

SEMESTER III. ZY3CMT03.

COMPLEMENTARY COURSE -3

PHYSIOLOGY AND IMMUNOLOGY

54 hrs
Credits 3

Objectives

1 To appreciate the correlation between structure and function of organisms
2 To make the student aware of the health related problems, their origin and treatment.
3 To understand how efficiently our immune system work in our body.
4 To acquire knowledge about preventing common diseases rather than curing.

Module I **14 Hrs**

Nutrition: Types of nutrition – autotrophy, heterotrophy. Nutritional requirements – carbohydrates, proteins, lipids, minerals (Ca, Fe, I), vitamins (sources and deficiency disorders), nutritional disorders

Respiration: Transport of respiratory gases in blood - transport of oxygen, transport of carbon dioxide, chloride shift. Respiratory disturbances – Hypoxia, Hypercapnia, Asphyxia, physiological effect of smoking, carbon monoxide poisoning.

Circulation: Composition and functions of blood. Plasma and formed elements - WBC, RBC and platelets, Mechanism of blood coagulation – clotting factors, intrinsic and extrinsic pathways, anticoagulants. ECG, Blood pressure, Arteriosclerosis, Heamophilia, cerebral and pulmonary thrombosis.

Module II **14 hrs**

Excretion: Structure of a nephron. Urine formation – glomerular filteration, tubular reabsorption, tubular secretion. Urine concentration – counter current mechanism. Composition of urine – normal and abnormal constituents. Hormonal regulation of kidney function. Kidney stone, dialysis.

Neuro physiology: Structure of a neuron. Myelinated and non myelinated nerve fibre, nerve impulse production (resting membrane potential, action potential), Impulse propagation, All or none law, saltatory conduction, synaptic transmission. Neurotransmitters (acetyl choline, adrenalin, dopamine), brain waves, EEG. Neural disorders - Parkinson's disease, Alzheimer's disease.

Muscle physiology: Types of muscles: striated, non striated and cardiac. Ultra structure of striated muscle, Mechanism of muscle contraction, cori cycle and muscle relaxation. Muscle fatigue, oxygen debt, Rigor mortis.

Module III **8 hrs**

Endocrinology: Introduction to Endocrine system. Mechanism of hormone action, Endocrine glands - hypothalamus, pituitary gland, pineal gland, thyroid gland, parathyroid gland, endocrine pancreas, adrenal gland, thymus gland, testis and ovary. Physiological role of hormones, Hormonal disorders.

Module IV **12 Hrs**

Immunology: Introduction to immunology, types of immunity – innate, acquired, passive, active, mechanism of innate immunity (barriers, inflammation, phagocytosis). Types of antigens. Basic structure of immunoglobulins, Classes of immunoglobulins and functions. Antigen antibody reactions, Precipitation test, agglutination test, WIDAL, VDRL, HIV test (ELISA),

Module V **6 Hrs**

Immune response system: (Brief accounts of the followings)

Primary and secondary lymphoid organs, Cells of Immune system - T&B lymphocytes, natural killer cells, macrophages, plasma cells , memory cells, Monoclonal antibodies, Hybridoma technology.

Immune disorders: Hypersensitivity, Auto immunity (rheumatoid arthritis) & Immunodeficiency (AIDS), Vaccines - BCG, DPT, Polio vaccine.

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SEMESTER III

COMPLEMENTARY COURSE - 3 PRACTCAL

PHYSIOLOGY AND IMMUNOLOGY

36Hrs

Credit 1

1. Preparation of Human Blood smear & identification of leucocytes
2. Qualitative analysis of Reducing Sugar, Protein and Lipid
3. Action of Salivary amylase on Starch (Demonstration Only)
4. Estimation of Haemoglobin (Demonstration only)
5. Identification of human blood groups, A, AB, B and O, Rh factor
6. Instruments (Principle & uses)- Sphygmomanometer , Stethoscope

SEMESTER IV. ZY4CMT04.

COMPLEMENTARY COURSE - 4

APPLIED ZOOLOGY

54 hrs
Credits 3

Objectives

1. To acquire basic knowledge and skills in applied branches of zoology.
2. To understand the technology for utilising ecofriendly organisms around them for beneficial purpose.
3. To equip the students for self employment opportunities with scientific knowledge to perform profitably & confidently.

Module I **24 Hrs**

Aquaculture: Advantages of aquaculture, Traditional methods of aquaculture, Biotic and abiotic factors in water, Pond culture – construction and maintenance. Types of aquaculture, composite fish culture, integrated fish culture, induced breeding of carp & prawn, Importance of algae in aquaculture. Aquarium management - Setting up of an aquarium, biological filter and aeration. Common cultivable fishes of Kerala. Fish diseases, Prawn culture, mussel culture, pearl culture, Fish processing and preservation.

Module II **12 Hrs**

Sericulture: Four species of silkworms, life history of silkworm, silk worm rearing techniques, Mounting of silkworm - Chandrika, defective cocoons, harvesting and stifling of coccons. Silkworm diseases and pest, preventive and control measures.

Module III **6 Hrs**

Vermiculture: Species of earthworms, ecological classification of earthworms, life cycle and reproduction of earthworm. Physical & chemical effects of earthworms on soil, Vermicomposting – site selection, preparation of pit, maintenance, monitoring and harvesting of vermicompost.

Module IV **12Hrs**

Apiculture: Species of honey bees, organization of honey bee colony. Bee keeping methods and equipments. Apiary management and maintenance. Bee pasturage, byproducts of honey bees and their uses. Diseases, pests of honey bees and control measures.

References:

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Shukla G.S., & Updhyay V.B., Economic Zoology (Rastogi Publ. Meerut)

Singh, S., 1962 Bee keeping in India (ICAR, New Delhi

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SEMESTER IV

COMPLEMENTARY COURSE - 4 PRACTCAL

APPLIED ZOOLOGY

2 Hrs/week

36 Hrs

Credit 1

1. General identification, economic importance, morphology, scientific names and common names of the following
   a. Economic importance and morphology of culturable fishes (Catla, Rohu, Grass carp, Common carp, Silver carp, Etroplus, Tilapia)
   b. Two species of earthworms used in Vermiculture
   c. Two species of honey bees
   d. Silkworm. Cocoon/Adult
2. Castes of honey bees
3. Bee keeping equipments - Bee hive, Smoker, honey extractor
4. Identification and uses - Bee wax, Honey, Silk, Vermicompost
5. Chandrika / Natrika used in sericulture

14. MODEL II VOCATIONAL COURSES

MODEL II

B.Sc. PROGRAMME
(VOCATIONAL COURSES)

1. B.Sc. (Aquaculture)
2. B.Sc. (Food Microbiology)
3. B.Sc. (Medical Microbiology)

A. VOCATIONAL COURSES (MODEL II)

Semester	Course No.	AQUACULTURE	FOOD MICROBIOLOGY	MEDICAL MICROBIOLOGY
1	I	Principles and Methods in Aquaculture	General Microbiology	Fundamentals of Microbiology
1	II	Hatchery and Culture Techniques	Biological Techniques	Basics of Microbial Physiology & Genetics
1	Practical - I	Principles and Methods in Aquaculture & Hatchery and Culture Techniques	General Microbiology & Biological Techniques	Fundamentals of Microbiology and Basics of Microbial Physiology & Genetics
2	III	Capture Fishery	Microbial physiology & Genetics	Parasitology
2	IV	Biology of Fishes	Applied Microbiology	Medical Virology
2	Practical - II	Capture Fishery & Biology of Fishes	Microbial physiology Genetics &Applied Microbiology	Parasitology & Medical Virology
3	V	Fisheries Environment	Dairy Microbiology	Medical Mycology
3	Practical - III	Fisheries Environment	Dairy Microbiology	Medical Mycology
3	VI	Fish Nutrition	Industrial Microbiology	Diagnostic Microbiology
3	Practical - IV	Fish Nutrition	Industrial Microbiology	Diagnostic Microbiology
4	VII	Reproductive Physiology and Endocrinology	Basic Food Micro biology	Medical Bacteriology
4	Practical - V	Reproductive Physiology and Endocrinology	Basic Food Micro biology	Medical Bacteriology
4	VIII	Microbiology, Pathology and Post Harvest Technology	Food Microbiology and Fermented Food	Clinical Microbiology

4	Practical - VI	Microbiology, Pathology and Post Harvest Technology	Food Microbiology and Fermented Food	Clinical Microbiology

b. CONSOLIDATED DISTRIBUTION OF HOURS FOR BSc. (MODEL II VOCATIONAL COURSES)

COURSE STRUCTURE

Total Credits : 120
Total Instructional Hours : 150
3 Vocational Programmes : Aquaculture (A) / Food Microbiology (F)/ Medical Microbiology (M)

SEMESTER I

No	Course Code	Course Title	Course Category	Hrs per week	Credits	Marks ratio	
						Intl	Extl
1		English - 1	Common Course	5	4	1	4
2		Second Language – 1	Common Course	5	4	1	4
3	ZY1CRT01	General perspectives in Science & Protistan Diversity	Core Course I : Theory	2	2	1	4
4		General perspectives in Science & Protistan Diversity	Core Course I : Practical	2	0	0	0
5		Principles and Methods in Aquaculture (A) / General Microbiology (F)/Fundamentals of Microbiology(M)	Vocational Course I : Theory	2	2	1	4
6		Hatcery & Culture techniques (A) / Biological technique (F)/Basics of Microbial physiology & Genetics (M)	Vocational Course II:	2	2	1	4
7		Principles and Methods in Aquaculture, Hatchery and Culture techniques (A)/ General	Vocational Course : Practical	2	0	0	0

		Microbiology and Biological technique (F)/Fundamentals of Microbiology,Basics of Microbial physiology &Genetics(M)					
8		Complementary Course – I	Complementary Course: Theory	3	2		
9		Practical	Practical	2	0		
Total				**25 hrs**	**16**		

SEMESTER II

No	Course Code	Course Title	Course Category	Hrs per week	Credits	Marks ratio	
						Intl	Extl
1		English 2	Common Course	5	4	1	4
2		Second Language -2	Common Course	5	4	1	4
3	ZY2CRT02	Animal Diversity- Non Chordata	Core Course II : Theory	2	2	1	4
4	ZY2CRP01	Animal Diversity – Non Chordata	Core Course II : Practical	2	2	1	4
5		Capture Fishery (A) /Microbial physiology & Genetics(F)/Parasitology (M)	Vocational Course III : Theory	2	2	1	4
6		Biology of Fishes (A) / Applied Microbiology (F)/Medical virology(M)	Vocational Course III : Theory	2	2	1	4
7		Capture Fishery &Biology of Fishes(A)/Microbial physiology &Applied Microbiology(F)/Parasitology&MedicalVirology (M)	Vocational Course IV : Practical	2	2	1	4
8		Complementary Course – II	Complementary Course: Theory	3	2		
9		Practical	Practical	2	2		

Total	**25 hrs**	**22**	

SEMESTER III

No	Course Code	Course Title	Course Category	Hrs per week	Credits	Marks ratio	
						Intl	Extl
1		English 3	Common Course	5	4	1	4
2	ZY3CRT03	Animal Diversity – Chordata	Core Course III : Theory	3	3	1	4
3		Animal Diversity- Chordata	Core Course III : Practical	2	0	0	0
4		Fisheries Environment (A) / Dairy Microbiology (F) / Medical mycology(M)	Vocational Course V : Theory	2	2	1	4
5		Fisheries Environment (A) / Dairy Microbiology (F) / Medical mycology(M)	Vocational Course : Practical	3	0	0	0
6		Fish nutrition (A) / Industrial Microbiology (F)/ Diagnostic Microbiology (M)	Vocational Course VI : Theory	2	2	1	4
7		Fish nutrition (A) / Industrial Microbiology (F)/Diagnostic Microbiology	Vocational Course : Practical	3	0	0	0
8		Complementary Course – III	Complementary Course: Theory	3	3	1	4
9		Practical	Practical	2	0	0	0
Total				**25 hrs**	**14**		

SEMESTER IV

No	Course Code	Course Title	Course Category	Hrs per week	Credits	Marks ratio	
						Intl	Extl
1		English - 4	Common Course	5	4	1	4
2	ZY4CRT04	Research methodology, Biophysics & Biostatistics	Core Course IV : Theory	3	3	1	4
3	ZY4CRP02	Research methodology, Biophysics & Biostatistics	Core Course IV : Practical	2	2	1	4
4		Reproductive Physiology and Endocrinology (A)/ Medical Bacteriology (M) / Basic Food Microbiology (F)	Vocational Course VII : Theory	2	2	1	4
5		Reproductive Physiology and Endocrinology (A)/ Medical Bacteriology (M) / Basic Food Microbiology (F)	Vocational Course : Practical	3	4	1	4
6		Microbiology , Pathology and Post Harvest Technology (A)/ Clinical Microbiology (M) / Food Microbiology and Fermented Food (F)	Vocational Course VIII : Theory	2	2	1	4
7		Microbiology , Pathology and Post Harvest Technology (A)/ Clinical Microbiology (M) / Food Microbiology and Fermented Food (F)	Vocational Course : Practical	3	4	1	4
8		Complementary Course – IV	Complementary Course: Theory	3	3	1	4
9		Practical	Practical	2	2	1	4
Total				**25 hrs**	**26**		

SEMESTER V

No	Course Code	Course Title	Course Category	Hrs per week	Credits	Marks ratio	
						Intl	Extl
1	ZY5CRT05	Environmental Biology & Human rights	Core Course V : Theory	3	3	1	4
2	ZY5CRPO5	Environmental Biology & Human rights	Core Course V : Practical	2	0	0	0
3	ZY5CRT06	Cell Biology & Genetics	Core Course VI : Theory	3	3	1	4
4	ZY5CRPO6	Cell Biology & Genetics	Core Course VI : Practical	2	0	0	0
5	ZY5CRT07	Evolution, Ethology & Zoogeography	Core Course VII : Theory	3	3	1	4
6	ZY5CRPO7	Evolution, Ethology & Zoogeography	Core Course VII : Practical	2	0	0	0
7	ZY5CRT08	Human Physiology, Biochemistry & Endocrinology	Core Course VIII : Theory	3	3	1	4
8	ZY5CRPO8	Human Physiology, Biochemistry & Endocrinology	Core Course VIII : Practical	2	0	0	0
9	ZY5OPT01	1 – Vocational Zoology (Apiculture, Vermiculture, Ornamental fish culture)	Open Courses for other streams *(Select any one out of three)*	4	3	1	4
	ZY5OPT02	2 – Public health and Nutrition					
	ZY5OPT03	3 – Man, nature & Sustainable Development					
10		Group activity and Field Study - Report to be submitted in 6th Semester along with Project and Practical Exam		1	0		
Total				**25 hrs**	**15**		

Semester VI

No.	Course Code	Course Title	Course Category	Hrs per week	Credits	Marks ratio	
						Intl	Extl
1	ZY6CRT09	Developmental Biology	Core Course IX : Theory	3	3	1	4
2	ZY6CRP09	Developmental Biology	Core Course IX : Practical	2	2	1	4
3	ZY6CRT10	Microbiology & Immunology	Core Course X : Theory	3	3	1	4
4	ZY6CRP10	Microbiology & Immunology	Core Course X : Practical	2	2	1	4
5	ZY6CRT11	Biotechnology, Bioinformatics and Molecular Biology	Core Course XI : Theory	3	3	1	4
6	ZY6CRP11	Biotechnology, Bioinformatics and Molecular Biology	Core Course XI : Practical	2	2	1	4
7	ZY6CRT12	Occupational Zoology (Aquaculture, Apiculture, Vermiculture & Quail farming)	Core Course XII : Theory	3	3	1	4
8	ZY6CRP12	Occupational Zoology (Aquaculture, Apiculture, Vermiculture & Quail farming)	Core Course XII : Practical	2	2	1	4
9	ZY6CBT01	Elective 1: Ecotourism & Sustainable Development	Choice Based Core Elective Courses *(Select any one out of four)*	4	3	1	4
	ZY6CBT02	Elective 2: Agricultural pest management					
	ZY6CBT03	Elective 3: Vector & Vector borne Diseases					
	ZY6CBT04	Elective 4: Nutrition, Health & life style management					
10	ZY6CRPRP	Project Work	Project	1	2		
11		OJT (On Job Training for 14 days)	OJT		2		
Total				**25 hrs**	**27**		

Model II Programmes in Zoology and Core Courses

Instructional Hours, Credit, Total Instructional Hours, University Examination, Weightage Internal and External Evaluation of Core Courses will follow the same pattern as in Model 1 Zoology Programme.

For Vocational Courses also University Examination will be conducted at the end of each Semester for Theory and at the end of even semester for Practical. Duration of examination is 3 hrs and Internal-External marks ratio is 1:4.

The main objective of 'on the job training' is to acquaint the students formally to a real life work place environment. This will help to explore the relationship between knowledge and skill acquired in the college with those required in the working situations. Students are expected to do the OJT in their respective vocational subject related field.

C. SCHEME OF EXAMINATION - VOCATIONAL SUBJECTS

Semester	Course	Weightage ratio			
		Theory		Pract.	
		Ext.	Int.	Ext.	Int.
1	1	4	1	4	1
1	2	4	1		
2	3	4	1		
2	4	4	1		
3	5	4	1	4	1
3	6	4	1		
4	7	4	1	4	1
4	8	4	1		

i. SCHEME OF EXAMINATION - THEORY
(VOCATIONAL SUBJECT – AQUACULTURE)

Semester	Code	Course No.	Course	Hrs	Internal External ratio	
					Internal	External
1	ZA1VOT01	1	Principles and Methods in Aquaculture	3	1	4
1	ZA1VOT02	2	Hatchery and Culture Techniques	3	1	4
2	ZA2VOT03	3	Capture Fishery	3	1	4
2	ZA2VOT04	4	Biology of Fishes	3	1	4
3	ZA3VOT05	5	Fisheries Environment	3	1	4
3	ZA3VOT06	6	Fish Nutrition	3	1	4
4	ZA4VOT07	7	Reproductive Physiology and Endocrinology	3	1	4
4	ZA4VOT08	8	Microbiology, Pathology and Post Harvest Technology.	3	1	4

SCHEME OF PRACTCAL

EXAMINATION (AQUACULTURE)

Practical Exams at the end of 2nd& 4th semesters

Semester	Code	Course	Exam duration	Internal External ratio	
				Internal	External
2	ZA2VOP01	**Practical 1 & 2** Principles and Methods in Aquaculture, Hatchery and Culture Techniques & Capture Fishery and Biology of Fishes	3 hrs	1	4
4	ZA4VOP02	**Practical 3 & 4** Fisheries Environment & Fish nutrition.	3 hrs	1	4
	ZA4VOP03	**Practical 5 & 6** Reproductive physiology, Endocrinology& Microbiology, Pathology and Post Harvest	3 hrs	1	4

		Technology			

ii. SCHEME OF EXAMINATION - THEORY (VOCATIONAL SUBJECT – FOOD MICROBIOLOGY)

Semester	Code	Course No.	Course	Hrs	Internal External ratio	
					Internal	External
1	ZF1VOT01	1	General Microbiology	3	1	4
1	ZF1VOT02	2	Biological Techniques	3	1	4
2	ZF2VOT03	3	Microbial Physiology & Genetics	3	1	4
2	ZF2VOT04	4	Applied Microbiology	3	1	4
3	ZF3VOT05	5	Dairy Microbiology	3	1	4
3	ZF3VOT06	6	Industrial Microbiology	3	1	4
4	ZF4VOT07	7	Basic Food Microbiology	3	1	4
4	ZF4VOT08	8	Food Microbiology and Fermented Food	3	1	4

SCHEME OF PRACTICAL EXAMINATION (FOOD MICROBIOLOGY)

Practical Exams at the end of 2nd& 4th semesters

Semester	Code	Course	Exam duration	Internal External ratio	
				Internal	External
2	ZF2VOP01	**Practical 1 & 2** General Microbiology & Biological Techniques,Microbial Physiology, Genetics & Applied Microbiology	3 hrs	1	4

4	ZF4VOP02	**Practical 3 & 4** Dairy Microbiology & Industrial microbiology	3 hrs	1	4
	ZF4VOP03	**Practical 5 & 6** Basic Food Microbiology, Food Microbiology and Fermented Food	3 hrs	1	4

iii. SCHEME OF EXAMINATION - THEORY (VOCATIONAL SUBJECT – MEDICAL MICROBIOLOGY)

Sem.	Code	Course No.	Course	Hrs	Internal External ratio	
					Internal	**External**
1	ZF1VOT01	1	Fundamentals of Microbiology	3	1	4
1	ZF1VOT02	2	Basics of Microbial Physiology & Genetics	3	1	4
2	ZF2VOT03	3	Parasitology	3	1	4
2	ZF2VOT04	4	Medical Virology	3	1	4
3	ZM3VOT05	5	Medical Mycology	3	1	4
3	ZM3VOT06	6	Diagnostic Microbiology	3	1	4
4	ZM4VOT07	7	Medical Bacteriology	3	1	4
4	ZM4VOT08	8	Clinical Microbiology	3	1	4

SCHEME OF PRACTICAL EXAMINATION (MEDICAL MICROBIOLOGY)

Practical Exams at the end of 2nd& 4th semesters

Sem.	Code	Course	Exam duration	Internal External ratio	
				Internal	**External**

2	ZF2VOP01	**Practical 1 & 2** Fundamentals of Microbiology, Basics of Microbial Physiology & Genetics, Parasitology & Medical virology	3 hrs	1	4
4	ZM4VOP02	**Practical 3 & 4** Medical Mycology & Diagnostic Microbiology	3 hrs	1	4
	ZM4VOP03	**Practical 5 & 6** Medical Bacteriology and Clinical Microbiology	3 hrs	1	4

d. SCHEME OF DISTRIBUTION OF HOURS AND CREDITS
(VOCATIONAL SUBJECT – AQUACULTURE)

Semester	Code	Course No.	Title of vocational course	Hrs	Inst. Hrs/Wk	Credit
1	ZA1VOT01	1	Principles and Methods in Aquaculture	36	2	2
1	ZA1VOT02	2	Hatchery and Culture Techniques	36	2	2
1		Practical -1	Principles and Methods in Aquaculture, Hatchery and Culture Techniques.	36	2	0
2	ZA2VOT03	3	Capture Fishery	36	2	2
2	ZA2VOT04	4	Biology of Fishes	36	2	2
2	ZA2VOP01	Practical - 2	Capture Fishery and Biology of Fishes	36	2	2
3	ZA3VOT05	5	Fisheries Environment	36	2	2
3		Practical - 3	Fisheries Environment	54	3	0
3	ZA3VOT06	6	Fish Nutrition	36	2	2
3		Practical - 4	Fish Nutrition	54	3	0
4	ZA4VOT07	7	Reproductive Physiology and Endocrinology	36	2	2
4	ZA4VOP02	Practical – 5	Reproductive Physiology and Endocrinology	54	3	4
4	ZA4VOT08	8	Microbiology, Pathology and Post Harvest Technology.	36	2	2
4	ZA4VOP03	Practical - 6	Microbiology, Pathology and Post Harvest Technology	54	3	4
			TOTAL		**32**	**26**

SCHEME OF DISTRIBUTION OF HOURS AND CREDIT
(VOCATIONAL SUBJECT –
FOOD MICROBIOLOGY)

Semester	Code	Course No.	Title of vocational course	Hrs	Inst. Hrs/Wk	Credit
1	ZF1VOT01	1	General Microbiology	36	2	2
1	ZF1VOT02	2	Biological Techniques	36	2	2
1		Practical -1	General Microbiology & Biological Techniques	36	2	0
2	ZF2VOT03	3	Microbial Physiology & Genetics	36	2	2
2	ZF2VOT04	4	Applied Microbiology	36	2	2
2	ZF2VOP01	Practical - 2	Microbial physiology, Genetics & Applied Microbiology	36	2	2
3	ZF3VOT05	5	Dairy Microbiology	36	2	2
3		Practical - 3	Dairy Microbiology	54	3	0
3	ZF3VOT06	6	Industrial Microbiology	36	2	2
3		Practical - 4	Industrial Microbiology	54	3	0
4	ZF4VOT07	7	Basic Food Microbiology	36	2	2
4	ZF4VOP02	Practical – 5	Basic Food Microbiology	54	3	4
4	ZF4VOT08	8	Food Microbiology and Fermented Food	36	2	2
4	ZF4VOP03	Practical - 6	Food Microbiology and Fermented Food	54	3	4
			TOTAL		**32**	**26**

SCHEME OF DISTRIBUTION OF HOURS AND CREDIT
(VOCATIONAL SUBJECT – MEDICAL MICROBIOLOGY)

Semester	Code	Course No.	Title of vocational course	Hrs	Inst. Hrs/Wk	Credit
1	ZF1VOT01	1	Fundamentals of Microbiology	36	2	2
1	ZF1VOT02	2	Basics of Microbial Physiology & Genetics	36	2	2
1		Practical -1	Fundamentals of Microbiology, Basics of Microbial Physiology & Genetics	36	2	0
2	ZF2VOT03	3	Parasitology	36	2	2
2	ZF2VOT04	4	Medical Virology	36	2	2
2	ZF2VOP01	Practical - 2	Parasitology &Medical Virology	36	2	2
3	ZM3VOT05	5	Medical Mycology	36	2	2
3		Practical - 3	Medical Mycology	54	3	0
3	ZM3VOT06	6	Diagnostic Microbiology	36	2	2
3		Practical - 4	Diagnostic Microbiology	54	3	0
4	ZM4VOT07	7	Medical Bacteriology	36	2	2
4	ZM4VOP02	Practical – 5	Medical Bacteriology	54	3	4
4	ZM4VOT08	8	Clinical Microbiology	36	2	2
4	ZM4VOP03	Practical - 6	Clinical Microbiology	54	3	4
			TOTAL		**32**	**26**

e. SYLLABUS (VOCATIONAL SUBJECTS)

– MODEL II

THEORY & PRACTICAL

1. AQUACULTURE

SEMESTER 1

VOCATIONAL COURSE 1

PRINCIPLES AND METHODS IN AQUACULTURE

36 Hrs
Credits 2

Objectives:

1. To make the student understand the basic concepts of the science and practice of aquaculture.
2. To introduce the student to the diverse practices of culturing of aquatic organisms.
3. The encourage the student to take up aquaculture practices as a vocation.

Module 1 **4 Hrs**

Scope and importance of Aquaculture. Significance of aquaculture compared to other agricultural systems and commercial fisheries. Types of aquaculture – Freshwater, Brackish water and Mariculture. Shell fish culture, Finfish culture, Monoculture, Polyculture.

Module 2 **3 Hrs**

Integrated farming – The concept of recycling of organic waste for maximum production. Rice cum fish culture. Culture practices of duck cum fish, poultry cum fish and pig cum fish culture. Sewage fed Fish Culture.

Module 3 **7 Hrs**

Site selection parameters for a pond site. Soil quality parameters –physical, soil type, porosity, percolation, shear strength, rate of compassion etc. Chemical –salinity, pH, nutrients, toxic gases etc. Water quality parameters-Chemical- salinity, pH, dissolved oxygen, Carbon dioxide, Nutrients, Ammonia. Physical – Temperature, suspended solids, . Biological parameters-presence of juveniles/seedlings, predators/ competitors, plankton, nekton .

Module 4 **10 Hrs**

Pond construction – Selection of site. Preparation of bunds and dykes. Calculation of earth works, sluice gates- Different types and fixing of sluice gates.**Pond preparation**-Drying, elimination of pests and predators. Preparation of nursery and stocking ponds.Manuring, Production of plankton. Stocking and acclimatization. Use of hapa. Stocking density. Harvesting and Harvesting methods

Module 5 **10 Hrs**

Fresh water cultivable fishes and their external characters-Indian Major Carps, Catfish, Eel, Tilapia, Etroplus, Trouts, Mahseer, Channa, Clarius, Anabas, Larvivorous and Weed fishes. Cultivable species of crustaceans and mulluscs: Identification and external characters. Shrimp, freshwater prawn, crab, lobster, pearl oyster, edible oyster, mussel and clams.

Module 6 **2 Hrs**

Brackish water aquaculture-Introduction, the tidal range, salinity and biota.

Major reservoirs of India and their fishery- Constarints in reservoir fisheries.

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SEMESTER I

VOCATIONAL COURSE 2

HATCHERY AND CULTURE TECHNIQUES

36 hrs
Credits 2

Objectives

1. Introduce the student to the culture practices of various indigenous edible and ornamental finfishes and edible shellfishes.
2. To create an understanding of the different technologies of seed production of common cultivable species
3. Introduce the student to various live feeds available for aquatic organisms and understand their culture methods.

Module 1 **6 Hrs**

Hatchery systems – Different types- fin fish (Carp), Mollusc (Edible oyster)- Seed collection, Spat collectors. Crustacean (Penaeid prawn)- Different Components and operation, Description of Larval stages.

Module 2 **8 Hrs**

Culture Practices of major groups of finfishes. Indian Major Carps- Nursery, Rearing and stocking ponds. Preparation of ponds. Stocking and post stocking management. Harvesting.

Culture of air breathing fishes(eg. Channa) .

Culture of Tilapia and Milk Fish, (Mention lablab and its preparation) production of Monosex in Tilapia.

Culture of Trouts.

Module 3 **8 Hrs**

Culture of Crustaceans - Penaeid prawns- Seed resources, prawn filtration practices, (Pokkali, Bheries Ghazan lands) ,extensive, semi intensive and intensive, prawn farming.

Crab culture- Crab fattening and growout.

Module 4 **8 Hrs**

Culture of Bivalve mollusks.- Mussels, Pearl oysters, Edible oysters, Clams. On Bottom and Off bottom culture methods- Stake culture (Bouchot culture), Rack culture (Rack and ren, Rack and tray), Long Line culture and Raft culture.

Module 5 **6 Hrs**

Culture of ornamental fishes- Types of Aquaria, Aquarium accessories. Setting up and maintenance of Aquaria. Filtration of Aquarium water- Mechanical, Chemical and Biological filtration. Breeding techniques of Aquarium fishes;- gold fish (Egg scatterer) and Fighter fish (Bubble nest builder)

Culture of sea weeds and holothurians.

Culture of live feeds- micro algae, artemia, rotifer, daphnia.

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CMFRI Special Publication: No. 23., 41 pp.1985.

2. Hatchery Manual for The Common, Chinese and Indian major carps
Jhingran .V.G. and R.S.V. Pulin, ICLARM publication.

3. Handbook of Fisheries and Aquaculture
Indian Council of Agricultural Research.

4. Hatchery techniques and culture of the Sea cucumber *Holothuria scabra*

5. Hand book on Indian sea cucumbers.

6. CMFRI Spl Publn: No. 59, 48 pp, 1994Manual of Freshwater Aquaculture
R.Santhanam,N.Sukumaran& P. Natarajan, (1990)
Oxford &IBH Publishing Co. Pvt. Ltd. 193 pages.

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Editors : James Lester and Arlo .W. Fast.

8. MPEDA - A Manual on Shrimp Farming

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10. MPEDA- Hand book on Aquafarming- Shrimp Hatchery.

11. Matsya Alankar ’99 Souvenier .Department of Fisheries,Government of Kerala &Matsyafed.

12. MPEDA Handbook on Aquafarming Live Feed .

13. Oyster culture: Status and Prospects
CMFRI. Bulletin No: 38, 1987

14. Seaweed resources of India
CMFRI Bulletin, No. 41, 1987

SEMESTER II

VOCATIONAL COURSE 3

CAPTURE FISHERY

36 hrs
Credits 2

Objectives:

1. Introduce the student to the fishery potential of Indian waters- marine and inland.
2. To study the major groups of finfishes and shellfishes contributing to the commercial fishery .
3. Introduction to fishing gears and diverse fish catching methods of tropical waters.
4. To develop the concept of fishery as a renewable resource to be managed and study of population dynamics and different management techniques in commercial fisheries.

Module 1 **8 Hrs**

Commercially important orders, families, genera and species of elasmobranches and teleost of the Indian region and their identification. Identification of commercially important species of prawn, crab, lobster, bivalve, gastropod and cephalopods.

Module 2 **8 Hrs**

Craft and gear-Types of fishing craft in India –Traditional, Motorised and Mechanized. Classification of fishing gear. Fishing gear material- Synthetic and natural. Properties of fishing gear, floats, sinkers and accessories. Major fishing gears and their operation. Static gear –Gill nets, Long line and Fish traps. Mobile gear-Drag nets-Trawl nets. Seine nets-Purse seine,Shore seines.

Module 3 **6 Hrs**

Inland capture fishery resources of India – Riverine fisheries,,Cold water fisheries resources, Lacustrine fisheries (Estuarine or brackish water fisheries and fisheries of fresh water lakes)- Important species and gears.

Module 4 **8 Hrs**

Marine Fishery Resources of India- Pelagic fishery- Fisheries of oil sardine, lesser sardine, anchovies, mackerel, ribbon fishes. Demersal fisheries. Fisheries of elasmobranchs, Bombay duck, cat fishes, silver bellies, sciaenids, pomfrets, threadfins, threadfin breams and other perches, Flatfishes, Prawns, Lobsters, Crabs, Mussels, Oysters and Clams – Fishing seasons, abundance and major gears for each group.

Module 5 **6 Hrs**

Fishery management- Concept of population, Yield and Recruitment. Factors affecting fish stocks. Population dynamics. Problems of over fishing- Growth overfishing and Recruitment overfishing.Fishery. Management practices- Input and output controls. Maximum Sustainable Yield.

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21. Von Brandt. Fishing gears of the world

22. Website: www.fishbase.org

SEMESTER II

VOCATIONAL COURSE 4

BIOLOGY OF FISHES

36 hrs
Credits 2

Objectives:

1. To create an understanding about the morphological and anatomical organization of finfishes and shellfishes.

2. Introduce the student to the basic principles of Taxonomy of cultivable organisms.

3. To have an awareness of the fundamental biological aspects of food and feeding, age and growth and reproductive biology.

Module 1 **4 Hrs**

Need for taxonomy, binomial nomenclature, Data requirements for classification of fishes, Methods for collection of taxonomic data- Morphologic and Meristic data., Study of external morphology of a typical elasmobranch and a typical teleost, Variations in form and structures used in taxonomic studies.

Module 2 **12 Hrs**

Internal anatomy of fish- Alimentary canal and associated structures. Gills, Swim bladder, Accessory respiratory organs, Heart and circulatory system, skeletal system (Visceral arches, Vertebral column and skeleton of fins only) Nervous and lateral line system, sense organs (eye, ear, olfactory organs)

Module 3 **6 Hrs**

Excretion, osmotic and ionic regulation in marine and freshwater fishes. Swimming activity. Types of locomotion- Anguilliform, Carangiform and Ostraciform. Muscles in locomotion. Parental care, Social behaviour- Aggregation and shoaling. Migration of fishes.

Module 4 **6 Hrs**

Natural food of fishes. Feeding habits and types of feeding in fishes- Carnivorous, Herbivorous and Omnivorous, Predators, Grazers, Suckers, Strainers and parasites.. Feeding habits and method of feeding in prawn, bivalve and cephalopod.

Module 5 **8 Hrs**

Growth of fishes- Absolute and relative growth, isometric growth and allometric growth. The cube law. Methods for determination of growth checks. Length frequency analysis. Analysis of growth using hard parts like scales, otoloiths and vertebrae. Estimation of growth by direct methods. Marking and tagging of fish for growth studies. Methods of studying reproduction- Maturity Stages, Gonadosomatic Index, Ova Diameter Frequency studies. Detemination of size at first maturity and spawning season, Fecundity and its determination.

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SEMESTER III

VOCATIONAL COURSE 5

FISHERIES ENVIRONMENT

36 hrs
Credits 2

Objectives

1. To study the environment and their effect on fish populations.

2. Study the use of Remote sensing techniques for the assess fish stocks

3. Introduction to the ancillary marine resources like seaweeds, echinoderms and corals.

4. To understand the different techniques and equipments for the study of environmental parameters and different fish finding devices.

Module 1 **5 Hrs**

Habitat Ecology. Freshwater Habitat- Lentic (Pond, Lake), Lotic (Riffles, Pools). Marine Habitat- Zonation, Biota and adaptations. Principles of limiting factors- Shelford's law of tolerance, Liebig's law of minimum, Combined concept. Ecological succession and Ecological indicators. Photosynthetic and saprophytic food chain.

Module 2

10 Hrs

Basic marine metereology- weather, air-sea interactions. Monsoons, seasonal changes, Circulation of water masses, Waves, Tides and sediment transportation.

Module 3 **7 Hrs**

Physical and chemical parameters of Aquatic environments- temperature, salinity, oxygen, nutrition, Microelements and Macroelements. Phytoplankton and primary production- Methods of Estimation (Dark and Light bottle method, C14 Method, Chlorophyll Technique). Estimation of Zooplankton and secondary production.

Module 4

4 Hrs

Ecology of estuaries and mangroves- Soil , Water and Biota. Biogeochemical cycles- Nitrogen, Phosphorus and Sulphur cycle.

Module 5

10 Hrs

Ancillary marine resources-Sea weeds, corals, Echinoderms and their commercial importance. Aquatic pollution- Causes and Remedial Measures. Instruments used for Biological sampling- Plankton International Indian Ocean Expedition Net, Hardy's continuous plankton recorder), Nekton (Isaac Kidd's Midwater trawl), Benthos (Dredges, Grabs, Agassiz trawl). Fish finding devices- Echo sounder, Sonar and net sonde . Remote sensing techniques and application.. Satellite remote sensing of fish stocks- Ocean colour maps, Sea surface Temperature Contour Maps. Potential Fishing Zone (PFZ). Deep Scattering or Sonic Scattering Layer.

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SEMESTER III

VOCATIONAL COURSE 6

FISH NUTRITION

36 hrs
Credits 2

Objectives:

1. To create an understanding on the nutritional needs of aquatic organisms in culture.

2. To make the student have a basic concept of energy budgeting, food additives and varieties of feed ingredients used in Aquafeeds.

3. To have a basic understanding of the principles of feed formulation and equipments used in feed manufacture.

Module 1 **5 Hrs**

Digestive system of fish, Digestive Glands and their secretions. Digestive physiology of fish- Digestion of Carbohydrates, Proteins and Fats. Proteins, carbohydrates, fats, vitamins and minerals in fish nutrition- Classification, Structure and functions.

Module 2 **8 Hrs**

Nutritional Bioenergetics- Gross energy, Digestible energy (Digestibility co-efficient and measurement of digestible energy), Metabolisable energy,Heat increment (Specific Dynamic action) Net energy, Retained energy, Protein utilization. (Protein Efficiency Ratio, Protein

conversion ratio, Productive protein value) .Proximate Analysis- Moisture, Crude protein, Crude Lipid, Crude Fibre, Ash and , Nitrogen free extract- Methods of analysis of each component.

Module 3 **8 Hrs**

Factors affecting digestibility, Nitrogen balance index, Food additives- Binders, Antioxidants, Chemo-attractants and feeding stimulants, Pigments, Antimicrobial agents and Anabolic agents. Non conventional feed stuffs. Food growth equation. Feed ingredients of plant and animal origin.

Module 4 **5 Hrs**

Feed preparation techniques. Factors affecting the energy requirement of fish. Non nutrient constituents of the diet. Measurement of calorific value- Component Analysis, Wet oxidation, Bomb Calorimetry. Types of feeds (Wet, Moist and Dry feeds-advantages and disadvantages) Larval feeds- Minced diets, Microparticulate diets, Spray dried diets,Microbound diets, Microcoated diets and Microencapsulated diets.

Module 5 **10 Hrs**

Growth promoters. Principles of feed formulation (Pearson's Square and Linear programming). Different systems of fish feeding or Fish feeding devices. Equipments used in Feed mills- Weighing Scales, Grinders, Mincers, Mixers, Elevators, Extruders, Coolers/Dryers, Fat sprayer, Crumbler, Sifter and Bag seamer. Food Conversion Ratio and Food efficiency ratio. Economics of feed preparation.

References

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SEMESTER IV

VOCATIONAL COURSE 7

REPRODUCTIVE PHYSIOLOGY AND ENDOCRINOLOGY

36 hrs
Credits 2

Objectives:

1. To have an understanding of the variety of reproductive techniques in finfishes and shellfishes and the factors controlling reproduction.

2. To study the endocrine and neurosecretory system of finfishes and shellfishes.

3. To understand the principles and techniques of induced breeding, and cryopreservation of fish gametes.

Module 1 **6 Hrs**

Reproductive systems and Sexual dimorphism in fish, crab and prawn. Types of reproduction- Viviparity, ovoviviparity, oviparity in Teleosts and Elasmobranchs. Classification of maturity stages of ovary and testes in fishes and prawns. Oogenesis and spermatogenesis in fishes. Hermaphroditism- different types. Sex reversal and sex determination in fishes.

Module 2 **6 Hrs**

Organisation, structure and Functions of Neurosecretory and endocrine systems in fin fishes. Pituitary, Thyroid, Chromaffin tissue,Interrenal tissue, Pancreatic islets,Corpuscles of Stannius, Ultimobranchial Glands, Gonads, Gastro-intestinal Hormones, Pineal organ, Caudal neurosecretory system or Urophysis. Neuroendocrine control of reproduction. Role of Hypothalamus - Pituitary – Gonadal axis in control of maturationin fishes. Gonadotropin releasing hormones, gonadotropins and sex steroids.

Module 3 **6 Hrs**

Neuroendocrine systems in crustaceans and control of reproduction. Sinus gland complex and X- organs. Pericardial and Post-commisural organs. True Endocrine organs-Y- organs, androgenic gland and Mandibular organs. Hormones produced by the neuroendocrine and true endocrine glands and their role in the control of reproduction and moulting in Crustaceans. Parasitic castration.

Module 4 **10 Hrs**

Principles of induced maturation and spawning in fishes and crustaceans. Levels of control in induced breeding and maturation in fishes. Environmental control of reproduction in fishes and prawns. Use of hormones and hormone analogues in fishes- Gonadotropin releasing hormones, Gonadotropins and Sex steroids. Methods of hormonal administration. Hypophysation. Linpe Method. Ovaprim. Use of Anaesthetics. Eyestalk ablation- Its principle and application in crustacean hatcheries. Use of hormones for producing monosex population and sex reversal in fishes. Principles and methods ofcryopreservation of gametes.

Module 5 **8 Hrs**

Types of eggs in fishes – Pelagic, Demersal and according to yolk content. Embryonic development- Cleavage, fate map of Blastula, gastrulation- Invagination, Involution, Delamination, Convergence, Epiboly. Hatching , Post Embryonic development and Larval development.

References

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Chapter 19- Principles of Biological cryopreservation.
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SEMESTER IV

VOCATIONAL COURSE 8

MICROBIOLOGY, PATHOLOGY AND POST HARVEST TECHNOLOGY

36 Hrs
Credits 2

Objectives

1. To have a clear understanding of the bacterial fauna associated with fish sanitation.

2. To have a basic idea of the factors associated with fish spoilage and the variety of fish preservation techniques.

3. To clearly understand the symptoms, diagnostic and remedial measures of fish diseases and have an idea of the Critical Control Points in seafood industry.

Module 1 **8 Hrs**

Bacteriology- Classification of bacteria based on temperature and oxygen requirements, Bacterial growth curve, growth phasesSterilization techniques, preparation of culture media, Estimation of total plate count, Staining techniques (Gram's Staining). Important bacteria of sanitary significance-*Staphylococcus aureus, Vibrio cholerae, salmonella*. Faecal Indicator organisms- *E.coli* and Faecal streptococcus.

Module 2 **8 Hrs**

Biochemical composition of fish- Moisture, Protein, Fats, NPN compounds and Minerals. Spoilage of fish - Post mortem changes and Rigor mortis. Causes of spoilage - Enzymatic, microbial, Biochemical (rancidity). Indices of spoilage - organoleptic, chemical (Total Volatile

Basic Nitrogen, Hypoxanthine content, Peroxide value and microbial (direct count and Total Plate Count).

Module 3 **8 Hrs**

Processing and Preservation of fish – Chilling and Freezing- Slow freezing, and quick freezing-critical temperature. Freezer burn, thawing, drip loss and glazing. Types of Freezers- Plate Freezer, Tunnel (Air Blast) Freezer, Immersion Freezer, Fluidised bed Freezer (IQF), Cryogenic Freezing, Accelerated Freeze drying , Irradiation. Canning- Principle and Procedure. Common defects in canning- Struvite formation, Panelling, Flipper, Springer, Soft swell and Hard swell.

Module 4 **6 Hrs**

Curing- Types of Curing- Simple, Sun drying, dry and wet curing, Monacuring, Pit Curing, Colombo curing, Smoke curing. Special cured products- Masmine and Marinade. Common defects in curing- Dun, Rust, Pink, Maggots. Value added products. Fishery byproducts- Fish oil, Shark liver oil, Chitin, Chitosan, Isinglass, Fish meal , Shark fin rays.

Module 5 **6 Hrs**

Diseases of fin fishes and prawns.-Protozoan, Bacterial, viral, fungal, Crustacean, Leech, Helminth diseases. Symptoms and Remedial measures. Nutritional deficiency diseases - Pin head, Rickets, Soft Shell Syndrome, Lipoid hepatic degeneration, Vitaminosis A. Hazard analysis and critical control points in seafood industry.

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AQUACULTURE PRACTICALS

ZA1V02U (P) PRINCIPLES AND METHODS IN AQUACULTURE, HATCHERY AND CULTURE TECHNIQUES

36 hrs **Credit 1**

1. Identification and major biological characteristics of cultivable organisms
2. Gut content analysis.
3. Study of common weed and predatory fishes in aquaculture ponds
4. Study of aquatic insects and aquatic weeds.
4. Identification of different larval stages and hatchery operations of prawn
6 Setting up and keeping of aquariums
7 Visit to carp and prawn hatcheries.

SEMESTER II

ZA2V04U (P) PRACTICAL – II CAPTURE FISHERY & BIOLOGY OF FISHES

36 Hrs **Credit 1**

1. Identification of commercially important fishes, crustaceans and molluscs.
2. Fish- Study of external morphology and scales..
3. Dissection of Alimentary canal.
4. Dissecting and identification of internal organs of a fish.
5. Prawn- Study of external morphology and nervous system
6. Gill structure- Herbivorous, carnivorous and omnivorous fishes.
7. Gill structure of a prawn - Dissection
8. Molluscs- Study of morphology, and Dissection of Gills of bivalves
9. Visit to marine fish landing centre.

SEMESTER III

ZA3V05U(P) PRACTICAL – III FISHERIES ENVIRONMENT

54 Hrs **Credit 2**

1. Determination of salinity, dissolved oxygen, pH, total alkalinity, hardness, nitrate, nitrite and ammonia and phosphate.
2. Determination of soil pH
3. Study of common marine phytoplankton, zooplankton.
4. Quantitative evaluation of phytoplankton and zooplankton in culture ponds
5. Identification of the common Ancillary Marine Resources – Corals, Sea cucumber and Sea weeds
6. Equipments and Instruments used for the collection of Environmental Data – Plankton samplers and Counters including haemocytometer, Digital pH meter, Salinometer, Spectrophotometer, Colorimeter etc.
7. Study of Ecological sub-divisions of the sea, Principles of Remote sensing and software used (Wikimapia.org)

SEMESTER III

ZA3V06U (P) PRACTICAL – IV FISH NUTRITION

54 Hrs **Credit 2**

1. Comparative study of Digestive system of Herbivorous and Carnivorous fishes
2. Qualitative estimation of proteins, Polysaccharides and lipids
3. Formulation of artificial feed for aquarium fishes and prawns with locally available ingredients.
4. Study of identification feed ingredients of plant origin and animal origin (oil cakes and meals eg: Groundnut oil cake, coconut oil cake, Mustard oil cake, Fish meal, Crustacean meals, Molluscan meals, Blood meal etc)
5. Use of Pearson's square method in balancing feed Ingredients.
6. Study of equipments used in feed preparation (Oven, Pelletiser, Feed Press and Die Plate, Extruders etc.)
7. Study of non-conventional feed stuffs eg. Spirulina etc. and Feed Additives (Binders, Antibiotics etc).

SEMESTER IV

ZA4V07U(P) PRACTICAL – V REPRODUCTIVE PHYSIOLOGY AND ENCOCRINOLOGY

54 Hrs **Credit 2**

1. Dissection of reproductive organs of Teleost fish.
2. Dissection of reproductive organs of Prawn and Crab.
3. Eyestalk ablation technique and electrocautery apparatus(Demonstration)
4. Methods of hormone injection in fish.
5. Observation of larval and embryonic stages in fish egg development.
6. Estimation of maturity stages and fecundity in fish
7. Equipments used in cryopreservation (Cryocan, French straws etc)

SEMESTER IV

ZA4V08U(P) PRACTICAL – VI MICROBIOLOGY , PATHOLOGY AND POST HARVEST TECHNOLOGY

54 Hrs **Credit 2**

1. Sterilisation techniques, preparation of culture media (TGBE and Nutrient Agar Media), nutrient agar slants, staining techniques.(Gram staining)
2. Determination of total plate count
3. Types of bacterial colonies
4. Instruments used in bacteriological Studies (Inoculation chamber, Autoclave, Colony counter etc.)
5. Examination of internal and external organs of diseased fish and shell fishes.
6. Identification of parasites in fishes and shell fishes.
7. Materials used in fish processing and packaging (Cans, Retortable pouches etc.)

ZOOLOGY - MODEL II

VOCATIONAL SUBJECT:
2. FOOD MICROBIOLOGY
SYLLABUS -
THEORY & PRACTICALS

SEMESTER 1

ZF1VOT01 - VOCATIONAL COURSE 1

GENERAL MICROBIOLOGY

36 Hrs

2 Credits

Objectives

1. To introduce students to the fascinating world of microbes
2. To describe the differences in prokaryotic and eukaryotic cell morphology and structure
3. To impart knowledge on major categories of microorganisms and analyze their classification and diversity.

Module I **8 Hrs**

The historical development of microbiology, Prokaryotes and Eukayotes,Principles of microbial taxonomy, Classification of bacteria according to Bergy's manual, classification based on molecular techniques-G+C % and RNA,DNA hybridization.

Module II **10 Hrs**

Morphology and fine structure of bacteria, size, shape and arrangements.Flagella, pili, capsule, cell wall and its composition.Cytoplasmic membrane, protoplasts, spheroplasts, intracellular membrane systems, cytoplasm, vacuoles, nuclear material, bacterial spores, cell inclusions.

Module III **10 Hrs**

Morphology and fine structure of virus, size, shape capsid and capsomeres.Capsid symmetry-helical, icosahedral and complex, Srtucture of TMV.Viral multiplication-lytic and lysogenic cycle.

Module IV **5 Hrs**

General characters, Morphology and fine structure of of fungi.

Module IV **3 Hrs**

General characters of algae and protozoa

References

1. Alcamo Fundamentals of microbiology, 5th Edition,.
2. Ananthanarayan&Paniker.Text book of Microbiology, 7th Edition, Orient Longman.
3. David Freifelder, Molecular biology, Narosa Publishing House
4. Jacquelyn G. Black, Microbiology: Principles and Explorations, 9th Edition, Willey Publication
5. M.J. Pelczar, E.C.S Chan & N.R. Kreig, Microbiology, 5th Edition, Tata McGraw Hill Edition.
6. Michael T. Madigan, Brock Biology of Microorganisms,13th Edition, Amazon Publication
7. R.P. Singh, Microbiology, 1st Edition, Kalyani Publishers.
8. GeraldJ.Tortora,Berdell.R.Funke,ChristineL.case,Microbiology–An Introduction.Pearson Publication.

SEMESTER 1

ZF1VOT02 - VOCATIONAL COURSE 2

BIOLOGICAL TECHNIQUES

36 Hrs
2 Credits

Objectives

1. To describe the parts and working principle of instruments used in microbiology
2. To introduce other techniques used in microbiology
3. To learn the applications of the instruments and techniques in the bio-medical field.

Module I **8 Hrs**

Specimen preparation for light microscopy – wet mount preparation, hanging drop method, smear preparation. Bacterial staining -simple staining, Differential staining:- Gram's staining, acid fast staining, Special staining:- capsule staining, spore staining, negative staining – Indian ink staining. Specimen preparation for Electron microscopy.

Module II **8 Hrs**

Microscopy: - light microscopy, bright field, Dark field, phase contrast microscopy, fluorescence, Electron microscopy- SEM, TEM, STEM, Newer techniques in microscopy- confocal, scanning probe microscopy.

Module III **8 Hrs**

Introduction to immunology Techniques - Tests for Antigen Antibody reactions, Immuno diffusion, Radio Immuno Assay, ELISA, Flow cytometer

DNA/RNA Amplification techniques- Polymerase Chain Reaction(PCR) and RT-PCR; principle, procedure and application.

Module IV **6 Hrs**

Control of microorganisms- Sterilization and disinfection - physical (moist and dry heat, by filtration, by irradiation) & chemical methods (alcohols, phenol, detergents, halogens, dyes);

Module V **6 Hrs**

Chemotherapeutic agents-antibacterial-Antibiotic, antiviral-interferon, antifungal. Tests for antibiotics-Kirby bauer and tube dilution.

References

1. Janis Kuby, Immunology
2. Beacker&Deamer, The World of cell,
3. Benson, Microbiological application laboratory manual in general microbiology, 8th Edition, McGraw Hill Publication.
4. Jacquelyn G. Black, Microbiology: Principles and Explorations, 9th Edition, Willey Pub.
5. Joanne M. Willey, Prescott, Harley & Klein's Microbiology, 7th Edition by McGraw & Hill Pub.
6. M.A. Subramanian Biophysics principles and techniques, MJP Publishers
7. P.K. Bajpai, Biological instrumentation and methodology, S. Chand & Company
8. Upadhyay, Upadhyay, Nath, Biophysical Chemistry Principles & techniques, 4th Edition 2007, Himalaya Publishing House.
9. Gerald J.Tortora, Berdell.R. Funke, Christine L.case, Microbiology – An Introduction. Pearson Publication.

COURSE TITLE- GENERAL MICROBIOLOGY& BIOLOGICAL TECHNIQUES PRACTICAL 1

36 hrs **0 Credit**

1. Cleaning and sterilization of glassware
2. Bacterial Staining Method
   a. Simple Staining
   b. Gram's staining

c. Spore staining
d. Negative staining

3. Examination of microbes in Living condition
   a. Wet mount
   b. Hanging drop method
4. Measurement of bacterial growth by optical density method
5. Instrumentation and working principle of
   a. Laminar air flow Bench
   b. Autoclave
   c. Hot air oven
   d. Colony counter
6. Antibiotic sensitivity test

SEMESTER 2

ZF2VOT03 - VOCATIONAL COURSE 3

MICROBIAL PHYSIOLOGY AND GENETICS

36 Hrs
2 Credits

Objectives

1. To understand the fundamentals of Physiology of microorganisms.
2. To define the science of microbiology and describe some of the general methods used in the study and culture of microorganisms
3. To study mutation and genetics in microorganisms.

Module I **8 Hrs**

Microbial Nutrition- Nutritional requirements and nutritional grouping of microbe. Bacterial growth, Bacterial growth curve (Batch), Fed batch, continuous culture of microbes, Influence of environmental factors on microbial growth.

Module II **7 Hrs**

Culture Media & Cultivation of Bacteria (Aerobic & Anaerobic culture methods).

Module III **5 Hrs**

Measurement of microbial size and numbers.

Module IV **8 hrs**

Mutation:- Type of mutation-Point and Frame shift mutation.Chemical and physical mutatgens.

Module V **8 Hrs**

Bacterial Genetics- Plasmids, cosmid, Bacterial recombination- conjugation, transformation and transduction.

References

1. Alcamo Fundamentals of microbiology, 5th Edition,.
2. Ananthanarayan&Paniker.Text book of Microbiology, 7th Edition, Orient Longman.
3. Ronald M. Atlas and Richard Bartha, Microbial ecology, Fundamentals & applications 4th edition, Pearson Publication.
4. GeraldJ.Tortora, Berdell.R.Funke, ChristineL.case, Microbiology – An Introduction. Pearson Publication

SEMESTER 2

ZF2VOT04 - VOCATIONAL COURSE 4

APPLIED MICROBIOLOGY

36 Hrs

2 Credits

Objectives

1. To describe the roles and importance of microbes in various environments
2. To develop an understanding of beneficial activities of microorganisms and the application of this understanding to benefit mankind.
3. To study the various interactions that exists among microbes and also between microbes and plants
4. To describe the roles and importance of microbes in various areas of agriculture

Module I **8 Hrs**

Microbiology of soil- soil profile, microbial flora, factor affecting flora, biogeochemical cycle-carbon and, nitrogen and its importance Microbial interrelationship of microorganisms, mutualism, synergism (protocooperation) commensalisms, Amensalism, Parasitism, and Predation.Interaction of microbes with plants- Microbes with plant roots- Rhizosphere concept, mycorrhizae, ecto, endo, VAM, actinomycorrhizae, phyllosphere concept.

Module II **8 Hrs**

Aquatic microbiology; Microbiology of water, Purification and disinfection of water.Waterborne pathogens, Sewage microorganism, BOD and COD, Sewage (waste water) treatment: primary treatment, secondary treatment (Oxidation Pond Trickling Filter, the Activated sludge, Anaerobic digesters), Tertiary treatment.

Bacteriological examination of drinking water- membrane filtration, MPN, plate count, (pour, spread), ONPG-MUG.

Module III **8 Hrs**

Role of microorganism in agriculture- Biofertilizer Bacterial- biological Nitrogen fixers- Symbiotic and free living nitrogen fixers, phosphate solubilizers, Algal biofertilizers- Azolla.

Module IV **8 Hrs**

Phytopathogens- Causative organism, mode of transmission, symptoms and control measures of Bacterial (soft rot, canker, wilt, crown gall), fungal (Blight, rot, wilt and mildew) and viral (TMV, Bunchy top disease of banana)plant diseases.

Control measures- Biopesticides (Bacterial, viral, fungal).

Module IV **4 Hrs**

Biogas, Role of microbes in biodegradation, bioremediation (natural organic compound, plastics, pesticides and petroleum pollutants).

Role of microbes in bioleaching, biomining.

References

1. B.P.Pandey Plant pathology, S. Chand & Company
2. G. Rangaswami, Agricultural Microbiology, Prentice Hall of India Pvt. Ltd.
3. R. P. Singh, Microbiology, KalyaniPublishers .
4. Joanne M. Willey, Prescott, Harley & Klein's Microbiology, 7th Edition by McGraw & Hill Publisher
5. Joseph C. Daniel, Environmental aspects of Microbiology, Bright Sun publication
6. Pelzar E. C. S. Chan and Noel R. Krieg Microbiology, Fifth edition, Michael.; Tata McGraw-Hill publishing company Ltd.
7. R.C.Dubey and D. K. Maheshwari, A Text book of microbiology, First Edition, S. Chand & company Ltd.

COURSE TITLE - MICROBIAL PHYSIOLOGY &GENETICS AND APPLIED MICROBIOLOGY

PRACTICAL 2

36 hrs **2 Credit**

1. Preparation of Solid and liquid media for microbial cultures.
   a. Liquid media - Peptone water, Nutrient broth
   b. Solid media - Nutrient agar
   c. Semi Solid agar
2. Culture methods
   a. Streak culture
   b. Lawn culture
   c. Stab culture
3. Demonstration of selective and differential media
   a. Mac Conkey agar
   b. Blood agar
4. Isolation and enumeration of bacteria from rhizosphere & non- rhizosphere soil.
5. Standard plate count technique for the isolation and enumeration of microorganisms in water
6. Water quality analysis by MPN method
7. Isolation and identification of Rhizobium from root nodule
8. Basic idea about
   a. Trickling filter
   b. Membrane filter system
   c. Anaerobic sludge digester

SEMESTER 3

ZF3VOT05 - VOCATIONAL COURSE 5

DAIRY MICROBIOLOGY

36 Hrs

2 Credits

Objectives

1. To provide a scientific background to dairy microbiology by re-examining the basic concepts of general food microbiology and the microbiology of raw milk.
2. The role of dairy starter cultures in manufacturing fermented dairy products, developing novel functional dairy products through the incorporation of probiotic strains

Module I **10 Hrs**

Introduction, composition and properties of milk, Nutritional importance of milk. Milk processing sequences. Source of microorganism in milk. Classification of microorganism in milk , biochemical types, temperature characteristics and pathogenicity.

Module II **6 Hrs**

Contamination and spoilage of milk and milk products.

Module III **6 Hrs**

Bacteriological examination of milk. Preservation of milk – Pasteurization (different methods and advantages), sterilization (ultra high temperature processed milk) dehydration.

Module IV **8 Hrs**

Type of milk and milk products: whole milk, low fat milk, toned milk, skim milk, vitamin D milk, low sodium milk, homogenized milk, concentrated milk, sweetened condensed milk evaporated milk, dry milk, low lactose milk. Lactic starter cultures. Probiotic role of lactic acid bacteria. Fermented milk products - curd, cream, butter, butter milk, lassie, Kefir and Kumiss, cheese, yoghurt.

Module IV **6 Hrs**

Milk borne disease, microbial diseases of dairy cattle and its control measures.

References

1. Blank F.C., Hand book of food nutrition
2. Elmer H. Marth ,Marth H. Marth , Elmer H. Marth -Applied Dairy Microbiology, Second Edition.
3. James M. Jay , Modern food microbiology, 4th ed.
4. Rameshwar Singh, S.K.Tomar&GunjanGoel, Applied Dairy and Food Microbiology Robinson -Dairy Microbiology Handbook, Third Edition: The Microbiology Of Milk And Milk Products .
5. Shakuntala N, Manay, M. Shadaksharaswamy, Food facts and Principles 2nd ed. New Age International publishers
6. Shakuntala N, Manay, M. Shadaksharaswamy, Food facts and Principles 2nd ed. New Age International publishers
7. W.C. Frasier &Westhoff, Food Microbiology,
8. Winton and Winton, Milk and Milk Products.

PRACTICAL-3

COURSE TITLE – DAIRY MICROBIOLOGY

54 hrs **0 Credit**

1. Qualitative analysis of milk by standard plate count method .
2. Isolation of coliforms from milk.
3. Detection of number of bacteria in milk by breed count.
4. Quality testing of milk by rezazurin test
5. Methylene blue reduction test for microbial contamination of milk.
6. Determination of phosphatase activity of milk
7. Detection of mastitis through milk test .
8. Isolation of Lactobacilli and Staphylococcus from curd
9. Fermented Dairy products

SEMESTER 3

ZF3VOT06 - VOCATIONAL COURSE 6

INDUSTRIAL MICROBIOLOGY

36 Hrs

2 Credits

Objectives

1. Discuss the genetic manipulation of microorganism to construct strains that better meet the needs of an industrial or biotechnological process
2. Discuss the preservation of microorganisms
3. To study the major products or uses of industrial microbiology and biotechnology

Module I **6 Hrs**

History, development and scope of industrial microbiology, Screening of industrially important microorganisms- Primary and Secondary Screening. Strain Improvement – Mutation, Recombination, and protoplast Fusion.

Module II **8 Hrs**

Differentiate solid state and Basic Design & instrumentation of Fermenter, types of fermentation (solid state & submerged), types of fermenter - airlift fermenter, CSTR, tubular Fermenter, fluidized bed Fermenter.

Module III **8 Hrs**

Development of inoculum for industrial fermentation. Fermentation media, Carbon source, nitrogenous materials and antifoams.

Industrial sterilization- batch and continuous sterilization.

Module IV **6 Hrs**

Primary and secondary metabolites. Preservation of microbes - serial subculture, preservation by overlying culture with mineral oil, lypohilization, storage of microbes at a very low temperature or in liquid nitrogen. Methods for preservation of fungi.

Module V **8 Hrs**

Fermentation process: Surface, Submerged and solid state fermentation .Production of organic acids; acetic acid, citric acid, lactic acid. Production of amino acids: lysine and glutamic acid, production of enzymes: proteases and amylases. Production of antibiotics: Penicillin, Streptomycin, Production of vitamins- Vitamin B12 & riboflavin

References

1. A.H. Patel, Industrial microbiology, Mac Millan India Ltd.
2. K. Sukesh, M.M. Joe&P K Sivakumar- An Introduction to Industrial Microbiology,
3. L.E. Cesida, Industrial Microbiology, New Age International Publishers.
4. Michael J. Waites, Neil L. Morgan, John S. RockeyIndustrial Microbiology: An Introduction
5. Prescott, Harley & Klein Microbiology, 7th edition, Mac Graw Hill International edition.
6. Peter F. Stanbury, Principles of fermentation technology, Elsevier Publicatio

PRACTICAL 4

COURSE TITLE – INDUSTRIAL MICROBIOLOGY

54 hrs **0 Credits**

1. Crowded plate technique for screening microbial antibiotics.
2. Solid state fermentation –Mushroom production
3. Submerged fermentation- Study of alcoholic fermentation of fruit juice by yeast.
4. Immobilization of yeast cells
5. **Preservation techniques:**
   a. Serial sub culturing
   b. Over laying with mineral oil
   c. Lyophilization
   d. Liquid nitrogen storage.
   e. Methods for the storage of Fungi

SEMESTER 4

ZF4VOT07 - VOCATIONAL COURSE 7

BASIC FOOD MICROBIOLOGY

36 Hrs

2 Credits

Objectives

1. To study interaction between micro-organisms and food .
2. To discusses the factors affecting the presence of micro-organisms in foods and their capacity to survive and grow.
3. To study recent developments in procedures used to assay and control the microbiological quality of food.

Module I **8 Hrs**

Food as a substrate for microorganisms. Factors affecting microbial growth in food, extrinsic – Temperature, Relative humidity and concentration of gases and intrinsic - hydrogen ion concentration (pH) , water activity, oxidation reduction potential, nutrient content, inhibitory substances and biological structure.

Module II **7 Hrs**

Microorganisms - important in food microbiology, Bacterial - morphological , cultural and physiological characteristics important in food bacteriology, Important groups of bacteria associated with various foods. Molds and yeast associated with different foods.

Module III **7 Hrs**

Source of contamination of food:-Preharvest - from green plants and fruits, animals, soil, air, sewage, water and Post harvest:-processing equipment, transport, workers, during handling and processing General principles underlying spoilage of food; Chemical changes caused by microorganisms: Causes of spoilage, classification of food by ease of spoilage.

Module IV **7 Hrs**

Principles of food preservation, Asepsis, removal of microorganism, maintenance of anaerobic conditions, preservation by the use of high temperature, low temperature, drying, food additives and irradiation.

Module V **7 Hrs**

Methods for the microbiological examination of foods: indicator organisms, direct examination, culture techniques, Enumeration methods - plate counts, most probable number counts: dye reduction test. Rapid methods for the detection of specific organism and toxins, immunological methods

References

1. George J. Banwart,Basic Food Microbiology
2. James M. Jay, Modern food microbiology, Van Nostand Reinhold Company
3. M.R. Adams, M.O. Moss, Food microbiology, New Age International (P) Ltd. Publishers
4. Prescott, Harleg, Klein, Microbiology, 7th ed. Mac Graw Hill International edition.
5. W.C. Frazier and Westhoff, .Food Microbiology.

COURSE TITLE – BASIC FOOD MICROBIOLOGY

PRACTICAL 5

54 hrs **4 Credits**

I. Isolation and Enumeration of bacteria from spoiled food(vegetables, meat, fish).

II. Biochemical tests used for identification of Bacteria.
   a. IMVIC Test
   b. Sugar Fermentation tests (GLSM)
   c. Urease test
   d. Catalase test
   e. Oxidase test
   f. Litmus milk reaction
   g. TSI test

III. Identification of bacteria from spoiled food samples.

IV. Selective isolation and identification of
   a) Staphylococcus
   b) Salmonella
   c) Vibrio

SEMESTER 4

ZF4VOT08 - VOCATIONAL COURSE 8

FOOD MICROBIOLOGY AND FERMENTED FOODS

36 Hrs

2 Credits

Objectives

1. To study interaction between micro-organisms and food – spoilage.
2. To study Foodborne illness
3. Production of different fermented Foods.

Module 1 **10 Hrs**

Microbiology of cereal grains, flours and bread.Contamination, preservation and spoilage of vegetables and fruits, egg, meats and fish .

Module II **10 Hrs**

Fermented foods: oriental fermented foods-Tempeh,soysause, miso,idli,natto,Minchin and poi.Fermented vegetables - sauerkraut and Kimchi.,Fermented meat and fish.

Microbial role in production of Bread, wine and malt beverages, single cell protein Mushroom production.

Module III **7 Hrs**

Food borne Diseases- Food poisoning, Bacterial food born infections (*Clostridium perfringens, Salmonella, Shigella, Campylobactor, Listeria, Vibrio, E.coli and Streptococcus faecalis)* and intoxication (*Staphylococcus aureus* and *Clostridium botulinm*). Mycotoxins-Aflatoxin, Patulin, Ochratoxin, Luteoskyrin and ATA.

Module IV **5 Hrs**

Food sanitation:-Principles of food sanitation, hygiene and safety. Sanitising equipments, cleaning agents and sanitising chemicals**.**

Module V **4 Hrs**

Hazard Analysis Critical Control Points (HACCP).

References

1. Banwart, Basic Food Microbiology,
2. Khetarpaul, Neelam, Food Microbiology.
3. M.R. Adams, M.O. Moss, Food microbiology, New Age International (P) Ltd.
4. Prescott, Harleg, Klein, Microbiology, 7th ed. Mac Graw Hill International edition.
5. W.C. Frazier and Westhoff, Food Microbiology
6. W.M. Foster, Food Microbiology.

COURSE TITLE – BASIC FOOD MICROBIOLOGY
FOOD MICROBIOLOGY AND FERMENTED FOODS
PRACTICAL 6

54 hrs **4 Credits**

1. Isolation and enumeration of fungi from spoiled food samples (vegetables, meat, fish)
2. Identification of fungi from spoiled food.
3. Lactophenol cotton blue staining of fungi.
4. Slide culture technique for identification of fungi.
5. Effect of incubation temperature on microbial growth.
6. Measurement of TDP
7. Measurement of TDT
8. Estimation of total and volatile acidity in alcoholic beverages.
9. Fermented food products

MODEL II VOCATIONAL COURSE

3. MEDICAL MICROBIOLOGY

SYLLABUS –

THEORY & PRACTICALS

VOCATIONAL SUBJECT: MEDICAL MICROBIOLOGY

VOCATIONAL COURSES

COURSE I : Fundamentals of Microbiology
ZM2V01U

COURSE II : Basics of Microbial Physiology & Genetics
ZM2V02U

Practical I : Fundamentals of Microbiology and Basics of Microbial Physiology & Genetics
ZM2V02U (P)

COURSE III : Parasitology
ZM2V03U
COURSE IV : Medical Virology
ZM2V04U
Practical II : Parasitology & Medical Virology
ZM2V04U (P)

COURSE V : Medical Mycology
ZM3V05U
COURSE VI : Diagnostic Microbiology
ZM3V06U
Practical III : Medical Mycology
ZM3V05U (P)
Practical IV : Diagnostic Microbiology
ZM3V06U (P)

COURSE VII : Medical Bacteriology
ZM4V07U
COURSE VIII : Clinical Microbiology
ZM4V08U
Practical V: Medical Bacteriology
ZM4V07U (P)
Practical VI : Clinical Microbiology
ZM4V08U (P)

SEMESTER I

COURSE I – FUNDAMENTALS OF MICROBIOLOGY

36 Hrs **Credits 2**

Objectives

1. To introduce students to the fascinating world of microbes
2. Give an understanding of the scope of Microbiobiology
3. .To impart knowledge on major categories of microorganisms and understand their classification and appreciate their diversity.
4. To impart an awareness on how microbes can be controlled
5. To describe the parts and working principle of different microscopes and specimen preparation.

Module I **6 Hrs**

Definition of Microbiology, History: Early observation of microorganisms-Leewenhoek and Robert Hook; Spontaneous generation theory and refutation of spontaneous generation theory; Contributions of Robert Koch, Louis Pasteur, Lister, Edward Jenner, Beijernick and Winogradsky, discovery of antibiotics. Scope of microbiology

Module II **10 Hrs**

Microbial systematics –evolution of diverse microbial taxonomy as classification-taxonomic hierarchies- classical approach, numerical taxonomy, molecular based classification (16s rRNA-bacteria , Cytochrome oxidae I gene (COI), mitochondrial gene, ITS- in other protists **in brief**). Phylogenetic groups of bacteria- Archeae, Eukaryae-Bacterial taxonomy and nomenclature-Bergey's Manual

Module III **10 Hrs**

Control of microorganisms- Sterilization and disinfection .Control agents physical (moist and dry heat, by filtration, by irradiation) & chemical methods (alcohols, phenol, detergents, halogens, dyes);.Antibiotics– classification based on mode of action with eg. Instruments used microbial control – autoclave, hot air oven, laminar air flow

Module IV **10 Hrs**

Microscopy: - light microcopy, bright field, Dark field, phase contrast microscopy, fluorescence, Electron microscopy- SEM, TEM, STEM, Newer techniques in microscopy-

confocal, scanning probe microscopy, Specimen preparation for light microscopy – wet mount preparation, hanging drop method, smear preparation. Bacterial staining – types positive and negative staining, simple and differential staining,. Specimen preparation for electron microscopy.

References

Alcamo, Fundamentals of microbiology, 5th Edition,

Ananthanarayan & Panicker. Text book of Microbiology, 7th Edition, Orient Longman.

Jacquelyn G. Black, Microbiology: Principles and Explorations, 9th Edition, Willey Publication

Joanne M. Willey, Prescott, Harley & Klein's Microbiology, 7th Edition by McGraw & Hill Publisher

M.J. Pelczar, E.C.S Chan & N.R. Kreig, Microbiology, 5th Edition, Tata McGraw Hill Edition.

Michael T. Madigan, Brock Biology of Microorganisms, 13th Edition, Amazon Publication

R.P. Singh, Microbiology, 1st Edition, Kalyani Publishers.

SEMESTER I

BASICS OF MICROBIAL PHYSIOLOGY AND GENETICS
36 Hrs

Credits 2

Objectives

1. To describe the differences in procaryotic and eukaryotic cell morphology and structure
2. To give a brief understanding of microbial physiology
3. To describe some of the general methods used in the study and culture of microorganisms
4. To introduce microbial genetics

Module I **10 Hrs**

Morphology and fine structure of bacteria, size, shape and arrangements. Flagella, pili, capsule – Indian ink staining, cell wall and its composition- Gram's staining, acid fast staining,

Cytoplasmic membrane, protoplasts, spheroplasts, intracellular membrane systems, cytoplasm, vacuoles, nuclear material, bacterial spores- spore staining,cell inclusions.

Module II **8 Hrs**

Microbial Nutrition- Classification based on nutritional requirements. Uptake of nutrients- active and passive transport. Bacterial growth, Bacterial growth curve. Batch, Fed batch, continuous culture of microbes, Influence of environmental factors on microbial growth. Instruments involved in growth studies- Instruments- Incubator, colony counter

Measurement of microbial size- micrometry; Measurement of microbial numbers –viable and non viable counts **8 Hrs**.

Module III

Culture Media- definition, types of media- solid semi-solid and liquid media, Basal media, differential, selective, enrichment, enriched and transport media. Cultivation of Bacteria – Aerobic methods- streak plate, lawn culture, pour plate, spread plate,stab , liquid culture

& Anaerobic culture methods-displacement O_2 with other gases, Pyrogallic acid and NaOH (chemical/biological method),anaerobic jar,Gaspak

Module IV **9 Hrs**

Bacterial genetics -Introduction and history-Discovery of DNA as genetic material, DNA double helix-structure; Extrachromosomal genetic element- Plasmids-episome, compatible and incompatible, F factor, R plasmids (resistance transfer factor), Col plasmids. Reasons for variation- Bacterial recombination- conjugation (F+ x F- mating), transformation, transduction, transposons; Mutation (in brief) ; Transposable genetic element

References

Benson, Microbiological application laboratory manual in general microbiology, 8th Edition, McGraw Hill Publication.

Joanne M. Willey, Prescott, Harley & Klein's Microbiology, 7th Edition by McGraw & Hill Publisher

Jacquelyn G. Black, Microbiology: Principles and Explorations, 9th Edition, Willey Publication

M.A. Subramanian , Biophysics principles and techniques, MJP Publishers

Microbiology, 5th Edition, M. J. Pelczar, E.C.S Chan & N.R. Kreig, Tata McGraw Hill Edition

David Freifelder, Molecular biology, Narosa Publishing House

Michael T. Madigan, Brock Biology of Microorganisms, 13th Edition, Amazon Publication

SEMESTER I

PRACTICAL I- FUNDAMENTALS OF MICROBIOLOGY & BASICS OF MICROBIAL PHYSIOLOGY & GENETICS

36 Hrs

1. Cleaning and sterilization of glassware, Autoclave, hot air oven, incubator and laminar air flow (3 Hrs)
2. Instrumentation and working principle of
   Laminar air flow Bench, Autoclave, Hot air oven, Colony counter (2 Hrs)
3. Preparation of Solid and liquid media for microbial cultures.
   a. Liquid media (1) peptone water/Glucose broth (2) Nutrient broth (4 Hrs)
   b. Solid media (1) Nutrient agar (2) Mac Conkey's agar (3) Blood agar
   c. Semi Solid agar
4. Culture methods (a) streak culture (b) Lawn culture (c) Stab culture
   (d) Pour & spread plate culture (e) Liquid culture. (7 Hrs)
5. Isolation of pure colonies (a) streak plate method (b) pour plate method c) spread plate method (8 Hrs)
6. Bacterial Staining Method - Simple Staining, Gram's staining (4 Hrs)
7. Examination of microbes in Living condition (4 Hrs)
   (a) wet mount (b) Hanging drop method for demonstrating motility of bacteria
8. Measurement of bacterial growth by optical density method (4 Hrs)

SEMESTER II

COURSE III PARASITOLOGY

36 Hrs **Credits 2**

Objectives

1 To understand the basic science of medial parasitology
2 To define the role of vectors in parasitology
3 To study the morphology, life cycle and pathogenesis of protozoan parasites
4 To study the morphology, life cycle and pathogenesis of protozoan parasites

5 To recognize the general outlines of parasite identification, control and prevention

MODULE I **8 Hrs**

General Introduction to parasitology- Type of parasites, types of host, sources & modes of parasitic infection. Classification of protozoan and helminthes. Collection and preservation of specimens for parasitological examination, transport of specimens, Examination of blood parasites thick and thin smears for malarial, filarial and other parasites

MODULE II **6 Hrs**

Common Vectors in Parasitology

Classification of arthropods of public health importance,

Role of Arthropods in the transmission of disease and their control measures (Mosquito-Aedes, Anopheles, Culex), Ticks, Flea)

MODULE III **10 Hrs**

Morphology, life cycle & pathogenesis (in brief), laboratory diagnosis of Protozoa: *Entamoeba, Trichomonas, , Trypanosoma, Leishmania, Giardia, Plasmodium, Toxoplasma.*

MODULE IV **12 Hrs**

Morphology, life cycle & pathogenesis (in brief), laboratory diagnosis each of the helminthes : a) Platyhelminthes: *Taenia, Echinococcus, Schistosoma, Fasciola*, (b) Nemathelminthes: *Ascaris, Ancylostoma, Trichinella, Enterobius, Trichurias, Wuchereria, Dracunculus*

References

C. H. Parija Text book of medical parasitology

K. P. Srivastava, A Text book of applied entomology, Kalyani Publishers

Panicker's Text book of medical parasitology, 7th edition C.K.Jayaram Panicker, Jaypee brother's medical publishers (p) Ltd.

Park's text book of preventive and social medicine, 22nd edition, Banasirdas Bhanot Publishers

Subash C. Parija Text Book of Medical parasitology All India Publishers & Distributors Publisher

Monica Cheesbrough, Medical Laboratory manual for Tropical Countries Microbiology

Vol.I & II ELEBS.

SEMESTER II

COURSE IV MEDICAL VIROLOGY

36 Hrs **Credits2**

Objectives

1. To develop a basic knowledge of virus morphology, classification and replication
2. To introduce the methods of cultivation of virus
3. To promote understanding of pathogenesis, diagnosis,prevention and control of human viruses

Module I

8 Hrs

Viruses- Introduction. General characteristics of Viruses, Morphology-Size, structure & shape. Chemical properties. Bacteriophage-structure. Classification and nomenclature of viruses. Viroids & Prions. Steps in replication of Viruses. One-step growth curve. Lytic and lysogenic cycle.

Module II **10 Hrs**

Cultivation of Animal Viruses-animal inoculation, embryonated eggs, Tissue culture-organ culture, explants culture and cell culture a) primary cell culture, b) diploid cell culture d)continuous culture. Detection of growth of virus in cell culture-cytopathic effect (CPE),metabolic inhibition, hemadsorption, interference, transformation, immunoflurescence. Viral assay- electron microscopy and hemagglutination, assay of infectivity. Bacteriophage-plaque assay-PFU. Antiviral agents-based on action with examples

Module III **13 Hrs**

Morphology, Pathogenicity, clinical features (in brief), lab diagnosis and treatment of each of these viruses:

Herpes virus (HSV, Varicella Zoster), Orthomyxovirus (influenza), Paramyxoviruses, (mumps, measles) Rubella virus, Hepatitis virus (A, B, C), Rhabdo virus, AIDS virus , Polio virus, Papiloma, Rota viruses, Corona virus-SARS

Module IV **5 Hrs**

Arboviruses. Definition, Pathogenesis- 3 main syndromes: fever with and without rash and arthraglia, encephalitis, hemorrhagic fever (Brief mention of Chikun gunya, dengue, yellow fever, Zika, Ebola).

Oncogenic viruses-Definition and mechanism in brief, Examples of DNA oncogenic virus – Papova, Pox, Herpes and hepatitis B virus, RNA-retovirus (discussed in brief).

References

Ananthanarayan R. and C. K. J. Paniker. Text book of Microbiology, Sixth edition

Gabriel Virella, B.I. Microbiology and Infectious diseases, 3rd ed. Waery Publications

Philip A. Thomas, Clinical Microbiology, Orient Longman Pvt. Ltd.

Practical II PARASITOLOGY AND MEDICAL VIROLOGY

36 hrs

1. Detection of parasite by Iodine mount preparation (5 Hrs)
2. Detection of parasite by Concentration technique (floatation-Zinc Sulphate method, sedimentation-formol ether) (6 Hrs)
3. Examination of blood for parasites- Thin blood film (8 Hrs)
4. Identification of Vectors of clinical importance- Mosquito(Anopheles, Culex), Fleas, Ticks (2 Hrs)
5. Identification of helminthic parasite- *Ascaris, Ancylostoma, Taenia* (2 Hrs)
6. Introduction to cultivation techniques used in virology laboratory (3 Hrs)
7. Method of cultivation of virus using embryonated eggs – Chorio Alantoic Membrane (CAM) (6 Hrs)
8. Demonstration of haemagglutination (4 Hrs)

References

1. N.Kannan, Laboratory manual in general microbiology, Palani Paramount Publications
2. Subash Chandra parija textbook of practical microbiology, Ahuja Publishing House, First edition

SEMESTER III

COURSE V MEDICAL MYCOLOGY

36 Hrs

Credits2

Objectives

1. To study the classification of fungus
2. To familiarize with routine mycological techniques , culture media and identification procedures
3. To promote understanding of pathogenesis, diagnosis,prevention and control of medically important fungus

MODULE I **9 Hrs**

Classification of fungi; collection & transport of specimens, Examinations of fungus- mounting fluids and stains, Routine mycological techniques & Culture Media used for cultivation (Sabouraud's Dextrose Agar, Potato Dextrose Agar, Brain Heart Infusion broth & agar, Czapek Dox Agar, Corn meal agar, Bird Seed agar), Maintenance of fungus culture.

MODULE II **10 Hrs**

Superficial, Cutaneous& subcutaneous mycoses:

Superficial- distribution, etiological agents, clinical features, diagnosis, treatment of *Tinea versicolar, Tinea nigra, piedra (Black &White),*

Cutaneous- Dermatophytoses (Causative agent, pathogensesity, lab diagnosis& treatment)

Subcutaneous: distribution, etiological agents, clinical features, diagnosis, treatment of Mycetoma, Sporotrichosis, Chromoblastomycosis,

MODULE III **9 Hrs**

Systemic mycoses- Causative agent, pathogenicity, clinical features, lab diagnosis & treatment of - Blastomycoses, Paracoccidioidomycoses, Coccidioidomycoses

MODULE IV **8 Hrs**

Opportunistic mycoses- Causative agent, pathogensesity, clinical features, lab diagnosis & treatment of - Aspergillosis, Penicilliosis, Zygomycoses (Mucor, Rhizopus). Candidiasis

References

Jagadish Chander Text book of Medical mycology

Ananthanarayan R. and C.K.J. Paniker. Text book of Microbiology, Sixth edition

Medical Mycology by Rippon

P.Sivamani, Medical Mycology, 1st edition Siva Publications

Practical III MEDICAL MYCOLOGY

54 Hrs

1. Microbiology laboratory safety (2 Hrs)
2. Collection of samples for fungal infections. (2 Hrs)
3. Slide culture method for cultivation of fungus (15 Hrs)
4. Study of cultural characteristics of fungi on SDA- *Aspergillus, Penicillium , Rhizopus ,Mucor* (6 Hrs)
5. Study of morphology of fungi by lactophenol cotton blue - *Aspergillus, Penicillium , Rhizopus ,Mucor* (15 Hrs)
6. Study of morphology of fungi by cellophane tape method (4 Hrs)
7. Germ tube test for the identification of *Candida albicans* (4 Hrs)
8. Demonstration of hair bait technique (6 Hrs)

References

1. N.Kannan, Laboratory manual in general microbiology, Palani Paramount Publications
2. Subash Chandra parija textbook of practical microbiology, Ahuja Publishing House, First edition

SEMESTER III

COURSE VI DIAGNOSTIC MICROBIOLOGY

36 Hrs **Credits 2**

Module I **5 Hrs**

Laboratory safety-Good lab hygiene, Personal barrier protection-gloves, outerwear, respiratory protection,eyes & face. Warning signage. Microbiological hazards-Biological Safety cabinet: Class I, II & III, Biosafety levels, Universal precautions, Decontamination, Hazardous waste-Infectious waste, Sharp waste and waste disposal.

Module II **5 Hrs**

Microbiological methods- Morphology, Cultural characteristics, Biochemical characteristic-Indole, Methyl red, Voges Prauskauer, Citrate, Sugar fermentation , TSI, Oxidase, Catalase, Coagulase, DNAase, Urease, Gelatinase, Cellulase. H_2S production. Bacitracin, Optochin sensitivity, Antibiotic susceptibility assay- Kirby –Bauer method of Disk Diffusion, Tube dilution technique

Module III **7 Hrs**

Immunological/ Serological diagnosis- Definition of antigen, antibody, Ag-Ab reaction-precipitation and agglutination. Immunological detection methods- Immunodiffusion-Ouchterlony technique, Immunoelectrophoresis- Couter Immuno Electrophoresis (CIA), RadioImmuno Assay, ELISA, WIDAL, VDRL, ASO Coombs Test, Haemmagglutination inhibition, Quellung reaction, Mantoux test, Weil-Felix test

Module IV **12 Hrs**

Automated Methods for Diagnostic microbiology: Principles employed by common automated systems for detection and identification of viable pathogens - Turbidity as an indicator of growth, Colorimetric and pattern recognition methods for microbial identification – Vitek bacterial identification system, Flurophore- labelled/ oxidation-reduction substrate metabolism as indicator of growth & substrate utilization-Biolog identification, API 20 E strips, measurement of CO_2 as product of metabolic activity- BACTEC system, analysis of Fatty acid profile – using GLC-MIDI Sherloch Microbial Identification Systems, Bioluminescence assay, electrical impedance.

Module V **7 Hrs**

Molecular techniques: DNA probes, Blotting techniques-Western blotting, PCR, Emerging techniques in microbiology laboratory- MALDI-TOF Mass Spectrometry –description of this technique in brief.

Core Readings

Shanson D.C., Speller D.C. E. Microbiology in clinical practice,III edition, Butterworth & Heinemann Publication

Kenneth D M Clatchey Clinical Laboratory Medicine 2nd Edition

Carry-Ann D Burnham . Automation and Emerging Technology in Clinical Microbiology

Paul G. Engelkirk, Janet L. Duben-Engelkirk Diagnosis of infectious diseases: Essentials of diagnostics

Practical IV DIAGNOSTIC MICROBIOLOGY
54 Hrs

Biochemical tests for the identification of microbes

1. Fermentation of carbohydrates (Glucose, lactose, Mannitol) (4 Hrs)
2. IMViC tes (6 Hrs)
3. Urease test (2 Hrs)
4. Catalase test (4 Hrs)
5. Oxidase test (4 Hrs)
6. Coagulase test (4 Hrs)
7. Triple sugar iron agar test for the identification of E. coli, Klebsiella, Proteus and Pseudomonas (4 Hrs)

Serological tests for identification of microbes

8. VDRL (6 Hrs)
9. Widal (12 Hrs)
10. Demonstration of immunodiffusion method (4 Hrs)
11. Perform ASO (4 Hrs)

References

1. N.Kannan, Laboratory manual in general microbiology, Palani Paramount Publications

2. Subash Chandra parija textbook of practical microbiology, Ahuja Publishing House, First edition

SEMESTER IV

COURSE VII MEDICAL BACTERIOLOGY

36 hrs
Credits 2

Objectives

1 To develop a knowledge of medically important bacteria and their relevance of infectious diseases;
2.To understand the principles of prevention and treatment of pathogenic microorganism infection in humans.

Module I **6 Hrs**

Gram Positive & Negative cocci

Morphology, cultural& biochemical characteristics, antigenic properties, toxins/virulence factors(in brief), pathogenecity, lab diagnosis, prophylaxis & treatment - *Staphylococcus aureus*, *Streptococci* (*Str. pyogenes* and *Str. pneumonia*), Neisseriae (*N. meningitides* and *N. gonorrhoeae*)

Module II **6 Hrs**

Gram Positive Rods

Morphology, cultural& biochemical characteristics, antigenic properties, toxins/virulence factors(in brief), pathogenecity, lab diagnosis, prophylaxis & treatment *Bacillus anthracis*, *Corynebacterium diphtheriae*, *Clostridium tetani*

Module III **12 Hrs**

Gram Negative Rods

Morphology, cultural& biochemical characteristics, antigenic properties, toxins/virulence factors(in brief), pathogenecity, lab diagnosis, prophylaxis & treatment

Escherichia coli, Klebsiella pneumoniae, Salmonella typhi, Shigella, Bordetella pertussis, Pseudomonas aeruginosa, Vibrio cholerae

Module IV **12 Hrs**

Branching, Spiral, Pleomorphic & cell wall less bacteria-

Mycobacterium tuberculosis, Actinomycetes, Treponema pallidum, Haemophilus influenza type B, Rickettsiae (Typhus fever & Spotted fever group), *Mycoplasma pneumoniae.*

References

Ananthanarayan R. and C.K.J. Paniker. Text book of Microbiology, Sixth edition

Chakraborthy P., A textbook of Microbiology, 1st edition, , New Central Book Agency (P) Ltd.

Gabriel Virella, B.I. Microbiology and Infectious diseases, 3rd ed. Waery Publications

Practical V SEMESTER MEDICAL BACTERIOLOGY

54 hrs

Identification of bacteria based on morphology

1. Differential staining- Spore staining for endospore *(10 Hrs)*
2. Negative staining for capsulated organism *(8 Hrs)*
3. Metachromatic granule staining for granules *(10 Hrs)*

Identification of bacteria based on colony morphology

4. Cultural characteristics on NA and Mac Conkey agar (4 Hrs)
5. Demonstration of haemolytic property on Blood agar (4 Hrs)
6. Antimicrobial susceptibility test *(8 Hrs)*
7. Identification of Gram positive bacteria *(Staphylococcus aureus*) *(5 Hrs)*
8. Identification of Gram negative bacteria *(Escherichia coli, Klebsiella pneumoniae)* *(5 Hrs)*

References

1. N.Kannan, Laboratory manual in general microbiology, Palani Paramount Publications
2. Subash Chandra parija textbook of practical microbiology, Ahuja Publishing House, First edition

SEMESTER IV

COURSE VIII CLINICAL MICROBIOLOGY

36 Hrs

Credits 2

Objectives

1.To develop a basic understanding of laboratory safety, specimen collection and transport

2 To describe the epidemiology, clinical manifestations, pathogenesis, and laboratory diagnosis of the following diseases caused by different microbial pathogens

Module 1 **4 Hrs**

Microbiology laboratory safety, General concepts for specimen collection and transport of clinical specimens. Diagnostic methods in clinical microbiology and recent advances in diagnosis (in brief)

Module 2 **10 Hrs**

Symptoms, Causative agents, clinical features, epidemiology and treatment of important Respiratory tract infections: Infections of the upper and lower respiratory tract-

Bacterial- Strep throat, Diphtheria, pneumonia (pneumococcal, *Klebsiella, Mycoplasma*), Pertussis, tuberculosis

Viral- Common cold- rhinovirus, Adenoviral pharyngitis, influenza, Respiratory Syncytial virus infections, Corona virus (SARS)

Fungal- Oral thrush

Module 3 **8 Hrs**

Symptoms, Causative agents, clinical features, epidemiology and treatment of important gastrointestinal tract infections;

Bacterial-Cholera, Shigelllosis, *E. coli* gastroenteritis, Salmonellosis, Campylobacteriosis

Viral- Rota viral gastroenteritis, Hepatitis A, B, C

Protozoan- Giardiasis, Amoebiasis

Module 4 **10 Hrs**

Symptoms, Causative agents, clinical features, epidemiology and treatment of important Urinary tract infection- Bacterial- bacterial cystitis, *(E. coli, Klebsiella, Proteus, Staphylococcus, Pseudomonas*), Fungal- Candida

Symptoms, Causative agents, clinical features, epidemiology, lab diagnosis and treatment of **Sexually transmitted diseases Non veneral**- bacterial vaginosis, vulvo vaginal Candidiasis; **Veneral**- Bacterial- Gonorrhoea, syphilis, Chlamydial genital system infection; **Viral**- AIDS, Papilloma virus, Genital Herpes Simplex

Module 5 **4 Hrs**

Important Infections of the nerve system- **Bacterial**- meningococcal meningitis, Hansen's disease (leprosy), Botulism

Viral- Viral meningitis (HSV, Mumps), Polio (infantile paralysis), rabies

References

Ananthanaryanan R. and C.K.J. Paniker Text book of Microbiology, 9th edition, University Press (India) Pvt. Ltd. Publisher

Elmer W. Koneman Color Atlas & Textbook of Diagnostic Microbiology 5th edition, Lippincott Publication

Eugene W. Nester, Microbiology a Human perspective, 4th edition McGraw Hill Publication.

Gabriel Virella, B.I. Microbiology and Infectious diseases, 3rd edition, Waverly Publications

Patricia M. Tille, Bailey & Scott's Diagnostic Microbiology 13th edition, Elsevier Publication

Philip A. Thomas, Clinical Microbiology, Orient Longman Pvt. Ltd.

Richard V Goering, Mim's Medical Microbiology 5th edition, Elsevier Publication

Practical VI CLINICAL MICROBIOLOGY

54 Hrs

1. Microbiology of laboratory safety (1Hr)
2. General concept for specimen collection & handling (3 Hrs)
3. Semi quantitative method for analysis of urine (8 Hrs)
4. Examination of clinical sample- urine
    a. Examination of specimen microscopically- wet mount, Gram staining (4 Hrs)

b. Culturing of specimen (4 Hrs)

c. Biochemical identification of pathogen (4 Hrs)

d. Antibiotic susceptibility test (4 Hrs)

5. Examination of clinical sample- Sputum

a. Examination of specimen microscopically- wet mount, Gram staining (4 Hrs)

b. Culturing of specimen (4 Hrs)

c. Biochemical identification of pathogen (4 Hrs)

d. Antibiotic susceptibility test (4 Hrs)

6. Identification of normal flora of skin (5 Hrs)

7. Identification of normal flora of mouth (5 Hrs)

References

1. N.Kannan, Laboratory manual in general microbiology, Palani Paramount Publications
2. Subash Chandra parija textbook of practical microbiology, Ahuja Publishing House, First edition

15. B.Sc ZOOLOGY PROGRAMME-MODEL – III

1. B.Sc. (BIOLOGICAL TECHNIQUES AND SPECIMEN PREPARATION) (B.Sc. BT & SP)

2. INDUSTRIAL MICROBIOLOGY(DOUBLE CORE)

1. B.Sc. BIOLOGICAL TECHNIQUES AND SPECIMEN PREPARATION (B.Sc. BT & SP)

Total Credits 120
Total Instructional Hours 150

a. SCHEME OF DISTRIBUTION OF HOURS & EXAMINATION

i. THEORY:

Theory Examinations will be conducted by the University at the end of the respective semester in which the course is conducted. Duration 3 Hrs (Internal External ratio =1:4)

SEMESTER 1

No	Course Code	Course Title	Course Category	Hrs per week	Credits	Marks ratio	
						Intl	Extl
1		English- *(From Board of studies - English)*	Common Course	5	4	1	4
2	ZB1CRT01	Introduction to Biological Sciences	Core Course 1 : Theory	2	2	1	4
3		Introduction to Biological Sciences	Core Course 1 : Practical	2	0	0	0
4	ZB1CRT02	Collection and Preservation of Biological Specimen 1 (Plants)	Core Course 2 : Theory	2	2	1	4
5		Collection and Preservation of Biological Specimen 1 (Plants)	Core Course 2 : Practical	2	0	0	0
6	ZB1CRT03	Collection and Preservation of Biological Specimen 2 (Animals)	Core Course 3 : Theory	2	2	1	4
7		Collection and Preservation of Biological Specimen 2 (Animals)	Core Course 3 : Practical	2	0	0	0
8		Biochemistry-1 (From Board of Studies“ Biochemistry)	Complementary I : Theory	2	2	1	4
9		Practical	Complementary I :	2	0	0	0

			Practical				
		Zoology -1 (From Board of Studies- Zoology)	Complementary II : Theory	2	2	1	4
		Practical	Complementary II : Practical	2	0	0	0
Total				**25 hrs**	**16**		

SEMESTER 2

No	Course Code	Course Title	Course Category	Hrs per week	Credits	Marks ratio	
						Intl	Extl
1		English *(From Board of studies – English*	Common Course	5	4	1	4
3	ZB2CRT04	General Biological Techniques	Core Course 4 : Theory	2	2	1	4
4		General Biological Techniques	Core Course 4 : Practical	2	2	1	4
5	ZB2CRT05	Teaching Laboratory Techniques	Core Course 5 : Theory	2	2	1	4
6		Teaching Laboratory Techniques	Core Course 5 : Practical	2	2	1	4
7	ZB2CRT06	Food Microbiology & Biotechnology	Core Course 6 : Theory	2	2	1	4
8		Food Microbiology & Biotechnology	Core Course 6 : Practical	2	2	1	4
8		Biochemistry-2 (From Board of Studies - Biochemistry)	Complementary I : Theory	2	2	1	4
9		Practical	Complementary I : Practical	2	2	1	4
		Zoology -2 (From Board Of Studies- Zoology**)**	Complementary II : Theory	2	2	1	4
		Practical	Complementary II : Practical	2	2	1	4
Total				**25 hrs**	**24**		

SEMESTER 3

No	Course Code	Course Title	Course Category	Hrs per week	Credits	Marks ratio	
						Intl	Extl
1	ZB3CRT07	Physiology With Clinical Correlation	Core Course 7 : Theory	3	3	1	4
2		Physiology With Clinical Correlation	Core Course 7 : Practical	2	0	0	0
3	ZB3CRT08	Clinical Chemistry an Clinical Microbiology	Core Course 8 : Theory	3	3	1	4
4		Clinical Chemistry and Clinical Microbiology	Core Course 8 : Practical	2	0	0	0
5	ZB3CRT09	Tissue Culture and Gene Manipulation	Core Course 9 : Theory	3	3	1	4
6		Tissue Culture and Gene Manipulation	Core Course 9 : Practical	2	0	0	0
7		Biochemistry-3(From Board Of Studies“ Biochemistry)	Complementary I : Theory	3	3	1	4
8		Practical	Complementary I : Practical	2	0	0	0
9		Zoology -3 (From Board Of Studies Zoology	Complementary II : Theory	3	3	1	4
10		Practical	Complementary II : Practical	2	0	0	0
Total				**25 hrs**	**15**		

SEMESTER 4

No	Course Code	Course Title	Course Category	Hrs per week	Credits	Marks ratio	
						Intl	Extl
1	ZB4CRT10	Radiology and Advanced Instrumentation Techniques	Core Course 10 : Theory	3	3	1	4
2		Radiology and Advanced Instrumentation Techniques	Core Course 10 : Practical	2	2	1	4
3	ZB4CRT10	Entrepreneurship Development and Marketing	Core Course 11 : Theory	3	3	1	4
4		Entrepreneurship Development and Marketing	Core Course 11 : Practical	2	2	1	4
5	ZY4CRT04	Research methodology,Biophysics & Biostatistics *(*Core Course IVof *Board of Studies - Zoology)*	Core Course 12 : Theory	3	3	1	4
6		Research methodology, Biophysics &Biostatistics	Core Course 12 : Practical	2	2	1	4
7		Biochemistry - 4 (From Board of Studies - Biochemistry)	Complementary I : Theory	3	3	1	4
8		Practical	Complementary I : Practical	2	2	1	4
9		Zoology - 4 (From Board of Studies – Zoology	Complementary II : Theory	3	3	1	4
10		Practical	Complementary II : Practical	2	2	1	4
Total				**25 hrs**	**25**		

SEMESTER 5

No	Course Code	Course Title	Course Category	Hrs per week	Credits	Marks ratio	
						Intl	Extl
1	ZY5CRT05	Environmental Biology & Human rights	Core Course 13 : Theory	3	3	1	4
2	ZY5CRPO5	Environmental Biology & Human rights	Core Course 13 : Practical	2	0	0	0
3	ZY5CRT06	Cell Biology & Genetics	Core Course 14 : Theory	3	3	1	4
4	ZY5CRPO6	Cell Biology & Genetics	Core Course 14 : Practical	2	0	0	0
5	ZY5CRT07	Evolution, Ethology & Zoogeography	Core Course 15 : Theory	3	3	1	4
6	ZY5CRPO7	Evolution, Ethology & Zoogeography	Core Course 15 : Practical	2	0	0	0
7	ZY5CRT08	Human Physiology, Biochemistry & Endocrinology	Core Course 16 : Theory	3	3	1	4
8	ZY5CRPO8	Human Physiology, Biochemistry & Endocrinology	Core Course 16 : Practical	2	0	0	0
9	ZY5OPT01	1 – Vocational Zoology (Apiculture, Vermiculture, Ornamental fish culture)	Open Courses for other streams *(Select any one out of three)*	4	3	1	4
	ZY5OPT02	2 – Public health and Nutrition					
	ZY5OPT03	3 – Man, nature & Sustainable Development					
		Project work & Field Visit/Study Tour, Visit to research institutes , Group activity	Project work	1	0		
Total				**25 hrs**	**15**		

SEMESTER 6

No	Course Code	Course Title	Course Category	Hrs per week	Credits	Marks ratio	
						Intl	Extl
1	ZY6CRT09	Developmental Biology	Core Course 17 : Theory	3	3	1	4
2	ZY6CRP09	Developmental Biology	Core Course 17 : Practical	2	2	1	4
3	ZY6CRT10	Microbiology & Immunology	Core Course 18 : Theory	3	3	1	4
4	ZY6CRP10	Microbiology & Immunology	Core Course 18 : Practical	2	2	1	4
5	ZY6CRT11	Biotechnology, Bioinformatics and Molecular Biology	Core Course 19 : Theory	3	3	1	4
6	ZY6CRP11	Biotechnology, Bioinformatics and Molecular Biology	Core Course 19 : Practical	4	2	1	4
7	ZY6CRT12	Occupational Zoology (Aquaculture, Apiculture, Vermiculture & Quail farming)	Core Course 20 : Theory	3	3	1	4
8	ZY6CRP12	Occupational Zoology (Aquaculture, Apiculture, Vermiculture & Quail farming)	Core Course 20 : Practical	2	2	1	4
9	ZY6CBT01	Elective 1: Ecotourism & Sustainable Development	Choice Based Core Elective Courses *(Select any one out of four)*	3	2	1	4
	ZY6CBT02	Elective 2: Agricultural pest management					
	ZY6CBT03	Elective 3: Vector & Vector bourne Diseases					
	ZY6CBT04	Elective 4: Nutrition, Health & life style management					
10	ZY6CRPRP	Project work & Field Visit/Study Tour, Visit to research institutes , Group activity	Project		1		
11	ZB6OJT01	OJT 64 Hours (MOC) + 36 hours (Tissue Culture training)	OJT		2		
Total				**25 hrs**	**25**		

ii. SCHEME FOR PRACTICAL EXAMINATION FOR BSc (Biological Techniques and Specimen Preparation) BSc (BT&SP)

University Practical Examinations will be conducted at the end of even semesters (Semester II, IV and VI).

Semester	Code	Course	Exam duration	Marks-ratio		Credits
				Internal (I)	External (E)	
2	ZB2CRP01	**Practical 1** (Core 1 & 4)	3 hrs	1	4	2
	ZB2CRP02	**Practical 2** (Core 2 & 5)	3 hrs	1	4	2
	ZB2CRP03	**Practical 3** (**C**ore 3 & 6)	3 hrs	1	4	2
		Complimentary 1 Biochemistry	3 hrs	1	4	2
		Complimentary 2 Zoology	3hrs	1	4	2
4	ZB4CRP04	**Practical 4** (Core 7 & 10)	3 hrs	1	4	2
	ZB4CRP05	**Practical 5** (Core 8 & 11)	3 hrs	1	4	2
	ZB4CRP06	**Practical 6** (**C**ore 9 & 12)	3 hrs	1	4	2
		Complimentary 1 Biochemistry	3 hrs	1	4	2
		Complimentary 2 Zoology	3hrs	1	4	2
6	ZY6CRP03	**Practical 7** (**C**ore 13 & 17)	3 hrs	1	4	2
	ZY6CRP04	**Practical 8** (**C**ore 14 & 18)	3 hrs	1	4	2
	ZY6CRP05	**Practical 9** (**C**ore 15 & 19)	3 hrs	1	4	2
	ZY6CRP06	**Practical 10** (**C**ore 16 & 20)	3 hrs	1	4	2

b. SYLLABUS
THEORY & PRACTICALS

(BIOLOGICAL TECHNIQUES AND SPECIMEN PREPARATION) (B.Sc. BT & SP)

SEMESTER I

ZB1CRT01 - CORE COURSE 1
INTRODUCTION TO BIOLOGICAL SCIENCES

36 hrs

Credits 2

OBJECTIVES

1. To develop proper scientific mind, culture and work habits
2. To emphasize the central role that biological sciences plays in the life of all organisms
3. To introduce the student to some of the present and future applications of bio-sciences

Module 1 **6 Hrs**

What is biology: Salient features of life; Importance of biology on the frontiers of science and technology, History of Biology, Biology in ancient times, Landmarks in the progress of Biology, Branches of Biology

Module 2 **8 Hrs**

Introduction to the world of living organisms: Outline classification of living organism, levels of biological organization, Broad overview of life on earth; history and evolution of life on earth, Theories of evolution, origin and progression of life on earth.

Module 3 **10 Hrs**

Chemicals of life: Elements found in living organisms, acids and bases, An overview of Carbohydrates, proteins, lipids,nucleic acids, vitamins and minerals including functions, physical, chemical properties, basic units, types, Physical chemistry and significance of water, interactions between molecules.

Module 4 **6 Hrs**

Homeostasis: Definition, Concept and importance in biological system. Control systems in biology, general idea of biological negative feedback mechanisms and temperature regulation.

Module 5 **6 Hrs**

Nature and Scope of biology: Branches of biology- Botany, Zoology, Cell biology, Molecular biology, Developmental biology, Marine biology, Ecology, Physiology, Anatomy, Morphology, Genetics, Biochemistry, Microbiology, Biotechnology

Rferences

1. Debbies Holmes, Peter Moody and Diana Dine (2006) Research methods for the Biosciences. International student Edition: Oxford University Press. P. 288-299.
2. Bowler Peter J. And Iwan Rhys Morus (2005) Making Modern Science: A Historical Survey. University of Chicago Press, Chicago, IL:
3. N. Campbell and J. Reece (2005) Principles of Biology: Interactive textbook from Nature Education Biology: 7th edition, Pearson, Benjamin,Cummings
4. Chakrabarti B K, Ghosh H N & Sahana S N (1984): Human Physiology, The New Book Stall, Calcutta, India
5. Ernst Mayr (1982) The Growth of Biological Thought: Diversity, Evolution and Inheritance.Published by Harvard University Press.
6. Ernst Myer. (1997). This is Biology: The Science of the living World.University Press, Hyderabad, India
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8. Knudsen, J.W (1966)*Biological Techniques* Harper InternationalEdition by Harper & Row
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13. Thomas, A.P (2009) Biology – Perspectives and Methods. Green Leaf Publishers, Kottayam.
14. K. Vijayakumaran Nair & Biju Dharmapalan (2010) Methodology and Perspectives of Science; Publisher: Trivandrum: Academica.

SEMESTER I

CORE COURSE 1
INTRODUCTION TO BIOLOGICAL SCIENCES
(PRACTICAL)

36 Hrs

0 Credit

1. Simple identification of any 5 vertebrates and 5 invertebrates upto species and differences in classification of vertebrates and invertebrates **6 Hrs**
2. Identification of a) plant c
3. ell (onion cell) b) animal cell (cheek cell) (5 hrs)
4. Study on food chain and food web **5 Hrs**
5. Physiological Measurements: Blood Pressure (normal & under stress) and Temperature **8 Hrs**
6. pH measurements **6 Hrs**

a) Measurement of pH of different solutions, like aerated drinks, fruit juices, shampoos and soaps (use dilute solutions of soaps and shampoos to prevent damage to the glass electrode) using pH-meter

b) Determination of pH of water

7. Titration experiments: estimation of acids and bases **6 Hrs**

SEMESTER I

ZB1CRT02 - CORE COURSE 2
COLLECTION AND PRESERVATION OF BIOLOGICAL SPECIMEN 1 (PLANTS)

36 Hrs
2 Credits

Objectives

1. To introduce the student to some of the collection and preservation of plant specimens
2. To develop critical thinking skill and research aptitude among students, byintroducing the frontier areas of the biological science

Module 1 **12 Hrs**

Broad classification of plants: where and how to collect plants, Overview of economically important plants, preparation and storage of herbarium sheets; preparation of dry specimens for

display boxes; preparation of museum specimens. Modelling materials: characteristics of teaching models, proportions, durability, attractiveness, innovativeness.

Module 2 **9 Hrs**

Anatomy of Plants: Special features of anatomical sections of monocot and dicot stems and roots; Double staining methods; Special staining methods; Preparation and storage of permanent slides.

Module 3 **9 Hrs**

Cell division stages: Stages of Mitosis and Meiosis in Plants; Sources of materials; Preparation of permanent slides showing stages of division; Use of chemicals to arrest division; Special stains and their preparation.

Module 4 **6 Hrs**

Distribution of plants: methods of survey, different approaches of sampling, determination of frequency dominance

References

1. Aggarwal S.K (2009)Foundation Course in Biology Ane's Students Edition
2. Cappucchino J.G., and Sherman, N. Microbiology – A Laboratory Manual3rd Ed. The Benjamin/Cummings Publishing Co.
3. Dubey, R.C. and Maheshwari, D.K. (2002) Practical Microbiology S.Chand& Company Ltd.
4. Eldon D. Enger, Frederick C. Ross and David Bailey (2008)(Eleventh Edition)Concepts in Biology. Tata – McGraw Hill, New Delhi
5. Talaro, K.P., and Talaro, A. 2002. Foundations in Microbiology 4th Ed. McGraw Hill.
6. Taylor, Green, Stout (2008) Biological Science, Cambridge University press.

SEMESTER 1

CORE COURSE 2

COLLECTION AND PRESERVATION OF BIOLOGICAL SPECIMEN 1(PLANTS)

(PRACTICALS)

36 Hrs

0 Credit

1. Preparation of herbarium sheets **(5 Hrs)**

2. Identification of mitotic stages: onion root tip **(5 Hrs)**

3. Preparation of museum specimens **(5 Hrs)**
4. Preparation of display boxes of dry plant and plant product mounts **(5 Hrs)**
5. Preparation of whole mounts **(4 Hrs)**
6. Collection and preservation of materials for anatomical and cytological studies **(2 Hrs)**
7. Preparation of teaching models [Plaster of Paris, Epoxy Resin, Clay] **(10 Hrs)**

SEMESTER 1

ZB1CRT03 - CORE COURSE 3
COLLECTION AND PRESERVATION OF BIOLOGICAL SPECIMEN 2 (ANIMALS)

36 Hrs
2 Credits

Objectives

1. To introduce the student to some of the collection and preservation of animal specimens
2. To develop critical thinking skill and research aptitude among students, byintroducing the frontier areas of the biological science

Module 1 **10 Hrs**

Collection and preservation of invertebrates: (Protista, porifera, coelenterata, ctenophora, Platyhelminthes, Nematoda, Annelida, Arthropoda, Mollusca, Echinodermata, hemichordata

Module 2 **6 Hrs**

Collection and preservation of vertebrates: Pisces, aves, amphibians, reptiles and mammals

Module 3 **8 Hrs**

Life cycles: study on life cycle of a selected animal from each phylum (Protista, porifera, coelenterata, ctenophora, Platyhelminthes, Nematoda, Annelida, Arthropoda, Mollusca, Echinodermata, hemichordate, Pisces, aves, amphibians, reptiles and mammals)

Module 4 **6 Hrs**

Preparation of specimens: Preparation of museum specimens, articulated skeletons, Dermestid technique, Alizarin preparation and resin-embedded specimens, Preparation of sections involving microtome and cryostat, Taxidermy.

Module 5 **6 Hrs**

Demographic Techniques and Population Patterns of animals: Techniques Used to Quantify Population Density, Patterns of Spacing, Fragmented Habitats, Spatial Arrangement of Habitats and Organisms.

References

1. Blamire, J. (1994)Exploring Life- The Principles of Biology,Wm. C.Brown Publishers
2. Campbell, N.A., and Reece, J.B (2005)Biology. 7th (International) Ed. Pearson-Benjamin-Cummings
3. Green, N.P.O., Stout, G. W. & Taylor, D.J (1990) Biological Science2nd Ed. Cambridge Low Price Edition, Cambridge University Press.
4. Knudsen, J.W (1966) Biological TechniquesHarper InternationalEdition by Harper & Row
5. Hickman, C.P., Roberts, L.S. and Larson, A (2003) Animal Diversity3rd Ed. Mc Graw Hill
6. Miller, S.A., and Harley J.P. (2005)Zoology. 6th Ed. Mc Graw Hill

SEMESTER I

CORE COURSE 3
COLLECTION AND PRESERVATION OF BIOLOGICAL SPECIMEN 2 (ANIMALS)
(PRACTICALS)

36 Hrs

0 Credit

1. Whole mount preparation of small animals and parts of animals	**(9 Hrs)**
2. Alizarin preparation of small invertebrates	**(4 Hrs)**
3. Preparation of articulated skeletons	**(6 Hrs)**
4. Preparation of resin embedded specimens	**(4 Hrs)**
5. Demonstration of Taxidermy	**(5 Hrs)**
6. Preparation of specimens by each student from a given phylum	**(4 Hrs)**
7. Frequency distribution of animals in a specific area of campus	**(4 Hrs)**

SEMESTER 2

ZB2CRT04 - CORE COURSE 4

GENERAL BIOLOGICAL TECHNIQUES

36 Hrs
2 Credits

Objectives

1. To impart a knowledge and understanding of biological experimental techniques, includingpractical laboratory skills
2. To familiarize with the basic tools and techniques of scientific study with emphasis on biological sciences

Module 1 **12 Hrs**

Microscopy: Magnification and Resolution, bright field, dark field , phase contrast, stereoscopic, fluorescence, polarization microscopy, electron microscopy-SEM, TEM.

Ocular and stage micrometers; Hemocytometer; Camera lucida

Module 2 **6 Hrs**

Seperation techniques: Centrifuge, chromatography, electrophoresis

Module 3 **6 Hrs**

Analytical techniques: Colorimeter, pH meter, Spectrophotometer, x-ray crystallography.

Module 4 **12 Hrs**

Micrbiological Techniques: Identification of common microorganisms, culture techniques; Types of solid and liquid culture media for bacteria, fungi, algae and protozoa (at least 2 for each); Sterilization methods, Cell counting and methods for measuring microbial growth; Storage and maintenance of Stock cultures.

References

1. Bhaskaran, K.K (1986) Microtechnique and Histochemistry.EvershinePress, Vellangalloor
2. Cappucchino, J.G., and Sherman N. *Microbiology – A Laboratory Manual*3rd Ed. The Benjamin/Cummings Publishing Co
3. Dubey, R.C. and Maheshwari, D.K (2002) Practical Microbiology S.Chand& Company Ltd.
4. Junqueira, L.C., and Carneiro, J (2005)Basic Histology11th Ed. Mc GrawHill
5. Talaro ,K.P., and Talaro, A (2002)Foundations in Microbiology4th Ed. McGraw Hill.

SEMESTER 2

ZB2CRP01 - CORE COURSE 4
GENERAL BIOLOGICAL TECHNIQUES
(PRACTICALS)

36 Hrs
Credit 2

1. Light microscope: its parts and their description **(3 Hrs)**
2. Use of ocular and stage micrometers for measurement of width of hair etc. **(5 Hrs)**
3. Camera lucida **(4 Hrs)**
4. Chromatography **(10 Hrs)**
5. Instrumentation-pH meter, Colorimeter, centrifuge, electrophoresis **(8 Hrs)**
6. Counting cells in hemocytometer; Growth Curve **(6 Hrs)**

SEMESTER 2

ZB2CRT05 - CORE COURSE 5
TEACHING LABORATORY TECHNIQUES

36 Hrs

Credits 2

Objectives

1. To impart a knowledge and understanding of biological experimental techniques, including practical laboratory skills.
2. To learn about laboratory techniques, water, soil and air analyses.

Module 1 **10 Hrs**

Organization of a teaching laboratory: equipment, reagents, glass wares,specimens, purchase and maintenance of stock register

Module 2 **8 Hrs**

Distillation of water: Types of distillation stills [metal, solar, glass still],Cleaning agents for glassware, Methods of sterilization and storage of glassware.

Module 3 **6 Hrs**

Water pollution: Abiotic and biotic pollutants of water and their indicators; Assay techniques (any 5).

Module 4 **6 Hrs**

Air pollution: Introduction to air pollution, various factors contributing to air pollution, common air pollutants and sources of air pollutants, technology for air pollution control, Assay techniques(any 5).

Module 5 **6 Hrs**

Soil pollution: Introduction to soil pollution, types and sources, main causes and effects, control measures of soil pollution. Assay techniques(any 5).

References

1. Arms, K. (1990)Environmental Science,Saunders College Publishing
2. Christopher.F Forster, D.A.John Wase, (1987) Environmental Biotechnology, Ellis Harwood.
3. Joseph C. Daniel(1999),Environmental aspects of Microbiology, Bright Sun publication
4. Khopkar, S.M (1993) Environmental Pollution Analysis, New Age International (P) Limited Publishers
5. Robert Jennings Heinsohn, Robert Lynn Kabe(1999) Sources and Control of Air Pollution, Prentice Hall
6. Sharma, P.D (1994)Ecology and Environment6th ed. Rastogi Publications
7. R. P. Singh (2012) Microbiology, Kalyani Publishers

SEMESTER 2

ZB2CRP02 - CORE COURSE 5

GENERAL LABORATORY TECHNIQUES

(PRACTICALS)

36 Hrs

2 Credits

1. Components of distillation stills and ion exchanger **(2 Hrs)**
2. Cleaning of dirty glass wares using various cleaning agents. **(4 Hrs)**
3. Sterilization of glass wares [using hot air oven and autoclave **(4 Hrs)**
4. Analysis of water pollutants:

    Determination of hardness of water **(3 Hrs)**

    Determination of residual chlorine of water **(3 Hrs)**

Estimation of COD **(3 Hrs)**

Estimation of BOD **(3 Hrs)**

Bacteriological examination of water by MPN method **(6 Hrs)**

5. Analysis of soil pollutants: Determination of total bacterial populations from soil **(4 Hrs)**

6. Analysis of air pollutants: Enumeration of microorganisms from air **(4 Hrs)**

SEMESTER 2

ZB2CRT06 - CORE COURSE 6
FOOD MICROBIOLOGY & BIOTECHNOLOGY

36 Hrs

2 Credits

OBJECTIVES

1. To make aware of different useful microorganisms, their role in food processing and preservation.
2. To understand the factors and predict microorganisms, which can cause foodspoilage.
3. To understand the causes of foodborne diseases.
4. To give a brief outline of food production through biotechnology

Module 1 **8 Hrs**

Roles of microbes in food production: Bread, wine, curd, yoghurt, cheese, , food and fodder yeast. Mushroom production.

Module 2 **8 Hrs**

Preservation and spoilage of food: Principles underlying spoilage of food,causes of spoilage, classification of food by ease of spoilage.

Control of microbes in food; Sterilization- Preservation by the use of high temperature, low temperature, drying. Aseptic packaging , Canning

Module 3 **8 Hrs**

Food borne diseases: Important groups of bacteria associated with various foods. Food poisoning , food borne infections and intoxication. Brief description on *Clostridium botulinum, Vibrio, Salmonella, Hepatitis A, E. coli* 0157:H7,*Listeria*.

Module 4 **6 Hrs**

Food additives and adulteration: Uses of food additives: Non preservative, preservative.

Food adulterants & Prevention of Food Adulteration: common adulterants for foods like milk and milk products, atta, edible oils, cereals, condiments and curry powder.

Module 5 **6 Hrs**

Biotechnology in food production: Transgenic plants-Flavr- savr tomatoes; Nutritionally enriched foods:Golden rice, "heart healthy" canola oil.GM foods- advantages and disadvantages. Single cell protein, algae as food. Biotechnological potential of microalgae, food, feed and fuel production of pharmaceutically valuable microalgae.

References

1. M.R. Adams, M.O. Moss, Food microbiology, New Age International (P) Ltd. Publishers .
2. Bala Subramanian D., C.F & Bryle & K. Dharmarajan J. Green Kunthala Jayaraman (2007)Concept in Biotechnology. University Press
3. Colin Ratledge & Bijorn Kristiansen (2008)Basic Biotechnology 3 rd ed. Cambridge University
4. W.C. Frazier and Westhoff, . Food Microbiology.
5. Lindsay, (1988) Willis Biotechnology, Challenges for the flavour and food industries", Elsevier Applied Science.
6. George J.B., (1987) Basic Food Microbiology, CBS Publishers & Distributors,
7. Gavin Brooks (1998) Biotechnology in Healthcare: An Introduction to Biopharmaceuticals Pharmaceutical Press.
8. Janarthanan S & Vincent S (2007) Practical Biotechnology, Method of Protocols. University Pres .
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12. Ronald H. Schmidt and Gary E. Rodrick. (2002). Food Safety Handbook. Wiley; 1st edition. Part 1: Definition of food safety and characterization of food hazards.
13. Ronald H. Schmidt and Gary E. Rodrick (2002) Food Safety Handbook. Wiley; 1st edition. Part 2: Prevalence of foodborne pathogens
14. Singh B.D. (2002) Biotechnology Kalyan Publishers Nw Delhi.
15. N Shakuntala Manay, M. Shadakshara Swamy Food-Facts and Principles II Ed. New Age International Pub.

16. Som Nath Mahindru (2009). Food additives: characteristics, detection and estimationNew Delhi APH Publ. Corp.

SEMESTER 2

ZB2CRP03 - CORE COURSE 6
FOOD MICROBIOLOGY & BIOTECHNOLOGY
(PRACTICALS)

36 Hrs

2 Credits

1. Preparation of fermented foods: curd, yogurt. **(6 Hrs)**
2. Isolation and Enumeration of bacteria from spoiled food (vegetables,meat and fish) . **(8 Hrs)**
3. Identification of bacteria from spoiled food samples. **(6 Hrs)**
4. Qualitative analysis of milk by standard plate count method. **(6 Hrs)**
5. Methylene blue reduction test for microbial contamination of milk. **(5 Hrs)**
6. Food adulteration detection by physical and chemical tests. **(5 Hrs)**
   Physical tests; Tea leaves, Black pepper, Cumin seeds, Cloves,Arhar dal (Toor dal)
   Chemical tests; Coffee powder, Turmeric powder, Coconut oil, Ghee, Jaggery, Sugar

SEMESTER 3

ZB3CRT07 - CORE COURSE 7
PHYSIOLOGY WITH CLINICAL CORRELATION

54 Hrs
3 Credits

Objectives

1. To inspire the students in learning the frontier areas of biological sciences
2. To appreciate the correlation between structure and function of organisms
3. To make them aware of the different body systems and the need for maintaining good health through appropriate life style.

Module 1 **2 Hrs**

Basics of human physiology: levels of structural organisation- chemical level, cellular level (in brief), tissue level- epithelial tissue, connective tissue, membranes.

Module 2 **6 Hrs**

Muscular system: types of muscular tissue, ultra structure of myofibril, sliding filament mechanism, neuromuscular junction, muscle metabolism, common clinical abnormalities (any 8).

Respiratory system:functional organization, common clinicalabnormalities

Module 3 **10 Hrs**

Nervous system: structure of neuron, electrical signals in neuron, signal transmission, anatomy of brain and anatomy of spinal cord, spinal cord physiology, common clinical abnormalities (any 8).

Module 4 **8 Hrs**

Endocrine system: anatomy of endocrine glands, hormone activity, mechanism of hormone action, functions and common clinical abnormalities (any 8).

Module 5 **10 Hrs**

Cardiovascular system: anatomy of Heart and circulation of blood, cardiac conducting system, ECG, cardiac cycle, cardiac output, composition of blood, blood clotting and blood groups ,blood pressure and Common clinical abnormalities (any 8)

References

1. Fox, S.I.(2006) Human Physiology9th ed. McGraw Hill International Edition
2. Guyton and Hall (2006) Text book of Medical Physiology
3. Seeley, R.R., Stephens, T.D., and Tate, P(2006) Anatomy and Physiology7th ed. McGraw Hill International Edition
4. Thibodeau, G.A., and Patton, K.T(2007)Anthon's Textbook of Anatomy and Physiology. 18th ed. Mosby
5. Tortora, G.J., and Derrickson, B (2006) Principles of Anatomy and Physiology11th ed. John Wiley & Sons, Inc.

SEMESTER 3

CORE COURSE7
PHYSIOLOGY WITH CLINICAL CORRELATION
(PRACTICALS)

36 Hrs
0 Credit

1. Determination of O_2 uptake by cockroach [Respirometer] **(3 Hrs)**
2. Effect of adrenalin and noradrenalin on the heart beat of frog (demo) **(2 Hrs)**
3. Preparation of human blood smear and identification of leucocytes (6 Hrs)
4. Determination of differential WBC count **(6 Hrs)**
5. Estimation of haemoglobin **(4 Hrs)**
6. Demonstration of hemin crystals **(3 Hr)**
7. ESR **(4 Hrs)**
8. Blood grouping (ABO, Rh). **(2 Hrs)**
9. Bleeding time and Clotting time **(6 Hrs)**

SEMESTER 3

ZB3CRT08 - CORE COURSE 8
CLINICAL CHEMISTRY AND CLINICAL MICROBIOLOGY

54 Hrs
3 Credits

Objectives

1. To inspire the students in learning the frontier areas of biological sciences
2. To expose the students to fundamentals in clinical chemistry and to make them appreciate the relevance of the subject in biological studies.
3. To make them aware of the pathogens, health related problems, their origin and treatment.

Module 1 **12 Hrs**

Lifestyle diseases: AIDS, Diabetes Mellitus, Obesity, Cancer, Cardiovascular diseases, kidney disorders, liver disorders.

Module 2 **12 Hrs**

Functions of various organs and their clinical assessment (Brief treatment only but emphasizing the biochemical aspect): e.g., liver, kidney, heart, pancreas,endocrine glands, lung, brain. Biochemical changes in the organs under pathological conditions.

Module 3 **4 Hrs**

Routine biochemical tests of blood sugar, cholesterol and NPN.

Module 4 **14 Hrs**

Microorganisms of medical importance- Symptoms, causative agents, clinical features, laboratory diagnosis and treatment of important

Bacterial diseases- Diphtheria, Pneumonia, Cholera, Tuberculosis, Salmonellosis, Typhoid

Viral diseases - Common cold, Respiratory Syncytial virus infections, Corona virus (SARS), AIDS

Fungal diseases - Oral thrush, Aspergillosis

Module 5 **12 Hrs**

Parasitic diseases- Symptoms, causative agents, clinical features, laboratory diagnosis and treatment of Malaria, Filariasis, Giardiasis, Amoebiasis,

References

1. Ananthanaryanan R. and C.K.J. Paniker (2009) Text book of Microbiology, 9th edition, University Press (India) Pvt. Ltd. Publisher
2. Elmer W. Koneman (2006) Color Atlas & Textbook of Diagnostic Microbiology 5th edition, Lippincott Publication
3. Cheesbrough, M. (1998) District Laboratory Practice in Tropical CountriesPart 1. Cambridge Low Price Edition. Cambridge University Press
4. Cheesbrough, M. (1998) District Laboratory Practice in Tropical CountriesPart 2. Cambridge Low Price Edition. Cambridge University Press
5. Mukherjee, K.L. (ed,) (1988) Medical Laboratory Technology Vol. 1. TataMcGraw Hill
6. Mukherjee, K.L. (ed,)(1988) Medical Laboratory Technology Vol. 2. TataMcGraw Hill
7. Mukherjee, K.L. (ed,)(1988) Medical Laboratory Technology Vol. 3. TataMcGraw Hill
8. Philip A. Thomas (2007) Clinical Microbiology, Orient Longman Pvt. Ltd.
9. Talaro, K.P., and Talaro, A. (2002). Foundations in Microbiology4th ed. McGraw Hill

SEMESTER III

CORE COURSE 8
CLINICAL CHEMISTRY AND CLINICAL MICROBIOLOGY
(PRACTICALS)

36 Hrs
0 Credit

1. Estimation of: blood glucose, total protein in serum, serum albumin, bloodurea, creatinine in blood, serum bilirubin, serumcholesterol, serum alkaline phosphatase, serum acid phosphatase. **(14 Hrs)**
2. Media preparation, Inoculation, and maintenance of bacteria. **(7 Hrs)**
3. Gram staining **(2 Hrs)**
4. Acid fast staining **(2 Hrs)**
5. Widal Test **(2 Hrs)**
6. Identification of microorganisms (bacteria, fungi) ofclinical significance **(9 Hrs)**

SEMESTER 3

ZB3CRT09 - CORE COURSE 9
TISSUE CULTURE & GENE MANIPULATION

54 Hrs
3 Credits

OBJECTIVES

1. To emphasize the central role that genetics plays in the life of all organisms
2. To learn about the tissue culture techniques
3. To introduce the student to some of the present and future applications of bio-sciences
4. To develop critical thinking skill and research aptitude among students, by introducing the frontier areas of the biological science.

Module 1 **12 Hrs**

Manipulating DNA: in microbes, plants and animals – overviews

Restriction endonucleases, ligases, cloning vectors [plasmids & phage DNA]

Isolation of genomic DNA, Mechanism of gene transfer and methods, Identification and selection of recombinants.

Recombinant DNA technologyand its applications.

Module 2 **12 Hrs**

Gene Cloning: Introduction and overview of Gene cloning; Techniques, principles and applications

Module 3 **8 Hrs**

Plant tissue culture:mediaand composition. Characteristic of plant cells in culture, callus,meristem,anther,embryo,ovule,ovary and endosperm culture

Module 4 **12 Hrs**

Germ plasm: Storage, somatic hybridization

Module 5 **10 Hrs**

Animal cell culture: growth media and maintenance of culture. Characteristics of animal cells in culture, hybridoma technology.

References

1. Brown, T.A (2007)Genomes 3. GS Garland Science
2. Glick B.R., Pasternak, J.J. and Patten, C.L (2010) Molecular Biotechnology: Principles and Applications of Recombinant DNA 4th ed., ASM Press (Washington DC).
3. James D. Watson (1993) Recombinant DNA: 2nd Edition
4. Prakash, M., and Arora, C.K. (1998) Cell and Tissue CultureAnmol Publications Pvt. Ltd.
5. Rema, L.P (2006). Applied BiotechnologyMJP Publishers
6. Surzycki, S. (2003) Human Molecular Biology Laboratory Manual, Blackwell Publishing
7. Watson, J.D., Caudy, A.A., Myers, R.M. and Witkowski, J.A., (2007) Recombinant DNA:Genes and Genomes- A Short Course , Cold SpringHarbor Laboratory Press

SEMESTER 3

CORE COURSE 9
TISSUE CULTURE AND GENE MANIPULATION
(PRACTICALS)

36 Hrs

0 Credit

1. Media formulation for plant tissue culture **(4 Hrs)**
2. Surface sterilization. **(2 Hrs)**
3. Callus induction. **(2 Hrs)**
4. Auxillary bud culture. **(2 Hrs)**
5. Isolation of protoplast. **(4 Hrs)**
6. Isolation of genomic DNA and its quantification. **(10 Hrs)**
7. Isolation of plasmid DNA. **(6 Hrs)**
8. Restriction digestion, ligation, bacterial transformation. **(6 Hrs)**

SEMESTER 4

ZB4CRT10 - CORE COURSE10
RADIOLOGY AND ADVANCED INSTRUMENTATION TECHNIQUES

54 Hrs
3 Credits

Objectives

1. To introduce the student to some of the radiological techniques and its applications
2. To develop an awareness about the harmful effects of radiation

Module 1 **7 Hrs**

Radioactive materials: Types and sources of radiation. Effect of various types of radiation on biological systems. Radioactive emissions.

Module 2 **10 Hrs**

Isotopes: Definition, isotopes of common biological use, techniques for detection of isotopes and applications - [Autoradiography, Geiger counting technique, liquid scintillation, Gamma counter]

Use of radio isotopes in biological research, auto-radiography- pulse chase experiment.

Isotope dilution technique

Module 3 **10 Hrs**

Management of radioactive wastes: waste disposal and cleaning of contaminated glassware. Precautions for handling, safety in use of radiation sources and radio isotopes.

Module 4 **12 Hrs**

Newer techniques in microscopy: Confocal, Scanning probe microscopy, Flowcytometry & cell sorting.

Module 5 **15 Hrs**

Chromatographic techniques: Theory, methods and application of paper, gas, affinity, ion exchange chromatography, TLC, HPLC, Gel filtration.

Electrophoresis: Theory, methods and applications of gelelectrophoresis: AGE, PAGE,

Polymerase chain reaction, DNA sequencing, DNA fingerprinting.

References

1. Jones, M., Jones, Geoff, G. and Marchington, P (1999) Physics 2nd ed. Cambridge University Press
2. Jones, M., Jones, Geoff, G, and Acaster D. (1999)Chemistry 2nd ed. Cambridge University Press
3. Blei, I and Odian, G (2006)General, Organic and Biochemistry- Connecting Chemistry to your Life 2nd Ed. W.H. Freeman and Company
4. Kotz, J.C., and Treichel, P(1999) Chemistry and Chemical Reactivity 4th ed. Saunders College Publishing
5. Wilson, K., and Walker, J (2000) Practical Biochemistry- Principles and Techniques5th ed. Cambridge Low Price Editions, Cambridge University Press

SEMESTER 4

ZB4CRP04 - CORE COURSE10
RADIOLOGY AND ADVANCED INSTRUMENTATIONTECHNIQUES
(PRACTICALS)

36 Hrs
2 Credits

1. Types and effects of various radiations. Isotope dilution techniques. (Visit to a radioisotope lab.) **(14 Hrs)**
2. Problems in radiology [on half cycle, quantity, disposal] **(14 Hrs)**
3. Agarose gelelectrophoresis: AGE **(8 Hrs)**

SEMESTER 4

ZB4CRT11 - CORE COURSE 11
ENTREPRENEURSHIP DEVELOPMENT AND MARKETING

54 Hrs
3 Credits

Objectives

1. To understand the importance of marketing strategies and effects on entrepreneurial development.

Module 1 **8 Hrs**

Institutions, financing procedure and financial incentives.

Module 2 **10 Hrs**

Resource management: man, machine and materials, quality control/ quality assurance and testing of products

Module 3 **12 Hrs**

Elements of marketing & sales management [Nature of product and marketstrategy, packaging and advertising, after sales service]

Module 4 **12 Hrs**

Income tax, sales tax and excise rules

Module 5 **12 Hrs**

Need, scope and approaches for project formulation, structure of project reports.Project implementation, project report and appraisal. Network analysis –PERT,CPM
Entrepreneur traits of entrepreneur

References

1. Khanna, O.P. and Sarup A.(1999)Industrial Engineering and Management, Dhanpat Rai Publications (P) Ltd.
2. Khanna, O.P (1999). Work Study,Dhanpat Rai Publications (P) Ltd.
3. Khanna, O.P (1999)Textbook of Mecahnical Estimating and Costing, Dhanpat Rai Publications (P) Ltd.

SEMESTER 4

CORE COURSE 11
ENTREPRENEURSHIP DEVELOPMENT AND MARKETING
(PRACTICALS)

36 Hrs
2 Credits

1. Preparation and analysis of a project **(14 Hrs)**
2. Entrepreneurial motivation training through games, role playing, discussions and exercises **(8 Hrs)**
3. Preparation of report on an industry/firm **(14 Hrs)**

SEMESTER IV

CORE COURSE 12

RESEARCH METHODOLOGY, BIOPHYSICS AND BIOSTATISTICS

54 Hrs

3 Credits

Objectives

1. To familiarise the learner the basic concept of scientific method in research process.
2. To have a knowledge on various research designs.
3. To develop skill in research communication and scientific documentation.
4. To create awareness about the laws and ethical values in biology.
5. To equip the students with the basic techniques of animal rearing collection and preservation
6. To help the student to apply statistical methods in biological studies.

RESEARCH METHODOLOGY

Module I **13 Hrs**

Basic concepts of research: Meaning, Objectives, Approaches, Types of research.
Research Process: Scientific method in research (eight steps).
Importance of literature reviewing in defining a problem,
Identifying gap areas from literature review.
Research Communication and scientific documentation: Project proposal writing,
Research report writing, (Structure of a scientific paper), Thesis, dissertation, research article.
Presentation techniques: Oral presentation, Assignment, Seminar, Debate, Workshop, Colloquium, Conference
Sources of Information: Primary and secondary sources. Library- Books, Journals, Periodicals, Reviews, Internet.

Search engines Online libraries, e-Books, e-Encyclopedia, Institutional Websites.

Plagiarism

Module II **12 Hrs**

Animal Collection – Tools &techniques

Sampling techniques

Quadrate

Line transect

Measurements

Density

Abundance

Frequency

Biodiversity indices – concepts

Simpson index

Collection methods, techniques and equipments

Plankton

Insects

Fish

Bird

Preservation techniques – Taxidermy

Rearing techniques

Laboratory and field.

Units of measurements- units, SI system, Equivalent weight, normality, molarity

Biophysics

Module III **14 Hrs**

Basic understanding on principle and uses of the following:

Microscopy

(a) Light microscopy, Bright field (Compound Microscope), Phase contrast, Dark field microscopy, Fluorescence, Polorization microscopy, Video microscopy.

(b) Electron - Scanning (SEM), Transmission (TEM) and STEM

Micrometry – Stage and Eyepiece micrometers

Camera Lucida

Instrumentation

pH Meter

Separation Techniques: Centrifuge, Chromatography, Electrophoresis

Analytical techniques: Colorimeter, Spectrophotometer, X-ray crystallography

BIOETHICS

Module IV **5 Hrs**

Bioethics : Introduction, Animal rights and animal laws in India, Prevention of cruelty to animals Act 1960, Biodiversity Act 2003.

Concept of 3 R – conservation (Refined- to minimize suffering, Reduced – to minimize animals, Replaced – modern tools and alternate means), Animal use in research and education.

Laboratory animal use, care and welfare, Animal protection initiatives- Animal Welfare Board of India, CPCSEA, ethical commitment. Working with human: Consent,harm, risk and benefits.

BIOSTATISTICS **10 Hrs**

Module V

Sample & Sampling techniques: Collection of data, classification of data, frequency distribution tables, graphical representation: - Bar diagrams, Histogram, Pie diagram and Frequency curves - Ogives.

Measures of Central Tendency: Mean, Median, Mode (Problem - Direct method only)

Measures of dispersion: Range, Quartile Deviation, Mean Deviation, Standard Deviation, Standard error. (Merits & demerits and problems on SD).

Correlation: Definition, Types of correlation.(mention in brief)

Test of Hypothesis and Test of Significance: Basic concept, Levels of significance, test of significance, Procedure for testing hypothesis, types of hypothesis- Null hypothesis and Alternate hypothesis.

References :

1. Gupta K.C, Bhamrah, H.S and G.S.Sandhu (2006) Research Techniques in Biological Sciences. Dominant Publishers and Distributors, New Delhi.

2. Khan and Khanum, (1990) Fundamentals of biostatistics.Press, Chicago,

3. Rastogi, V.B (2009) Fundamentals of Biostatistics, Ane Books Pvt. Ltd. New Delhi.

4. Ackoff, R.L. (1962) Scientific Method, New York : John Wiley Press.

5. Aggarwal. S.K.(2009) Foundation Course in Biology, 2nd Ed.. Ane's Student Edition. Ane Books Pvt. Ltd.

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20. Ruxton, G.D. and Colegrave, N. (2006), Experinmental design for the life sciences. Oxford University Press.

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22. Taylor D.J. Green N.P.O and Stout G.W. (2008). Biological science (3rd edition- R.S. Oper Ed). Cambridge University press.

PRACTICAL

RESEARCH METHODOLOGY, BIOPHYSICS AND BIOSTATISTICS

2 credits

PART A. RESEARCH METHODOLOGY

Animal collection Tools, Techniques & Estimation

1. Quadrate study
2. Transect study
3. Sampling Methods
4. Species area curve
5. Simpson index

PART B - BIOPHYSICS

6. Study of simple and compound light microscopes
7. Micrometry –calibration and measurement of microscopic objects –low power
8. Camera Lucida (draw a few diagrams using Camera Lucida)
9. Paper chromatography (demonstration only)
10. Instrumentation – demonstration (write notes on principle, equipment and its use)

    pH Meter

    Colorimeter/ Spectrophotometer

Centrifuge

PART C BIOSTATISTICS

1. MS Excel : To create mean and median, Construction of bar diagram, Pie diagram and Line graphs.
2. MS Access: To create grade of students
3. Internet: Access a web page on any biological topic.
4. Frequency distribution of the given samples to find out arithmetic mean, median, mode.
5. Range and standard deviation for a biological data
6. Correlation using any biological data.
7. Graphical representation of data. Construction of bar diagrams, Histograms, Pie diagram and Line graphs.

SEMESTER V.

CORE COURSE 13
ENVIRONMENTAL BIOLOGY AND HUMAN RIGHTS

(54 Hrs)

Objectives

To instill the basic concepts of Environmental Sciences, Ecosystems, Natural Resources, Population, Environment and Society

To make the students aware of natural resources, their protection, conservation, the factors polluting the environment, their impacts and control measures.

To teach the basic concepts of toxicology, their impact on human health and remedial measures

To create a consciousness regarding Biodiversity, environmental issues & conservation strategies

To develop the real sense of Human rights – its concepts & manifestations

MODULE 1 ECOSYSTEM 12 Hrs

Basic concepts of ecosystem Components of ecosystem: Abiotic (Sunlight, temperature, soil, water, atmosphere) and Biotic components (Producers, consumers, decomposers), Ecological pyramid- number, biomass, energy, **Functions of ecosystem**: Productivity-Food chain-Food web-Energy flow-Laws of Thermodynamics.Types of Ecosystem: Terrestrial-Forest-Grassland-Desert, Aquatic-Marine-Fresh water, Wetland &Biome **Concept of limiting factors:** Liebig's and Shelford's laws of limiting factors.

Biogeochemical cycles: Concept, gaseous and sedimentary cycles, Carbon cycle, Nitrogen cycle. **Renewable resources (**solar,wind, hydroelectric, biomass and geothermal) **and Non renewable resources** (mineral and metal ore, fossil fuels)

MODULE 2 CONCEPTS OF POPULATION AND COMMUNITY 8 Hrs

Concept of population: Population attributes- Population growth forms, Basic concepts of growth rates, density, natality, mortality, growth curves

Animal interactions: Positive- Commensalism- Mutualism-Protocooperation, Negative-Predation-Parasitism-Competition-Antibiosis

Characteristics of a community: Species diversity- richness, eveness, stratification, dominance, ecological indicators, Ecotone and Edge effect, Keystone species, Concepts of Ecological Niche and Guild, Ecological succession, community evolution- climax.

MODULE 3 BIODIVERSITY AND ENVIRONMENTAL ISSUES 16 Hrs

Introduction to Biodiversity: Types of biodiversity- Alpha, Beta and Gamma diversity. **Concept and importance of Biodiversity**: Levels of Biodiversity-Species diversity, Genetic diversity, Microbial, Ecosystem diversity, India as a mega-diversity nation, Biodiversity hotspots

Global Environmental Issues: Ozone depletion, Greenhouse effect, Global warming, Climate change, Carbon trading, carbon credit; Carbon sequestration, Acid rain, Oil spills, Nuclear accidents, IPCC/UNFCC.

National Environmental issues: Deforestation, forest fire, pollution(air, water, soil, noise thermal, nuclear- brief account only) solid waste management, sewage, drinking water crisis and water logging,

Toxic products and disaster: Types of toxic substances – degradable, non degradable, Impact on human – case studies: Endosulphan tragedy, Bhopal disaster

Flood, drought, cyclone, earthquake and landslide (Management and mitigation)

Local Environmental issues: Landscape alteration, sand mining, quarrying, changing crop pattern, conversion of paddy lands,

Threats to water resources of Kerala: Degrading Mangrove and wetland ecosystems of Kerala, RAMSAR sites, Marine ecosystem crisis- pollution, overfishing etc. Impact of tourism on Environment.

MODULE 4 CONSERVATION OF BIODIVERSITY 12 Hrs

Protected area concept – Sanctuary, National Park, Biosphere reserve, Core Zone, Buffer Zone, Corridor concept. Conservation reserves

Concept of threatened fauna – IUCN categories - extinct, extinct in the wild, critically endangered, endangered, vulnerable, near threatened, least concern and data deficient. Red and Green Data Books.

Man–animal conflict (Tiger, Elephant, Dog, Monkey) – causes and concern

Water conservation- rainwater harvestiong, watershed management

Environment education

Environmental laws (Brief account only): The Water (Prevention and Control of Pollution) Act, 1974, The Air (Prevention and Control of Pollution) Act, 1981, Indian Forests Act (Revised) 1982. The Environment (Protection) Act, 1986, Hazardous Wastes (Management and Handling) Rules, 1989, The Forest (Conservation) Act, 1980, The Wildlife Protection Act, 1972, Biodiversity Act, 2002.

MODULE 5 HUMAN RIGHTS 6 Hrs

Introduction, main concepts associated with Human Rights, Different types of human rights,

Manifestations & phenomena, Role of agencies in promoting human rights, Mechanisms for checking violations of human rights, National human right commission, Constitutional provisions related to Human rights.

References

Erach Bharucha 2008 (UGC). Text Book of Environmental Studies of Undergraduate course. University Press.

J.B Sharma (2009), Environmental studies' - 3rdEd. University science Press

Misra S.P., Pandy S.N. 2009Essential Environmental Students, Ane books Pvt. Ltd.

P.D Sharma (2012), Ecology and Environment' - 11th Ed. Rastogi Publications

R.B Singh & Suresh Mishra PaulamiMaiti (1996), Biodiversity – Perception, Peril and Preservation' — PHI Learning , Environmental Law in India: Issues and Responses

Rajagopalan,R. 2005.*Environmental Studies from Crisis to Cure*. Oxford University Press, New Delhi.

Paul R.C., 2000.Situations of Human Rights in India. Efficient offset printers. ·

Arun kumar Palai(1999) National Human Rights Commission of India, Atlantic publishers

Sharma P.D. (2005)Environmental biology and Toxicology, Rastogi publication

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Alan Beeby, 2006 Anne – Maria Brennan First Ecology, Ecological principles and Environmental issues . International students edition Sec. edition Oxford University Press.

Robert Ricklefs (2001). The Ecology of Nature. Fifth Edition. W.H. Freeman and Company.

Stiling Peter (2002). Ecology: Theories and applications. Prentice Hall of India pvt.Ltd. New Delhi.

Landis, Wayne and Hing-hoYu, Baca Raton, 1995. Introduction to Environmental Toxicology: Impacts of chemicals upon Ecological systems: Lewis Publishers.

SEMESTER 5 PRACTICAL

ENVIRONMENTAL BIOLOGY & TOXICOLOGY

36 HRS **CREDIT 1**

1. Estimation of dissolved Oxygen
2. Estimation of carbon di oxide
3. Estimation of soil organic carbon (Demonstration only)
4. Identification of marine/ fresh water planktons
5. Counting of plankton using plankton counting chamber
6. Study of equipments – Secchi disc, Plankton net
7. Study of sandy shore fauna, rocky shore fauna.
8. Study of animal Association
9. Visit to any two important areas of bio diversity: 1. Forest, 2.Sea shore, 3. Mangrove, 3. Wet lands, 4. Bird sanctuary, 5. Wild life sanctuary, 6. Sacred groves
10. Field study (compulsory)

SEMESTER V.

CORE COURSE 14

CELL BIOLOGYAND GENETICS

54 Hrs

Credits 3

Objectives

1. To understand the structure and function of the cell as the fundamentals for understanding the functioning of all living organisms.
2. To make aware of different cell organelles, their structure and role in living organisms.
3. To develop critical thinking, skill and research aptitudes in basic and applied biology
4. To emphasize the central role of genes and their inheritance in the life of all organisms.

CELL BIOLOGY **22 HRS**

Module I **6 Hrs**

Introduction of cell and Diversity of cells: History, Cell theory, Prokaryotes, Eukaryotes, Mycoplasmas, Virus, Virions and Viroids, Prions.

Cell membrane & Permeability: Molecular models of cell membrane (Sandwich model, Unit membrane model, Fluid mosaic model). Cell properties - permeability, Transport [Diffusion, Osmosis, Passive transport, Active transport, bulk transport], Cell coat and Cell recognition.

Module II **10 Hrs**

Cell Organelles : Structure and functions of following cell organelles: Endoplasmic reticulum - Structure and functions. Ribosomes (Prokaryotic and Eukaryotic) Golgi complex - Structure and functions. Lysosomes - Polymorphism - GERL concept, functions. Mitochondria - Structure and functions. Nucleus: Structure and functions of interphase nucleus, Nuclear membrane, pore complex, structure and functions of nucleolus

Chromosomes – Structure & organization, Heterochromatin, Euchromatin, Nucleosomes, Polytene chromosomes-Balbiani rings, Endomitosis, Lamp brush chromosomes.

Module III **6 Hrs**

Cell Communication: Basic principles of cell communications,Cell signaling(in brief), Types of signaling, Mention signaling molecules (neurotransmitters, hormones, Growth Factors, Cytokines Vitamin A and D derivatives),

Cell Division: Cell cycle - G_1, S, G_2 and M phases,.Mitosis and Meiosis.The difference between Mitosis and Meiosis.

References:

1 Zoological Society of Kerala Study material. 2002. *Cell Biology, Genetics and Biotechnology*

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.5. Thomas A.P (Editor) (2011) *Cell & Molecular Biology The Fundamentals*. Green leaf publications. TIES. Kottaya

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16. James Darnell. (1998) Molecular Biology.Scientific American Books Inc.

GENETICS **32 Hrs**

Module I **10 Hrs**

MendelianGenetics: Mendel's experiments- Monohybrid Cross, Dihybrid Cross, Mendel's Laws, Test Cross, Back Cross and Reciprocal Cross. Chromosome Theory of Inheritance

Interaction of genes: Allelic: Incomplete Dominance (Four O Clock Plant).Co- Dominance (Skin colour in Cattle) Lethal Alleles: Dominant lethal gene[Creeper chicken] and recessive lethal gene
[cystic fibrosis].
Non Allelic: Complementary (Flower colour in Sweet Pea), Supplementary (Coat colour in mice), Epistasis - dominant (Plumage in poultry) and recessive (Coat colour in mice). Polygenes (Skin colour inheritance in man), Pleiotropism (Vestigial wing gene in Drosophila).

Multiple alleles – ABO Blood group system, Rh group and its inheritance. Erythroblastosis foetalis.

Module II **12 Hrs**

Sex determination: Chromosome theory of sex determination (Autosome and Sex chromosomes), male heterogamy and female heterogamy, (xx-xy, xx-xo, ZZ-ZW, ZZ-ZO), Genic Balance theory of Bridges. Barr bodies, Lyon's hypothesis, Gynandromorphism, sex mosaics, intersex (Drosophila), Hormonal [free martin in calf] and Environmental (Bonelia) influence on Sex determination

Recombination and Linkage: Linkage and recombination of genes based on Morgan's work in Drosophila, Linked genes, Linkage groups, Chromosome theory of Linkage, Types of linkage- complete and incomplete. Recombination, cross over value, chromosome mapping. [Definition]

Sex Linked inheritance : Characteristics of Sex Linked inheritance, X Linked inheritance of man (Hemophilia), Y linked inheritance [Holandric genes] , Incompletely Sex Linked genes or pseudoautosomal genes (Bobbed bristles in *Drosophila*), Sex limited genes (Beard in man) and Sex influenced genes (inheritance of baldness in man).

Module III **10 Hrs**

Mutation: Types of mutations - Somatic, germinal, spontaneous, induced, autosomal and allosomal, chromosomal mutations, structural and numerical changes. Gene mutations. [Addition, Deletion and substitution].

HumanGenetics: Karyotyping, Normal Human chromosome Complement, Pedigree analysis, Aneuploidy and Non- disjunction. Autosomal abnormalities (Down syndrome, Cry du chat syndrome) Sex chromosomal abnormalities (Klinefelters syndrome, Turner's syndrome) Single gene disorder (Brief mention) Autosomal single gene disorder [sickle cell anaemia), Inborn errors of metabolism such as phenylketonuria, alkaptonuria, , Albinism. Multifactorial traits – polygenic disorder- cleft lip and cleft palate.

Genetic Counseling, Eugenics and Euthenics -Brief account only

References:

1. Gardner, J.E., Simmons, J.M and Snustad D.P..(2007). *Principles of Genetics* (8th edn.). John Wiley and Sons, India.

2. Klug, W.S and Cummings,M.R. (2011). *Concepts of Genetics* (7th edn).Pearson Education Inc.India.

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SEMESTER V

PRACTICAL

CELL BIOLOGY AND GENETICS

36 Hrs

2 Credits

PART A: CELL BIOLOGY

1. Squash preparation of onion root tip for mitotic stages

2. Mounting of polytene chromosome (Drosophila/Chironomous.) Demonstration

3. Tissues (permanent slides of epithelial tissues, striated muscle, smooth muscle, cartilage, bone)

4. Identification of cell organelles

5. Preparation of temporary whole mount.

6. Preparation of permanent whole mount (demonstration)

7. Preparation of human blood smear and identification of Leucocytes

PART B :GENETICS

1. Genetic problems on Monohybrid, Dihybrid Crosses and Blood group inheritance

2. Study of normal male and female human karyotype (use photographs or Xerox copies)

3. Abnormal human karyotypes - Down, Edwards , Klinefelter and Turner syndromes (use photographs or Xerox copies)

4. Sexing of Drosophila.

5. Study of Barr body in human buccal epithelium

SEMESTER V.

CORE COURSE - 15: EVOLUTION, ETHOLOGY & ZOOGEOGRAPHY

54 Hrs

Credits 3

Objectives:

- To acquire knowledge about the evolutionary history of earth - living and nonliving
- To acquire basic understanding about evolutionary concepts and theories
- To study the distribution of animals on earth, its pattern, evolution and causative factors
- To impart basic knowledge on animal behavioural patterns and their role

Prerequisite:

- Basic knowledge on principles of inheritance and variation
- Knowledge on molecular basis of inheritance
- Basic understanding on the mechanism and factors affecting evolution
- Knowledge on origin and evolution of man

PART I - EVOLUTION **30 Hrs**

Module I - Origin of life **8 Hrs**

Theories - Panspermia theory or Cosmozoic theory, Theory of spontaneous generation (Abiogenesis or Autogenesis), Special creation, Biogenesis, Endosymbiosis.

Chemical evolution - Haldane and Oparin theory, Miller-Urey experiment;

Direct evidences of evolution – Recapitulation Theory of Haeckel, Fossilization, Kinds of fossils, fossil dating, Homologous organs and analogous organs.

Module II - Theories of organic evolution **9 Hrs**

Lamarckism and its Criticism, Weismann's Germplasm theory, Darwinism and its Criticism, Neo-Darwinism, Theory of De Vries,

Population genetics and evolution: Hardy-Weinberg Equilibrium, gene pool, gene frequency. Factors that upset Hardy-Weinberg Equilibrium, Effects of genetic drift on population: Bottleneck effect and founder effect

Module III – Nature of evolution **13 Hrs**

Species and Speciation: Species concept, subdivisions of species (sub species, sibling species, cline and deme), Speciation: Types of speciation, Phyletic speciation (autogenous and allogenous transformations), True speciation, Instantaneous and gradual speciation, allopatric and sympatric speciation

Isolation: Types of isolating mechanisms-Geographic isolation (mention examples) and Reproductive isolation. Role of isolating mechanisms in evolution

Microevolution, Macroevolution (Adaptive radiation -Darwin finches) Mega evolution, Punctuated equilibrium, Geological time scale, and Mass extinction (brief account only). Evolution of Horse

PART II - ETHOLOGY **14 Hrs**

Module IV– Introduction **1 Hr**

Definition, History and scope of ethology

Module V – Learning, imprinting and behaviour **9 Hrs**

Types of learning with examples; patterns of behaviors – types of rhythms, navigation, homing instinct, hibernation, aestivation; pheromones- types and their effect on behavior, hormones and their action on behavior (aggressive and parental behavior)

Module VI – Social organization **4 Hrs**

Social organization in insects (ants) and mammals (monkey), Courtship behaviour and reproductive strategies

PART III - ZOOGEOGRAPHY **10 Hrs**

Module VII – General Topics **4 Hrs**

Continental drift theory, Types and means of animal distribution, Factors affecting animal distribution; insular fauna – oceanic islands and continental islands,

Module VIII - Zoogeographical realms **6 Hrs**

Palaearctic region, Nearctic region, Neotropical region, Ethiopian region, Oriental region, Australian region (brief account with physical features and fauna, Wallace's line, Weber's line, Biogeography of India with special reference to Western Ghats

References:

EVOLUTION

1. Barton, N. H., Briggs, D. E. G., Eisen, J. A., Goldstein, D. B. and Patel, N. H. (2007). Evolution.Cold Spring, Harbour Laboratory Press.
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10. Coyne J.A. and Allen Orr H. (2004). Speciation, Sinauer Associates
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ETHOLOGY

1. Agarwal. V. K. (2009). Animal Behaviour.S.Chand and Company Pvt. Ltd., New Delhi.
2. Bonner, J.T. (1980). The Evolution of Culture in Animals. Princeton University Press.NJ, USA.

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5. Dunbar, R. (1988). Primate Social Systems. Croom Helm, London.
6. Gundevia J.S. and Singh H.G. (1996), A Text Book of Animal Behaviour. S. Chand and Company Pvt. Ltd., New Delhi.
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ZOOGEOGRAPHY

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2. Chandran Subash M.D. (1997). On the ecological history of the Western Ghats.Current Science, Vol.73, No.2.146-155.
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4. Daniels, R.J.R and Vencatesan J. (2008), Western Ghats Biodiversity. People Conservation; Rupa& Co. New Delhi. India.
5. Mani, M.S. (1974). Ecology and Biogeography of India; The Hague: .Dr. W. Junk b.v. Publishers,
6. Nair, C.S. (1991). The Southern Western Ghats: A Biodiversity Conservation Plan. INTACH, New Delhi.
7. Ramesh, B.R and R Gurukkal (2007), Forest Landscapes of the Southern Western Ghats, India- Biodiversity, Human Ecology and management Strategies. (French Institute of Pondicherry) India.
8. Tiwari, S. (1985), Readings in Indian Zoogeography (vol.1). Today & Tomorrow Printers & Publishers

PRACTICAL

EVOLUTION, ETHOLOGY & ZOOGEOGRAPHY

36 Hrs

Credit 1

1. Identification of Zoogeographical realms using map
2. Study on endemic species of each realm

3. Show the discontinuous distribution of (lung fishes, camel, elephant)
4. Providing a map trace the route of HMS Beagle
5. Providing a map mark any two continental/oceanic islands.: Greenland, Madagascar, New Zealand, New Guinea, Maldives, Iceland, Hawaii – any two
6. Contributions of scientists (showing photos) - Any four
7. Identification of different stages of horse evolution
8. Study on Homology and Analogy
9. Study on connecting links (*Peripatus*, Archaeopteryx, *Protopterus*, Echidna)
10. Pheromone traps
11. Skinner box & T Maze
12. Experiment to demonstrate phototaxis and chemotaxis using Drosophila/House fly
13. Identification of behaviour (Grooming/courtship dance of flamingos/stickle back fish/ Tail wagging dance/ Aggressive behaviour/ Auto/Allo grooming, Flehmen response) showing pictures (Any five)

SEMESTER V.

CORE COURSE VIII

HUMAN PHYSIOLOGY, BIOCHEMISTRY AND ENDOCRINOLOGY

54 Hrs

Credits 3

Objectives:

1. This course will provide students with a deep knowledge in biochemistry, physiology and endocrinology.

2. Defining and explaining the basic principles of biochemistry useful for biological studies for illustrating different kinds of food, their structure, function and metabolism.

3. Explaining various aspects of physiological activities of animals with special reference to humans.

4. Students will acquire a broad understanding of the hormonal regulation of physiological processes in invertebrates and vertebrates.

5. By the end of the course, students should be familiar with hormonal regulation of physiological systems in several invertebrate and vertebrate systems.

6. This also will provide a basic understanding of the experimental methods and designs that can be used for further study and research.

7. The achievement of above objectives along with periodic class discussions of current events in science, will benefit students in their further studies in the biological/physiological sciences and health-related fields, and will contribute to the critical societal goal of a scientifically literate citizenry.

HUMAN PHYSIOLOGY **31 Hrs**

Module I **8 Hrs**

Nutrition: Nutritional requirements – carbohydrates, proteins, lipids, minerals (Ca, P, Fe, I), vitamins (sources and deficiency disorders). Importance of dietary fibre and antioxidants.Balanced diet, Recommended Dietary Allowance (RDA). Nutrition during pregnancy and lactation, Infant nutrition, Malnutrition(PEM).

Digestion: Anatomy and histology of digestive glands (liver, pancreas, salivary, gastric and intestinal). Digestion and absorption of carbohydrates, proteins and fats.Nervous and hormonal control of digestion.

Module II **8 Hrs**

Respiration: Phases of respiration (external respiration, gas transport and internal respiration). Respiratory pigments: Haemoglobin, Myoglobin (Structure and Function). Transport of respiratory gases - transport of oxygen, oxyhaemoglobin curve, factors affecting oxyhaemoglobin curve, transport of carbon dioxide,(chloride shift). Control of respiration.Respiratory disturbances (Hypoxia, Hypercapnia, Asphyxia).Physiological effect of smoking, carbon monoxide poisoning, Oxygen therapy and artificial respiration.

Circulation: ESR, Haemopoiesis, blood pressure, ECG. Haemostasis (blood coagulation) – clotting factors, intrinsic and extrinsic pathways, anticoagulants and its mechanism of action.Cardiovascular diseases (Jaundice, Atherosclerosis, Myocardial infarction, Thrombus, Stroke).Angiogram and angioplasty.

Module III **5 Hrs**

Excretion: **H**istology of Bowman's capsule and tubular part. Urine formation – glomerular filtration, tubular reabsorption, tubular secretion.Urine concentration – counter current

mechanism. Acid – base balance, hormonal regulation of kidney function. Renal disorders (kidney stone, acute and chronic renal failure, and dialysis). Homeostasis: Definition, concept and importance in biological system. Thermal regulation and thermal adaptation in homeotherms.

Module IV **10 Hrs**

Nerve physiology: Ultra structure of neuron. Nerve impulse production (resting membrane potential, action potential), transmission of impulse along the nerve fiber, interneuron (synaptic) transmission, neuromuscular junction and transmission of impulses.Neurotransmitters (acetyl choline, adrenalin, dopamine).EEG. Memory, Neural disorders (brief account on Dyslexia, Parkinson's disease, Alzheimer's disease, Epilepsy).

Muscle physiology: Ultra structure of striated muscle, muscle proteins (myosin, actin, tropomyosin, troponin), Muscle contraction and relaxation-Sliding Filament Theory, cross bridge cycle, biochemical changes and ATP production in muscle, Cori cycle. Kymograph, Simple muscle twitch, muscle fatigue, tetanus, rigor mortis.

BIOCHEMISTRY **15 Hrs**

Module V **5 Hrs**

Carbohydrates: Basic structure, biological importance and classification of monosaccharides, oligosaccharides, polysaccharides with examples.

Proteins: Basic structure and classification of amino acids; structure, biological importance and classification of proteins with examples.

Lipids: Structure of fatty acid, saturated and unsaturated fatty acid, biological importance and classification of lipids with examples.

Vitamins and minerals: Major fat soluble and water soluble vitamins. Important minerals and trace elements required for living organisms. Biological importance of vitamins and minerals.

Enzymes: Chemical nature of enzymes, enzyme activation, enzyme inhibition, allosteric enzymes, isoenzymes, co-enzymes. Michaelis–Menten enzyme kinetics.

Module VI **10 Hrs**

Carbohydrate metabolism: Glycogenesis, Glycogenolysis, Gluconeogenesis, Hexose monophosphate Shunt, Glycolysis, Citric Acid Cycle, Electron Transport Chain and ATP synthesis. Ethanol metabolism.

Protein metabolism: Deamination, Transamination, Transmethylation, Decarboxylation, Ornithine cycle.

Lipid metabolism: Biosynthesis of fatty acids, Beta oxidation, physiologically important compounds synthesized from cholesterol.

ENDOCRINOLOGY

Endocrinology and reproduction **8 Hrs**

Module VII **8 Hrs**

Endocrine physiology: Hormones – classification and mechanism of hormone action. Major endocrine glands(Histology is not included) their hormones, functions and disorders (hypothalamus, pituitary gland, pineal gland, thyroid gland, parathyroid gland, islets of Langerhans, adrenal gland),. Homeostasis and feedback mechanism.

References:

Albert L. Lehninger, Michael Cox and David L. Nelson; 2004; Biochemistry Lehninger. Palgrave – Macmillan.

Arthur C. Guyton and John E. Hall; 2016; Text Book of Medical Physiology: Guyton, 13th edition; Elsevier

Barrington, E. J. W.; 1975; General and Comparative Endocrinology, Oxford, Clarendon Press.

Bhagavan, N.V.. 2007. Medical biochemistry, fourth edition Academic Press,

Awapara J, 1968. Introduction to Biological chemistry. Prentice Hall. New Jersey

Geetha N. 2014. Textbook of Medical Physiology:. Paras Medical Publishers, 3rd edition

Jain, A K.; 2016; Textbook of Physiology., Avichal Publishing Company

Martin, C.R. 1985.Endocrine Physiology: Oxford University Press.

Melmed, Shlomo, Williams, Robert Hardin; 2011; Textbook of Endocrinology: Elsevier, 12th edition.

PRACTICAL

HUMAN PHYSIOLOGY, BIOCHEMISTRY AND ENDOCRINOLOGY

36 Hrs

Credit1

HUMAN PHYSIOLOGY

1). Determination of haemoglobin content of blood

2). Total RBC count using Haemocytometer

3). Total WBC count using Haemocytometer

4). Estimation of microhaematocrit

5). Effect of hypertonic, hypotonic and isotonic solutions on the diameter of RBC.

6). Instruments: Kymograph, Sphygmomanometer and Stethoscope (principle and use)

7). Measurement of blood pressure using sphygmomanometer(demonstration only)

BIOCHEMISTRY

1. Qualitative analysis of protein, glucose, starch and lipids.
2. Chromatography – Determination of Rf value of amino acids and identification of amino acids (Identify the Amino Acids using different solvent front and solute front)

ENDOCRINOLOGY

1. Cockroach – Corpora cardiaca &Corpora allata (Demonstration)

2. Effect of adrenalin on heart beat of Cockroach (Demonstration)

SEMESTER VI.

CORE COURSE 17
DEVELOPMENTAL BIOLOGY

54 Hrs

3 Credits

Objectives:

1. To achieve a basic understanding of the experimental methods and designs that can be used for future studies and research.
2. To provide the students with the periodicclass discussions of current events in science which will benefitthem in their future studies in the biological/physiological sciences and health-related fields
3. To contribute tocritical societal goal of a scientifically literate citizenry.

Module1 **10 Hrs**

Introduction: Definition, Scope of developmental biology, sub-divisions (descriptive, comparative, experimental and chemical), historical perspectives, basic concepts and theories.

Reproductive Physiology: Gonads- anatomy of testis and ovary, spermatogenesis, oogenesis, gonadal hormones and their functions. Hormonal control of human reproduction - Female reproductive cycles (Estrous cycle, Menstrual cycle). Structure of mammalian sperm and egg, Pregnancy, parturition and lactation.Reproductive health and importance of sex education.

Egg types: Classification of eggs based on the amount, distribution and position of yolk. Mosaic and regulative, cleidoic and noncleidoic eggs.Polarity and symmetry of egg.

Fertilization: Mechanism of fertilization-(Encounter of spermatozoa and Ova, Approach of the Spermatozoon to the Egg, Acrosome Reaction and Contact of Sperm and Ovum, Activation of Ovum, Migration of Pronuclei and Amphimixis,), Significance of fertilization, Polyspermy, Parthenogenesis- Different types and significance.

Module II **14 Hrs**

Cleavage: Types, planes and patterns of cleavage, Cell lineage of Planaria. Influence of yolk on cleavage.

Blastulation: Morula, blastula formation, types of blastula with examples.

Fate maps: Concept of fate maps, construction of fate maps (artificial and natural), structure of a typical chordate fate map. Significance of fate map.

Gastrulation: Major events in gastrulation. Morphogenetic cell movements. Influence of yolk on gastrulation. Exogastrulation.Concept of germ layers and derivatives.

Cell differentiation and gene action: Potency of embryonic cells (Totipotency, Pleuripotency, Unipotency of embryonic cells). Determination and differentiation in embryonic development, Gene action during development with reference to Drosophila (maternal effect genes), Zygotic genes.

Module III **20 Hrs**

Embryology of Frog: Gametes, fertilization, cleavage, blastulation, fatemap, gastrulation, neurulation, notogenesis. Differentaition of Mesoderm and Endoderm, Development of eye.Metamorphosis of frog, Hormonal and environmental onrol.

Embryology of chick: Structure of egg, fertilization, cleavage, blastulation, fate map, gastrulation. Development and role of Primitive streak, Salient features of 18hour, 24 hour, 33 hour & 48 hour chick embryo.Extra embryonic membranes in chick.

Human development: Fertilisation, cleavage, blastocyst, implantation, placenta. Gestation, parturition and lactation.Human intervention in reproduction, contraception and birth control. Infertility, Invitro fertilization (test tube baby)

Module IV **5 Hrs**

Experimental embryology: Spemann's constriction experiments, Organizers and embryonic induction. Embryo transfer technology, cloning, stem cell research. Ethical issues.

Teratology / Dysmorphology, Developmental defects: Teratogenesis, important teratogenic agents.(Radiations, chemicals and drugs, infectious diseases) genetic teratogenesis in human beings,

Developmental defects: Prenatal death (miscarriage and still birth). Intrauterine Growth Retardation (IUGR).

Module V **5 Hrs**

General topics: Classification and functions of placenta in mammals. Prenatal diagnosis (Amniocentesis, Chorionic villi sampling, Ultra sound scanning, Foetoscopy, Maternal serum alpha-fetoprotein, Maternal serum beta-HCG).Regeneration in animals.

References:

Anthony S. Fauci, Eugene Braunwald, Dennis L. Kasper,Stephen L. Hauser, Dan L. Longo, J. Larry Jameson and Joseph Loscalzo; 2008; Harriosns Principles of Internal Medicine; Chruch Livingston 17th Ed.

Balnisky B.I.; 1981 An Introduction to Embryology, W.B. Saunders and Co.

Berril, N..J.; and Kars, G.; 1986. Developmental biology, Mc Graw Hills

Dutta 2007 Obstrestics , Church Livingston 17 Ed

Majumdar N. N -1985 Vetebrate embryology; Tata McGraw-Hill, New Delhi

Melissa A & Gibbs, 2006; A practical Guide to Developmental Biology, Oxford university press (Int. student edition)

Scott F. Gilbert; 2003; Developmental biology; Sinauer Associates Inc.,U.S.; 7th Revised edition.

Vijayakumarn Nair, K. & George, P. V. 2002. A manual of developmental biology, Continental publications , Trivandrum

Taylor D J, Green NPO & G W Stout. (2008) Biological Science third edition. Cambridge university press. Ref pp 748 biology 755

PRACTICAL

DEVELOPMENTAL BIOLOGY

36 Hrs

Credit 1

Model/Chart/ Slide may be used

12. Embryological studies- Blastula (frog, chick)
13. Embryo transfer, cloning, gastrula (frog, chick)
14. Amniocentesis
15. Embryotransfer technology, cloning
16. Study of placenta- pig and man
17. 18 hour, 24 hour, 33 hour and 48 hour chick embryo.

18. Candling method.
19. Vital staining- demonstration.
20. Male and female reproductive organs in cockroach
21. Calculate the fecundity of fish.
22. Calculate the gonado-somatic index of given fish.

SEMESTER VI.

CORE COURSE 18. MICROBIOLOGY & IMMUNOLOGY

54 Hrs

MICROBIOLOGY

Module I **10 Hrs**

Introduction: History and scope of microbiology. Outline classification of Microbes. (bacteria, fungus & virus)

Methods in Microbiology: Sterilization and disinfection - physical and chemical methods.

Culture media – selective media, enrichment media, differential media.Plating techniques and isolation of pure colony. Culture preservation techniques: refrigeration, deep freezing, freezing under liquid nitrogen, lyophilization.

Module II **15 Hrs**

Morphology and fine structure of bacteria: Size, shape, cilia, pili, flagella, capsule, cell wall and its composition. Cytoplasmic membrane, protoplast, spheroplast, intracellular membrane systems, cytoplasm, vacuoles, genetic material, cell inclusions, bacterial spores.

Bacterial growth Curve, Staining techniques – gram staining.

Bacterial Reproduction Sexual – (conjugation, transduction)and Asexual (budding,, fragmentation). Virology: Structure of virus; Human, animal, and bacterial virus. Viral replication, cultivation of animal viruses.

Module III **8 Hrs**

Infections & Diseases:Types of infections – primary, secondary and nosocomial infections.

(Brief Account only)Contagious diseases – epidemic, endemic and pandemic, mode of Transmission – food, water, air, vectors and carriers.

Diseases: Epidemiology, symptomology, diagnosis and treatment. Bacterial - Clostridium tetany (tetanus), Viral – HIV virus (AIDS), fungal –*Candida albicans* (candidiasis).

IMMUNOLOGY

Module IV **9Hrs**

Introduction to Immunology: Innate and acquired immunity, passive (natural and artificial) and active immunity (Natural and Artificial).Mechanisms of innate immunity - barriers, inflammation, phagocytosis.

Lymphoid organs: Primary (Thymus, Bone marrow) and secondary lymphoid organs (lymph nodes, spleen).

Lymphocytes: T and B cells, Natural killer cells, memory cells, macrophages.

Module V **9Hrs**

Antigens, Types of antigens, haptens,adjuvants, immunoglobulin structure, classes and functions of immunoglobulins.

Types of Immunity- , humoral & cell mediated immunity Monoclonal & polyclonal antibodies

Antigen – antibody reactions, Precipitation test, Agglutination test, VDRL WIDAL, ELISA. Auto immune diseases: Pernicious Anemia, Rheumatoid Arthritis. Immunodeficiency -

AIDS. Hyper sensitivity- Type I, (E.g. Anaphylaxix) II(Transfusion reaction) , III (Arthus reaction) and IV (Mantaux Test) (in brief).

Vaccines **3 Hrs**

Introduction Types of vaccines, Current Vaccines, Recent trends in vaccine preparation

References

1. Ananthanarayan R & Jayaram Paniker C K. (2009) Text Book of Microbiology Orient

Longman Private Ltd.

2. Gladys Francis & Mini K.D., (Editors) (2012), Microbiology, Zoological Society of Kerala, Kottayam.

3. Kuby J, Kindt T., Goldsby R. and Osborne B. (2007). Kuby immunology

4. Sharma K. (2005) Manual of Microbiology: Tools and Techniques, Ane books

5. Susan Panicker & George Abraham (Editors) (2008), Micro Biology and Immunology, Zoological Society of Kerala, Kottayam.

6. Colemen: (2002). Fundamentals of Immunology

7. Darla J. Wise & Gordon R. Carter: (2004): Immunology A Comprehensive Review Iowa state University Press. A Blackwell science company,

8. Hans G. Sch, Legal General Microbiology, Seventh Ed. Cambridge Low Price Ed.

9. Helen Hapel, Maused Harney Siraj Misbah and Next Snowden: (2006) Essentials of Clinical Immunology Fifth Ed. Blackwell Publishing Company,

10. Heritage, J, E.G.V. Evaus and R.A.Killungten (2007): Introductory Microbiology Cambridge University Press 6. Ivan Roitt I (2002) Essentials of Immunology ELBS.

MICROBIOLOGY AND IMMUNOLOGY

PRACTICAL

72 Hrs

2 Credits

1. Instruments –Autoclave, Hot air oven, Bacteriological incubator – Laminar air flow
2. Preparation of solid and liquid media for microbial cultures.
   (Ingradients, pH and method of preparation) (Demonstration)

(a) Solid media (1) Nutrient agar (2) Mac Conkey's agar

(b) Liquid Media(1) Nutrient broth (2) Peptone water.

3. Culture methods (Demonstration)

(a) Streak plate technique and isolation of pure colonies.

(b) Lawn culture (c) Pour plate culture (d) Liquid culture

4. Examination of microbes in living condition

Hanging drop method for demonstrating motility of bacteria.

5. Gram staining – preparation, procedure, identification of Gram + ve and Gram –ve bacteria.

6. Antibiotic sensitivity test (demonstration only)

7. Streak plating (individual performance)

8. Preparation of a fungal smear – Lactophenol cotton blue staining and mounting

9. Determination of ABO blood groups and Rh factor (Antigen – antibody Reaction)

10. Study through photographs/ illustration, the primary immune (Bone marrow and thymus) and secondary immune (spleen and lymph nodes) organs in Rat/Man

SEMESTER VI.

CORE COURSE 19

BIOTECHNOLOGY, BIOINFORMATICS & MOLECULAR BIOLOGY

BIOTECHNOLOGY **20 HRS**

Module I **11 Hrs**

Introduction: Scope, Brief History, Scope and Importance

Tools and Techniques in Biotechnology: Enzymes (restriction endonucleases, ligases, linkers & adapters), Vectors-[Plasmids, Phage vectors, Cosmids, Artificial Chromosomes] Host cells. Basic steps & techniques in rDNA technology

Gene Libraries, Construction of genomic library and cDNA Library. PCR technique and DNA amplification, Brief description of screening methods – Probes, Nucleic Acid hydridization, In situ Hybridization, Fluorescence in situ Hybridization (FISH), Colony hybridization. Methods of transfer of desired gene into target cell.Blotting Techniques- Southern, Northern, Western blotting.DNA Finger printing (DNA Profiling) and its application. Molecular markers - RFLP

Module II **9 Hrs**

Animal Cell Culture: Brief account on methods, substrates, media and procedure of animal cell culture, Stem Cells, types and potential use, Organismal Cloning- reproductive & therapeutic- brief account only.

Applications of Biotechnology: Applications in Medicine(insulin, growth hormone, gene therapy), Agriculture(GM plants and biopesticides),Environment(bioremediation), Industry (Single Cell Protein) and applications of Fermentation Technology- lactic acid, vitamins, food and beverages.

Potential Hazards of Biotechnological Inventions: Risks related to genetically modified organisms (GMO) and biologically active products, Biological warfare & Biopiracy. Protection of biotechnological inventions.Intellectual Property Rights, Patenting and patent protection.

References

1. Singh B.D Biotechnology 2002. Kalyan Publishers New Delhi.

2. Brown C.H., Campbell I & Priest F, G. 1987. Introduction of Biotechnology (Blackwell scientific publishers Oxford).

3. Colin Ratledge Bijorn Kristiansesn, 2008. Basic Biotechnology 3 rd ed. Cambridge University.

4. Janarathanan S & Vincent S. 2007. Practical Biotechnology, Method of Protocols. University Press.

5. John E. Smith. Biotechnology Cambridge Low priced ed. (Third Ed) 2005 Madingan, Martinko and Parker 2002, Biology of Microorganisms, Brock Eighth Ed. Prentice Hall.

6. Singh B.D. Biotechnolgy 2002, Kalyan Publishers New Delhi.

7. Sudha Gangal 2007. Biotechnology Principles and & practice of Animal Tissue culture, Universities Press.

BIOINFORMATICS **14 Hrs**

Module III **8 Hrs**

Introduction: Definition, importance and role of bioinformatics in life sciences. Computational Biology.

Biological databases: Nucleotide sequence databases (NCBI- GENBANK, DDBJ and EMBL). Protein databases - structure and sequence databases (PDB, SWISSPROT and UNIPROT). Introduction to Sequences alignments: Local alignment and Global alignment, Pair wise alignment (BLAST and FASTA] and multiple sequence alignment. Phylogenetic Tree construction and Analysis

Module IV **6 Hrs**

Molecular visualization software - RASMOL. Basic concepts of Drug discovery pipe line, computer aided drug discovery and its applications. Human Genome Project.

MOLECULAR BIOLOGY **20 Hrs**

Module V **8 Hrs**

Nature of Genetic Materials: Discovery of DNA as genetic material – Griffith's transformation experiments. Avery Macarty and Macleod, Hershey Chase Experiment of Bacteriophage infection, Prokaryotic genome; Eukaryotic genome.Structure and.types of DNA & RNA.DNA replication. Modern concept of gene (Cistron, muton, recon, viral genes)., Brief account of the following-- Split genes (introns and exons), Junk genes, Pseudogenes, Overlapping genes, Transposons.

Module VI **12 Hrs**

Gene Expressions: Central Dogma of molecular biology and central dogma reverse, one gene-one enzyme hypothesis, One gene-one polypeptide hypothesis Characteristics of genetic code, Contributions of Hargobind Khorana.

Protein synthesis [prokaryotic]: Transcription of mRNA, Reverse transcription, post transcriptional modifications, Translation, Post translational modifications.

Gene regulations: Prokaryotic(inducible & repressible systems) Operon concept -Lac operon and Tryptophan operon, Brief account of Eukaryotic gene regulation.

References

1. Bruce Albert, Bray Dennis, Levis Julian, Raff Martin, Roberts Keith and Watson James (2008). Molecular Biology of the Cell, V Edition, Garland publishing Inc., New York and London.

2. De Robertis, E.D.P. and De Robertis, E.M.F. (2006).Cell and Molecular Biology.VIII Edition. Lippincott Williams and Wilkins, Philadelphia.

3. Gupta, P. K (2002) Cell and Molecular Biology, (2ed), , Rastogi Publications., Meerut

4. James Darnell. (1998) Molecular Biology. Scientific American Books Inc

5. Thomas AP(Editor). 2011 Cell &Molecular Biology The Fundamentals. Green leaf publications .TIES Kottayam

6. Zoological Society of Kerala Study material. (2011) Cell and Molecular Biology

PRACTICAL SYLLABUS.

(BIOTECHNOLOGY, BIOINFORMATICS & MOLECULAR BIOLOGY)

BIOTECHNOLOGY

1. Identify and comment on the item provided: (Western blotting / Southern blotting / Northern blotting / PCR)
2. Write down the procedure involved in DNA isolation

BIOINFORMATICS

1. Download/use print out/pictures of genome sequences of any 2 organisms. Identify and mention the characteristic features of both.
2. Download/ use print out/pictures of a protein sequence , identify it & comment on its amino acid composition
3. Download / use print out/pictures of a macromolecule. Write a brief note on the bioinformatics tool used to visualize its structure.

MOLECULAR BIOLOGY

1. Identify and comment on its molecular composition / structural orientation / functional significance (Any tissue / Cell organelles/ DNA, DNA replication, RNA different types using models or diagrams)

V1 SEMESTER.
CORE COURSE 20.
OCCUPATIONAL ZOOLOGY .
(APICULTURE, VERMICULTURE, QUAIL FARMING & AQUACULTURE)

54 Hrs
Credits 3

Objectives:

1. To equip the students with self employment capabilities.
2. To provide scientific knowledge of profitablefarming.
3. To make the students aware of cottage industries.

Module 1. APICULTURE **18 Hrs**

Definition, Different species of honey bees, Organization of honey bee colony, Social life and adaptation of honey bees. Communication among honey bees. Bee keeping methods and equipments, Management and maintenance of an apiary, Growth period, honey flow period and dearth period Division of the colony, uniting two colonies, , replacing old queen with new queen, swarming management, monsoon management. Enemies of bees. Diseases of bees,.Bee pasturage. Uses of honey bees, By-products of honey bees, Honey and wax composition. Testing the quality of honey.Extraction of wax, Uses of honey and wax.Royal jelly, Propolis. Apitherapy, Agencies supporting apiculture.

Activity :Visitto an apiculture unit.
Field visit and report submission - 10 Hrs
Field visit and report submission on any two items are taken for internal evaluation.

MODULE: 2. VERMICULTURE **8 Hrs**

Introduction, Ecological classification of earth worms. Species of earth worms used for vermicultre, Reproduction & life cycle, Role of earth worm in solid waste management, in agriculture, in medicine etc. Preparation of vermibed, Maintenance & monitoring, Preparation of vermicompost, Preparation of vermiwash.

Activity : Submission of a report after preparing a vermiculture unit or visiting a vermicomposting unit.

MODULE: 3.QUAIL FARMING (*Coturnix coturnix*) 4 hrs

Introduction, care of quail chicks, care of adult quails, care of breeding quails, ration for quail, care of hatching eggs, health care, use of quail egg and meat.Sources of quality chicks.

MODULE: 4. AQUACULTURE. 24 Hrs

Advantages and salient features of aquaculture, Types of Aquaculture, Biotic and abiotic features of water, Importance of algae in aquaculture, Common cultivable fishes of Kerala, Fish diseases, Composite fish culture, Integrated fish culture, Carp culture, Prawn culture Mussel culture Pearl culture. Processing & Preservation.

Aquarium management - Setting up of an aquarium, Biological filter & Aeration, Breeding of gold fish, gourami (Osphronemus), fighter and Guppy (live bearer). Nutrition and types of feed for aquarium fishes, Establishment of commercial ornamental fish culture unit. Fish Transportation - Live fish packing and transport Common diseases of aquarium fishes and their management. Aquaponics (a brief introduction only).

Activity – Setting up of an Aquarium

Field visit – Visiting an Aquaculture farm

References:

NPCS Board, The complete book on Bee keeping and honey processing, NIIR Project consultancy services, 106E, Kamala nagar, Delhi- 110007.

Shukla G.S, & Updhyay V.B, Economic zoology ,Rastogi Publ. Meerut.

Pradip.V.Jabde , Text book of applied zoology, 2005

Applied Zoology, Study Material Zoological Society of Kerala , CMS college Campus

Clive. A Edwards, Norman. Q. & Rhonda. 2011. Vermitechnology: earthworms, organic waste & environmental management.
Chauhan, H.V.S. Poultry, Disease, diagnosis and treatment, Wiley eastern Ltd Delhi.
Otieno.F.O 2014. Quail farming: markets & market strategies
Pillai T.V.R., Aquaculture, principles and practices.
Ronald j. Roberts (1978) Fish pathology , Cassel Ltd London.
Cowey C. B. *et. al*. (1985) Nutrition and feeding in fishes, academy press.
Farm made aquafeeds. FAO fisheries Technical paper, 343.
Harisankar J. Alappat& A. Bijukumar, Aquarium Fishes. B. R. Publ. Corporation, Delhi.
MPEDA, A hand Book on AquafarmingOrnamentalfishes, MPEDA, Kochi.
Amber Richards. 2014. Aquaponics at home.
Pradip.V.Jabde. 1993. Text book of applied zoology
Venkitaraman, P.R,1983, Text book of Economic zoology(SudharsanaPuubl. Kochi)
Addison Webb, Bee Keepingfor profit and pleasure, Agrobios Ltd.
Edwards.C.A.&Lafty, J.R.1972 Biology of earthworms(Chapman & Hall Led.London)
Applied Zoology, Study Material Zoological Society of Kerala , CMS college Campus
George cust& Peter Bird, Tropical Fresh water Aquaria, Hamlyn London.
Verreth J. Fish larval nutrition, Chapman & Hall Publ.
Bone Packer. 2014. Aquaponic system

PRACTICAL

Occupational Zoology

36 Hrs

Credit 1

1. General Identification, Economic importance, Morphology, scientific names and common names of the following

   f) Economic important and morphology of culturable fishes (Catla, Rohu, Grass carp, Common carp, Silver carp, *Etroplus suratensis*, *Oreochromis /Tilapia, Mugil cephalus* and *Anabas Testudineus*)

   g) Identification and morphology of ornamental fishes (gold fish, fighter, Gourami, Angel fish, Guppy

   h) Two species of earthworms used in Vermiculture

i) Four species of honey bees

j) Economic importance and morphology of shell fishes (Any three species of prawn, two marine mussels, two oysters one rock oyster - *Crasostria* and pearl oyster - *Pinctada fucata* and freshwater mussel - *Lamellidens marginalis*).

2. Castes of bees

3. Principle & uses of - Aquarium filters, Aquarium aerator, Aquarium plants,Oven, Pelletiser, Screw Press, die plate

4. Identification and study of fish parasites and diseases (five numbers each) using slides/pictures

5. Bee keeping equipments, Beehive, Smoker, honey extractor, Queen Cage,

6. Bees wax, Honey, Vermicompost (Identification-Uses)

7. Formulation of artificial feed for aquarium fishes – demonstration

8. Tests for determining the adulteration in honey.

9. Mounting of pollen basket

10. Mounting of mouth parts of honey bee

11. Separation of cocoon from worm castings.

SEMESTER V. OPEN COURSES (FOR OTHER STREAMS)

1. VOCATIONAL ZOOLOGY 72 Hrs

4hrs/Week, Credits 3

Objectives of the Course

- To develop critical thinking skill and research aptitude among students, by introducing the frontier areas of the biological science.
- To emphasize the central role that biological sciences plays in the life of all organisms.
- To introduce the student to some of the present and future applications of bio-sciences

- To acquire basic knowledge and skills in aquarium management, Quail farming, vermicomposting and apiculture for self-employment
- To learn the different resources available and to develop an attitude towards sustainability
- Give awareness to society about need for waste management and organic farming

Module 1Aquarium management 12 Hrs

General introduction to Aquarium, Aims and types of aquarium (material, size and shape), Requirements of an aquarium - filtration of waste, physical, chemical and biological; Setting an aquarium (self-sustainable with biological filters), Major indigenous aquarium fishes of Kerala.

Activity: Setting up of a freshwater aquariumand rearing of aquarium fishes

Module 2Ornamental Fish Culture 20 Hrs

Introduction to ornamental fishes: Present status of ornamental fish culture in India with special reference to Kerala, Breeding of Gold fish, Fighter, Gourami (*Osphroneus),* and Guppy (live bearer). Nutrition and types feed for aquarium fishes,Use of live fish feed organisms in Ornamental fish culture. Methods and techniques involved in the formulation of fish feed. Fish Transportation: Live fish packing and transport, Common diseases of aquarium fishes and their management**.** Establishment of commercial ornamental fish culture unit,

Activity: field visit to an ornamental fish breeding Centre to understand breeding practices of various aquarium fishes.

Module 3Quail farming (*Coturnix coturnix*) 10 Hrs

Introduction, care of quail chicks, care of adult quails, care of breeding quails ,ration for quail, care of hatching eggs, health care, use of quail egg and meat, Sources of quality chicks.

Activity: Visit to a quail farm or viewing a quail documentary to familiarize the quail farming practices

Module 5Vermiculture and composting 12 Hrs

Introduction, ecological classification of earth worms, Life history, Species of earth worms used for vermicultre, Preparation of vermibed; Preparation of vermicompost, Preparation of vermiwash, Maintenance and management of vermicomposting unit, Role of vermiculture in solid waste management.

Activity: - Preparation of a vermiculture unit or visit to a vermicomposting unit.

Module 6 Apiculture 18 Hrs

Definition, Uses of bees, species of bees cultured, organization of honey bee colony, bee keeping methods (modern method only) and equipments, management and maintenance of an apiary-growth period, dividing the colony, uniting two colonies, replacing old queen with new queen, honey flow period, Bee pasturage, Death period, Enemies of bees, Bee diseases, uses of honey and wax, Apitherapy, Propolis, Royal jelly, Agencies supporting apiculture.

Activity: Identify different types of honey bees and rearing equipments

Field visit and report Submission

Field visit and report writing on any two items are taken for internal evaluation, instead of assignment and seminar. Conduct a workshop on various cultural practices and the preparation of byproducts.

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OPEN COURSE(FOR OTHER STREAMS)

2. PUBLIC HEALTH AND NUTRITION

72 Hrs

4hrs/Week

Credits 3

Objectives:

- To inculcate a general awareness among the students regarding the real sense of health.
- To understand the role of balanced diet in maintaining health.
- To motivate them to practice yoga and meditation in day-to-day life.

PART I HEALTH, EXERCISE & NUTRITION

Module 1 Definition and Meaning of Health **10 Hrs**

Dimensions and Determination of Health

Physical Activity and Health benefits

Effect of exercise on body systems – Circulatory, Respiratory, Endocrine, Skeletal and Muscular

Programmes on Community health promotion (Individual, Family and Society)

Dangers of alcoholic and drug abuse, medico-legal implications

Module 2 Nutrition and Health 10 Hrs

Concept of Food and Nutrition, Balanced diet

Vitamins, Malnutrition, Deficiency Disease

Determining Caloric intake and expenditure

Obesity, causes and preventing measures

Role of Diet and Exercise, BMI

Module 3 Safety Education in Health promotion 8 Hrs

Principles of Accident prevention

Health and Safety in daily life.

Health and Safety at work.

First aid and emergency care.

Common injuries and their management.

Modern life style and hypokinetic diseases.

Diabetese, Cardiovasculard disorders-Prevention and Management.

Module 4 Life Skill Education 8 Hrs

Life skills, emotional adjustment and well being,. Yoga, Meditation and Relaxation, Psychoneuroimmunology

PART II PUBLIC HEALTH AND SANITATION

Module 5 Public health and water quality. 11 Hrs

Potable water, Health and Water quality

Faecal bacteriae and pathogenic microorganisms transmitted by water.

Determination of sanitary quality of drinking water, water purification techniques

Module 6 Public health and diseases 15 Hrs

Water borne dseases-Cholera and Typhoid.Prevention of Water borne diseases.

Food borne diseases and Prevention

Botulinum, Salmenellosis, Hepatitis A

Vector borne diseases & Control measures

Chikungunya , Filariasis and Dengu fever

Zoonotic disease-Leptospirosis & its control

Emerging diseases - Swine flue (H1N1), bird flue (H5N1),

SARS, Anthrax

Re-emerging diseases –TB, Malaria

Health Centre visit & Report Presentation **10 Hrs**

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SEMESTER V.

OPEN COURSE (FOR OTHER STREAMS)

3. MAN, NATURE AND SUSTAINABLE DEVELOPMENT

72 Hrs

4Hrs/Week

Credits 3

Objectives:

8. To understand how Man originated and attained present status
9. To learn the basic concepts of Ecosystems and its functioning
10. To study the use and abuse of nature by Man
11. To learn the different resources available on earth
12. To study global environmental problems and its impact on human well being

13. To appreciate the perspectives of Man on nature and learn the strategies for conservation

14. To familiarize with sustainable development and develop an attitude for sustainability

Module I.Man in Nature **10 Hrs**

Introduction

Evolution of Man

Out of Africa and Candelabra Model

The Fossils and the Molecular Evidences

Hunter-Gatherer and the Agriculturist

Speech and Languages

Cultural Evolution

Altruism and Morality

Module II.The Biosphere **10 Hrs**

Earth-Continents and Continental drift

Concept of Landscapes and Habitats

Lithosphere- Forest (Tropical and Temperate)

Grasslands, Deserts and Montane

The Biomes of the World

Hydrosphere- Oceans, Estuaries

Freshwater

Water the Elixir of Life

Atmosphere- Structure and stratification

Module III.Dominance of Man on Earth **7 Hrs**

Industrial Revolution

Human Population Growth

Resource Utilization

Environmental Consequences

Modern Agriculture and Green Revolution

Environmental Impacts

Imperialism and its Ecological Root

Module IV.Natural Resources **7 Hrs**

Renewable and Non- renewable

Biodiversity

Importance of Biodiversity -the Six E ^{S}

Hotspots of Biodiversity

Biotic Richness of India

Monoculture and loss of Genetic Diversity

Extinction Crisis, IUCN and Red Data Book

Module V.Global Environmental Issues Threatening Natural Resources and Human Life

10 Hrs

Deforestation, Landscape alterations, Soil erosion, Flood and Drought, Desertification, Overexploitation, Pollution (Air, Water and Soil- Pollutants and Consequences only), Acid rain, Ozone depletion, Greenhouse effect and Global Warming (use case studies to illustrate the points) Waste disposal (Biodegradable and Non-degradable eg. Plastic and E- waste), Oil spill Energy - Production, Consumption and its Impact on Environment Quality of the Environment and Human Health

Module VI.Man's Perspective on Nature **10 Hrs**

Eco Spirituality, Eco-theology and Eco-feminism

Community initiatives

Indigenous People's Perspective (tribal and traditional communities)

Native American, Amazonian, Australian Aborigines, Bishnoi Contributions of -John Muir, Aldo Leopold, Thoreau, Rachel Carson Edward Abbey, Arne Ness, Carolyn Merchant,Vandana Shiva

Module VII. Global Strategies for Conservation **8 Hrs**

UN conference on Man and Environment-1972

UNEP and its Contributions

The World Conservation Strategy-1980

World Commission on Environment and Development

The Earth Summit -1992

The UNFCC and IPCC

Conservation Strategies in India-MoEF

Legal System- Mention Major Conservation Acts

People's Participation in Conservation:

Chipko Movement and Narmada Bachao Andolan,

Silent Valley

Module VIII Sustainable Development **10 Hrs**

Definition and Concept

Principles and Goals

Environment versus Development Debate

Johannesburg Conference -2002

Strategies for Sustainable development

Sustainable Development in the era of Globalization

Gandhian Environmentalism

Education for Sustainable Development (UNESCO-ESD)

Building a Sustainable society

Sustainable life styles

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SEMESTER VI.

ZOOLOGY CORE CHOICE BASED COURSES

FOR B.Sc. ZOOLOGY PROGRAMME

ELECTIVE COURSE I

ECOTOURISM & SUSTAINABLE DEVELOPMENT

72 Hrs

4hrs/week

Credits 3

Objectives:

1. To introduce the concepts, principles and applications of tourism and its sustainability
2. To critically analyse the cost and benefits of ecotourism, including related laws and policies, community involvement and future trends
3. To develop an appreciation among students with respect to tourism development from the sustainability perspective
4. To equip the students with basic knowledge for the emerging ecotourism industry

Module I. Fundamentals of Tourism **12 Hrs**

Introduction- Tourism, concepts and definitions

History, types, Characteristics

The facilitating sectors

Attractions

Geography, heritage

Wildlife, nature

Quality Control

Module II. Major areas of eco-tourism **10 Hrs**

Concepts, practices and case studies for each:

Marine tourism

Wildlife tourism

Adventure tourism

Module III. Emerging trends in eco-tourism **10 Hrs**

Cultural tourism

Pilgrimage tourism

Farm tourism

Backwater tourism

Health tourism

Module IV. Problems and prospects of eco-tourism **10 Hrs**

Economics and benefits of ecotourism

Cultural issues and negative aspects of ecotourism

Environmental Impacts of Tourism

Module V. Sustainable tourism **12 Hrs**

Quality, Standards

Systems of sustainable tourism: environmental, sociocultural, Economical

Environment and conservation: basic principles

Current practices of eco-conservation in tourism industry

Sustainable tourism and society

Community based ecotourism

Eco-development committee (EDC) of Periyar Tiger Rerserve

People initiatives

Module VI. Eco-tourism guides **8 Hrs**

Ecotourism guiding and case studies

Activity

Field visit to Ecologically relevant places & Report writing **10 Hrs**

References:

Bruner, E.M. 2005. *Culture on tour: ethnographies of travel*. The University of Chicago Press.

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ELECTIVE COURSE

2. AGRICULTURAL PEST MANAGEMENT 72 Hrs

4 Hrs/week - 3 Credits

Objectives

1. To acquire basic skills in the observation and study of nature.
2. To impart basic awareness regarding pest problem and crop loss due to their dominance.
3. To inculcate interest in adopting biological control strategies for pest control.
4. To understand various pests affecting our local crops and select the best method for their control
5. To acquire basic knowledge and skills in agriculture management to enable the learner for self-employment.

Module I I0 Hrs

Pest and crop loss: Introduction, historical perspective-origin of pest, Evolution of pest. Causes of pest outbreak- biotic, abiotic and genetic factors.Modern agricultural practices and pest problem - high yielding varieties, monoculture, fertilizers, pesticides, irrigation, and cultural practices.

Module II 10 Hrs

Pest categories: Types of pests- insect pest and non-insect pest.

Insect pest: insect structure and function-external features (body parts), mouth parts of phytophagous insects, internal anatomy, growth, development, reproduction, life cycle and metamorphosis (one example each from ametabolous, hemimetabolous and holometabolous insect), diapause. types of insect pests-key pests, occasional pests, potential pests.

Non insect pests: General features, different types-Rodents(mention the nature of crop loss by them),Mites-Main types of mites; plant injury caused by mite, millipedes and centipedes, slugs and snails (mention the damage of invasive Giant African Snail).

Activity: Identify a minimum of 5 invasive species (plant / animal) in your locality and make a report on their ecological impact.

Module III **7 Hrs**

Pest and plants: Plant feeding insects-plant host range, types of injury, relationship of pest injury and yield.

Host plant resistance: Characterization of resistance, mechanism of resistance (antixenosis, antibiosis, tolerance), biophysical, biochemical and genetic bases of resistance.

Module IV **20 Hrs**

Pest control-principles and practices: Types of control-cultural control, biological control, chemical control, integrated pest management, miscellaneous control.

Cultural control: Water management, tillage, sanitation, plant diversity, crop rotation, planting time, harvesting practices etc

Biological control: Parasitoids and predators, control by insect pathogens. Techniques in biological control-conservation, introduction and augmentation. Biopesticides

Chemical control: Origin of chemical control, chemistry, mode of action and nomenclature (organochlorines, organophosphates, carbamates, synthetic pyrethroids, miscellaneous group) of pesticides, pesticide formulations and pesticide appliances (sprayers and dusters). Brief mention of attractants, repellents, chemosterilants and pheromones

Activity 1: Conduct a workshop on preparation of biopesticides of various types suitable for kitchen garden and agricultural fields.

Integrated Pest Management (IPM)

Miscellaneous control: Mechanical (hand picking, exclusion by screens and barriers, trapping, clipping, pruning etc), physical (hot and cold treatment, moisture, light traps etc), sterility principle

Module V **25 Hrs**

Bionomics and control of major pests of crops and stored grains: Biology, life cycle and nature of damage by different pests of following crops and their control

Pests of paddy: *Leptocorisa acuta*, *Scirpophaga incertulas*, Spodoptera mauritia, *Orseolia oryzae*, *Nilaparvata lugens*

Pests of coconut: *Oryctes rhinoceros, Rhyncophorus ferrugineus, Opisina arenosella, Aceria guerreronis*

Pests of Banana: Cosmopolites sordidus, Pentalonianigronervosa

Pests of vegetables - Brinjal: Leucinodesorbonalis, Euzopheraperticella, Henosepilachnavigintioctopunctata, Urentiushystricellus

Gourds -Bactoceracucurbitae, Anadevidiapeponis, Epilachna spp. Raphidopalpafoveicollis, Baristrichosanthis

Pest of stored grains: Sitophilusoryzae, Corcyra cephalonica Triboliumcastraneum, Trogodermagranarium, Callasobruchuschinensis

Activity 2: Conduct a poster exhibition on various types of pests of paddy, coconut, banana and vegetable varieties of Kerala.

Activity 3: Collect different types of pest of stored grains from the local provision shops or houses and make a taxonomic study and prepare a powerpoint presentation on them.

Activity 4: Visit a minimum of 5 kitchen gardens in the neighborhood and enlist the common traditional pest control measures used in them.

Activity 5: Organise awareness classes on the ill effects of chemical pesticides and manure on human health with the support of local examples.

References

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ELECTIVE COURSE

3. VECTOR AND VECTOR BORNE DISEASES

72 Hrs

3 Credits

Objectives:

Module I **10 Hrs**

Introduction: Vector : mechanical and biological vector, Reservoirs, Host-vector relationship, Vectorial capacity, Host Specificity.

Insect vectors: Mosquitoes, flies, fleas, lice, ticks and bugs- General account of ecology morphology and mouth parts

Module I1 **6 Hrs**

Salient features and distribution of mosquito species:*Anopheles, Aedes, Culex, and Mansonia*.

Module II1 **25 Hrs**

Study of Vector Borne disease[Life cycle and pathology]: Mosquito-borne diseases – Malaria, Dengue, Chikungunya, Filariasis. Sand fly-borne diseases – Leishmaniasis, Phlebotomus fever. Tse- tse fly – sleeping sickness. House fly borne diseases :typhoid fever, cholera, dysentery, anthrax, Myiasis, . Flea-borne diseases – Plague, Typhus fever. Louse-borne diseases –Relapsing fever, Trench fever, Vagabond's disease, Phthiriasis.

Module IV **13 Hrs**

Introduction to Vector control: Aims, objectives and advantages.History and background, recent trends, alternatives to the use of insecticides (chemical & microbial), types of vector control - selective, integrated and comprehensive vector control.

Control measures of mosquitoes, sand fly, tsetse fly and domestic flies

Module V **8Hrs**

Introduction to epidemiology: History, Definition, scope and uses of epidemiology. Epidemiology and public health. Achievements in epidemiology: Smallpox Methyl mercury poisoning Rheumatic fever and rheumatic heart disease Iodine deficiency diseases Tobacco use, asbestos and lung cancer, Hip fractures. HIV/AIDS, SARS.

Field report on two case studies of epidemiology in India. **10 Hrs**

References:

1. Bates M (1949) Natural History of mosquitoes The Macmillan Co.
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ELECTIVE COURSE

4. NUTRITION, HEALTH AND LIFESTYLE MANAGEMENT

72 Hrs.

3 Credi

Objectives:

1. To provide students with a general concept of health and the parameters that define health and wellness.
2. To understand principles of nutrition and its role in health.
3. To familiarize the students regarding food safety, food laws & regulations.
4. To provide knowledge and understanding regarding life style diseases.

5. To promote an understanding of the value of good life style practices, physical fitness and healthy food habits for life style disease management.

Module I **15 Hrs**

Nutrition and health: Nutritional requirements of man, classification of major nutrients including protein,vitamins and minerals, water, role of fibre, biological value of food components, food groups and sources, balanced diet, RDA, BMI, BMR, Calorie intake and expenditure, Healthy eating pyramid, Nutrition in infancy, preschool, school, adolescent, pregnancy, lactation and old age. Nutrition in diseases and special conditions. Food safety: Nutrition education, food sanitation and hygiene, food adulteration and consumer protection.

Module II **18 Hrs**

Understanding of health: Define health, basic concepts, dimensions of health, basic parameters of health care. (Health Parameters: Individual normal standards, devices.1. Blood pressure, 2. Brain activities and sleep, 3.Focus or attention, 4.Pulse, 5. Body temperature, 6. Daily physical activities, 7. Electrocardiogram (ECG), 8.Cardiac fitness 9. Stress, 10. Haematological parameters, 11. BMI

Module III **15 Hrs**

Introduction to Life style diseases

Common life style diseases: Alzheimer's disease and other neural disorders, asthma, cancer, cardio vascular diseases - including hypertension, Atherosclerosis and stroke, chronic obstructive pulmonary disease, Diabetes Mellitus or Type 2 Diabetes, kidney disorders and chronic renal failure, constipation, depression, gastro-intestinal disturbances including diarrhoea and peptic ulcer, liver cirrhosis and other liver diseases, obesity, osteoporosis, occupational lifestyle diseases.

Modern lifestyle disorders: sleeping habits, junk food, poor eating habits, anxiety, food poisoning

Module IV **10 Hrs**

Causes of lifestyle diseases: Defects of modern food habits and unbalanced diet options, food adulteration, environmental pollution, poor life style choices, drug abuse, tobacco smoking, alcohol and drug consumption, lack of adequate exercise, wrong body posture, disturbed biological clock, stressful environmental conditions

Module V **14 Hrs**

Prevention and control of life style diseases:

Healthy life style habits and practices, healthy eating habits, exercise and fitness, good sleep patterns, a strict no to alcohol, drugs, and other illegal drugs. Uncontrollable factors like age, gender, heredity and race.

Healthy diet: disease prevention through appropriate diet and nutrition, avoiding foods that are high in fats, salt and refined products. Avoid junk food and replace by natural food/ organic food.

Physical exercise: Moderate exercise for fitness of body, walking, stretching, right postures of sitting & standing, relaxation and cutting down of stress, sports, aerobic exercise and yoga.

Health literacy as a public health goal: Awareness programs in schools, colleges and through mass media.

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MODEL III

B.Sc. *(INDUSTRIAL MICROBIOLOGY & ZOOLOGY)*

(DOUBLE MAIN)

B.Sc. *(INDUSTRIAL MICROBIOLOGY & ZOOLOGY)*
(DOUBLE MAIN)

MODEL –III DOUBLE MAIN – INDUSTRIAL MICROBIOLOGY.

B.Sc. INDUSTRIAL MICROBIOLOGY & ZOOLOGY

Total Credits 120
Total Instructional Hours 150

a. SCHEME OF DISTRIBUTION OF HOURS, CREDITS & EXAMINATIONS

i. THEORY

Theory Examinations will be conducted by the University at the end of the respective semester in which the course is conducted. Duration 3 Hrs (Internal External ratio =1:4)

SEMESTER 1

No	Course Code	Course Title	Course Category	Hrs per week	Credits	Marks ratio	
						Intl	Extl
1		English- *(From Board of studies - English)*	Common Course	5	4	1	4
2	1ZICRT01	Fundamentals of microbiology	Core Course 1 : Theory	2	2	1	4
3		Fundamentals of microbiology	Core Course 1 : Practical	2	0	0	0
4	IZ1CRT02	Microbial Diversity	Core Course 2 : Theory	2	2	1	4
5		Microbial Diversity	Core Course 2 : Practical	2	0	0	0
6	IZ1CRT03	Microbial physiology	Core Course 3 : Theory	2	2	1	4
7		Microbial physiology	Core Course 3 : Practical	2	0	0	0
8		Biochemistry-1 (From Board of Studies Biochemistry)	Complementary I : Theory	2	2	1	4
9		Practical	Complementary I : Practical	2	0	0	0
		‘Computer Science -I (From Board of Studies	Complementary II : Theory	2	2	1	4

		- Computer Science)					
		Practical	Complementary II : Practical	2	0	0	0
Total				**25 hrs**	**16**		

SEMESTER 2

No	Course Code	Course Title	Course Category	Hrs per week	Credits	Marks ratio	
						Intl	Extl
1		English *(From Board of studies – English*	Common Course	5	4	1	4
3	IZ2CRT04	Microbial waste management	Core Course 4 : Theory	2	2	1	4
4		Microbial waste management	Core Course 4 : Practical	2	2	1	4
5	IZ2CRT05	Medical microbiology	Core Course 5 : Theory	2	2	1	4
6		Medical microbiology	Core Course 5 : Practical	2	2	1	4
7	IZ2CRT06	Agricultural microbiology	Core Course 6 : Theory	2	2	1	4
8		Agricultural microbiology	Core Course 6 : Practical	2	2	1	4
8		Biochemistry-2 (From Board of Studies - Biochemistry)	Complementary I : Theory	2	2	1	4
9		Practical	Complementary I : Practical	2	2	1	4
		Computer Science – 2 (From Board of Studies – Computer Science)	Complementary II : Theory	2	2	1	4
		Practical	Complementary II : Practical	2	2	1	4
Total				**25 hrs**	**24**		

SEMESTER 3

No	Course Code	Course Title	Course Category	Hrs per week	Credits	Marks ratio	
						Intl	Extl
1	IZ3CRT07	Microbial Genetics and Recombinant DNA Technology	Core Course 7 : Theory	3	3	1	4
2		Microbial Genetics and Recombinant DNA Technology	Core Course 7 : Practical	2	0	0	0
3	IZ3CRT08	Industrial Microbiology	Core Course 8 : Theory	3	3	1	4
4		Industrial Microbiology	Core Course 8 : Practical	2	0	0	0
5	IZ3CRT09	Fermentation Technology	Core Course 9 : Theory	3	3	1	4
6		Fermentation Technology	Core Course 9 : Practical	2	0	0	0
7		Biochemistry-3(From Board Of Studies“ Biochemistry)	Complementary I : Theory	3	3	1	4
8		Practical	Complementary I : Practical	2	0	0	0
9		Computer science-3 (From Board Of studies, Computer Science)	Complementary II : Theory	3	3	1	4
10		Practical	Complementary II : Practical	2	0	0	0
Total				**25 hrs**	**15**		

SEMESTER 4

No	Course Code	Course Title	Course Category	Hrs per week	Credits	Marks ratio	
						Intl	Extl
1	IZ4CRT10	Food microbiology	Core Course 10 : Theory	3	3	1	4
2		Food microbiology	Core Course 10 : Practical	2	2	1	4
3	IZ4CRT11	Diary microbiology	Core Course 11 : Theory	3	3	1	4
4		Diary microbiology	Core Course 11 : Practical	2	2	1	4
5	ZY4CRT04	Research methodology,Biophysics & Biostatistics *(*Core Course IVof *Board of Studies - Zoology)*	Core Course 12 : Theory	3	3	1	4
6		Research methodology, Biophysics &Biostatistics	Core Course 12 : Practical	2	2	1	4
7		Biochemistry - 4 (From Board of Studies - Biochemistry)	Complementary I : Theory	3	3	1	4
8		Practical	Complementary I : Practical	2	2	1	4
9		Computer Science - 4 (From Board of Studies – Computer Science)	Complementary II : Theory	3	3	1	4
10		Practical	Complementary II : Practical	2	2	1	4
Total				**25 hrs**	**25**		

SEMESTER 5

No	Course Code	Course Title	Course Category	Hrs per week	Credits	Marks ratio	
						Intl	Extl
1	ZY5CRT05	Environmental Biology & Human rights	Core Course 13 : Theory	3	3	1	4
2	ZY5CRPO5	Environmental Biology & Human rights	Core Course 13 : Practical	2	0	0	0
3	ZY5CRT06	Cell Biology & Genetics	Core Course 14 : Theory	3	3	1	4
4	ZY5CRPO6	Cell Biology & Genetics	Core Course 14 : Practical	2	0	0	0
5	ZY5CRT07	Evolution, Ethology & Zoogeography	Core Course 15 : Theory	3	3	1	4
6	ZY5CRPO7	Evolution, Ethology & Zoogeography	Core Course 15 : Practical	2	0	0	0
7	ZY5CRT08	Human Physiology, Biochemistry & Endocrinology	Core Course 16 : Theory	3	3	1	4
8	ZY5CRPO8	Human Physiology, Biochemistry & Endocrinology	Core Course 16 : Practical	2	0	0	0
9	ZY5OPT01	1 – Vocational Zoology (Apiculture, Vermiculture, Ornamental fish culture)	Open Courses for other streams *(Select any one out of three)*	4	3	1	4
	ZY5OPT02	2 – Public health and Nutrition					
	ZY5OPT03	3 – Man, nature & Sustainable Development					
		Project work & Field Visit/Study Tour, Visit to research institutes , Group activity	Project work	1	0		
Total				**25 hrs**	**15**		

SEMESTER 6

No	Course Code	Course Title	Course Category	Hrs per week	Credits	Marks ratio	
						Intl	Extl
1	ZY6CRT09	Developmental Biology	Core Course 17 : Theory	3	3	1	4
2	ZY6CRP09	Developmental Biology	Core Course 17 : Practical	2	2	1	4
3	ZY6CRT10	Immunology	Core Course 18 : Theory	3	3	1	4
4	ZY6CRP10	Immunology	Core Course 18 : Practical	2	2	1	4
5	ZY6CRT11	Biotechnology, Bioinformatics and Molecular Biology	Core Course 19 : Theory	3	3	1	4
6	ZY6CRP11	Biotechnology, Bioinformatics and Molecular Biology	Core Course 19 : Practical	4	2	1	4
7	ZY6CRT12	Occupational Zoology (Aquaculture, Apiculture, Vermiculture & Quail farming)	Core Course 20 : Theory	3	3	1	4
8	ZY6CRP12	Occupational Zoology (Aquaculture, Apiculture, Vermiculture & Quail farming)	Core Course 20 : Practical	2	2	1	4
9	ZY6CBT01	Elective 1: Ecotourism & Sustainable Development	Choice Based Core Elective Courses *(Select any one out of four)*	3	2	1	4
	ZY6CBT02	Elective 2: Agricultural pest management					
	ZY6CBT03	Elective 3: Vector & Vector bourne Diseases					
	ZY6CBT04	Elective 4: Nutrition, Health & life style management					
10	IZY6PR01	Project work & Field Visit/Study Tour, Visit to research institutes , Group activity	Project		1		
11	ZB6OJT01	OJT 64 Hours (MOC) + 36 hours (Tissue Culture training)	OJT		2		
Total				**25 hrs**	**25**		

ii. SCHEME FOR PRACTICAL EXAMINATION
FOR BSc (Industrial Microbiology & Zoology) Double Main

University Practical Examinations will be conducted at the end of even semesters (Semester II, IV and VI).

Semester	Code	Course	Exam duration	Marks-ratio		Credits
				Internal (I)	External (E)	
II	IZ2CRP01	**Practical 1** (Core 1 & 4)	3 hrs	1	4	2
	IZ2CRP02	**Practical 2** (Core 2 & 5)	3 hrs	1	4	2
	IZ2CRP03	**Practical 3** (**C**ore 3 & 6)	3 hrs	1	4	2
		Complimentary 1 Biochemistry	3 hrs	1	4	2
		Complimentary 2 Computer Science	3hrs	1	4	2
IV	IZ4CRP04	**Practical 4** (Core 7 & 10)	3 hrs	1	4	2
	IZ4CRP05	**Practical 5** (Core 8 & 11)	3 hrs	1	4	2
	IZ4CRP06	**Practical 6** (**C**ore 9 & 12)	3 hrs	1	4	2
		Complimentary 1 Biochemistry	3 hrs	1	4	2
		Complimentary 2 Computer Science	3hrs	1	4	2
VI	ZY6CRP03	**Practical 7** (**C**ore 13 & 17)	3 hrs	1	4	2
	ZY6CRP04	**Practical 8** (**C**ore 14 & 18)	3 hrs	1	4	2
	ZY6CRP05	**Practical 9** (**C**ore 15 & 19)	3 hrs	1	4	2
	ZY6CRP06	**Practical 10** (**C**ore 16 & 20)	3 hrs	1	4	2

b. SYLLABUS
THEORY & PRACTICALS

SEMESTER I
IZ1CRT01 - CORE COURSE 1
FUNDAMENTALS OF MICROBIOLOGY

36 Hrs

2 Credits

Objectives

1. To introduce students to the fascinating world of microbes
2. To define the science of microbiology and describe some of the general methods used in the study and culture of microorganisms
3. To impart awareness on how microbes can be controlled

Module 1 **4 Hrs**

History and Scope of Microbiology
Spontaneous generation theory, Contributions of Leuwenhoek, Louis Pasteur, Robert Koch, Edward Jenner, Joseph Lister, Alexander Fleming, John Tyndall.

Module 2 **8 Hrs**

Morphology and Structure of bacteria.
Size, shape and arrangements of bacteria. Structure and arrangement of bacterial flagella, pili, capsule, structure and composition of Gram positive and Gram negative cell wall. Cytoplasmic membrane, protoplasts, spheroplasts, intracellular membrane systems,mesosomes, cytoplasm, vacuoles, nuclear material, endospores and cysts, cell inclusions

Module 3

8Hrs

Sterilization and disinfection
Sterilization-Principles and methods, physical and chemical methods.,Antibiotics - classification and mechanism of action. Drug resistance, Antibiotic sensitivity tests..

Module 4

8Hrs

Culture media and methods.
Culture media-Definition Media components : Peptone, yeast extract, beef extract, agar, blood/serum – Types : Selective media, Enriched media, Enrichment media, Indicator media, and Differential media, Transport media, Anaerobic media. Aerobic and Anaerobic culture methods.Culture preservation techniques Stains – Acidic, Basic and neutral stains - Staining techniques- Simple staining, differential staining (Gram stain and acid fast stain), Structural staining (spore, flagella, capsule and granule)

Module 5 **8 Hrs**

Microscopy - principles and application – Bright field, Dark field, Phase contrast, Fluorescence, SEM and TEM, ,

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Ingraham, J. L. and Ingraham, C. A. 2004. *Introduction to Microbiology: A case history approach*. 3rd Edition. Thomson Brooks/Cole, Pacific Grove, Ca.

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Black, J. G. 2013. *Microbiology: Principles and Explorations*. 6th Edition, John Wiley and Sons, Inc.

SEMESTER I

CORE COURSE 1
FUNDAMENTALS OF MICROBIOLOGY
(PRACTICAL)

36 Hrs

0 Credit

1. General rules in microbiology laboratory
2. Instrumentation
   a. Microscopy
   b. Incubator
   c. Hot air oven
   d. Autoclave
   e. Quebec colony counter
   f. water bath
3. Sterilization of glass wares
4. Preparation of cotton plug
5. Preparation of media
   Solid media- Nutrient agar , Mac Conkey agar, Blood agar , Chocolate agar, SDA, PDA (for fungi)
   Liquid media- Nutrient broth and Glucose broth
6. Isolation methods.
   a. Serial dilution
   b. Pour plate
   c. Spread plate
   d. Streak plate
   e. Stab culture
7. Antibiotic sensitivity tests.

References

Lammert, J. M. 2006. *Techniques for Microbiology: A Student Handbook*. Benjamin Cummings.

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Murugalatha, N. *et al*. 2012. *Microbiological techniques*. MJP Publishers, Chennai.

Goldman, E. and Green, L. H. 2008. *Practical Handbook of Microbiology*.2nd Edition. CRP Press.

SEMESTER I

IZ1CRT02 - CORE COURSE 2
MICROBIAL DIVERSITY

36 Hrs
2 Credits

Objectives

1. To impart knowledge on major categories of microorganisms and analyze their classification and diversity
2. To describe the differences in prokaryotic and eukaryotic cell morphology and structure

Module 1 **6 Hrs**

Principles of Classification, classification based on morphological characteristics, biochemical characteristics, staining reactions, genetic and molecular characteristics, principles of bacterial taxonomy, Outline classification of Bacteria according to Bergey's manual.

Module II **8 Hrs**

Archaebacteria and extremophiles, brief account on characteristics.Mycoplasma- general properties, structure, cultural characteristics and classification. Actinomycetes – General characteristics and classification, Rickettsiae -Classification, Morphology and distinguishing characteristics

Module III **8 Hrs**

Viruses - general properties, Structure and Replication of Bacteriophages, TMV, HIV. Cultivation of Viruses, Virions, Viroids and Prions

Module IV **6 Hrs**

Fungi –morphological features, classification, reproduction and economic importance, ascomycota, basidiomycota, zygomycota, deuteromycota. Cultivation of fungi, Distinguishing characteristics of *Rhizopus, Mucor, Aspergillus, Penicillium* and *Fusarium*. Yeasts – a brief account on *Candida* and *Saccharomyces*.

Module V **8 Hrs**

Algae- characteristics, morphology and structure. Algal pigments, motility, reproduction, classification and economic importance of algae.Cyanobacteria- distribution, characteristics and classification, Ultra structure of Cyanobacterial cell.

References

Topley, W. W. C., Wilson, G. S., Parker, T. and Collier, L. H. 1990. *Topley and Wilson's Principles of Bacteriology, Virology and Immunology*. 8th Edition. Edward Arnold, London.

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SEMESTER 1

CORE COURSE 2
MICROBIAL DIVERSITY
(PRACTICALS)

36 Hrs

0 Credit

I. Staining techniques

1. Simple staining

2. Differential staining

a. Gram's staining,

b. Acid fast staining

3. Structural staining

a. Endospore staining

b.. Capsule staining

c. Negative staining

4. Fungal staining

Lacto phenol cotton blue mounting

II Bacterial motility analysis

.Hanging drop technique

References

Lammert , J. M. 2006. *Techniques for Microbiology: A Student Handbook.* Benjamin Cummings.

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SEMESTER 1

IZ1CRT03 - CORE COURSE 3
MICROBIAL PHYSIOLOGY

36 Hrs
2 Credits

Objectives

1. To gain a fundamental understanding of cellular composition, membrane transport, energy generation, diversity of metabolic processes, growth and cell death, and techniques used to elucidatephysiological processes.
2. To get a better understanding of how microbes grow, how they respond and in turn influence their environments.

Module 1 **4 Hrs**

Microbial Nutrition -Nutritional requirements - C, N, P, S, and minerals, Nutritional classification of bacteria. Uptake of nutrients - passive diffusion, facilitated diffusion, Active transport, Group translocation .

Module 2 **10 Hrs**

Bacterial Growth, Bacterial growth curve and generation time.Continuous culturing of bacteria- chemostat, turbidostat,. Effect of Temperature, pH, Oxygen concentration and Radiation on bacterial growth.Enumeration methods of bacteria- SPC, Direct microscopic count, turbidometric estimation. Reproduction and Growth: Modes of cell division- binary fission, budding, and Spore formation.

Module 3 **8 Hrs**

Photosynthesis -Photosynthetic microorganisms, Photosynthetic apparatus in prokaryotes and eukaryotes, photosynthetic pigments, Mechanism of cyclic and non-cyclic photophosphorylation, Calvin cycle.

Module 4 **8 Hrs**

Microbial Metabolism- Glycolysis, Krebs's cycle, Pentose Phosphate Pathway, gluconeogenesis, ED pathway. Fermentation -Alcoholic fermentation, Homo and hetro-lacticacid fermentation.

Module 5 **6 Hrs**

Nitrogen metabolism -Nitrogen Cycle, nitrification, denitrification and ammonification. Transamination and deamination reactions, Nitrogen fixation in symbiotic, associative and free living system, oxygen regulation of nitrogen fixation.

References

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SEMESTER I

CORE COURSE 3
MICROBIAL PHYSIOLOGY

(PRACTICALS)

36 Hrs

0 Credit

1. Effect of pH on the growth of bacteria on solid media
2. Effect of salts on the growth of microorganisms.
3. Effect of temperature on growth of microorganisms.
4. Effects of antibiotics on bacterial growth.
5. Measurement of size – Micrometer
6. Measurement of cell number- Haemocytometer

7. Biochemical test:

a. IMVIC Test

b. Triple sugar iron agar test

c. Urease test

d. Catalase test

e.Oxidase

8. Determination of growth curve of *E.coli*

References

1. Lammert, J. M. 2006. *Techniques for Microbiology: A Student Handbook*. Benjamin Cummings.
2. Aneja, K. R. 2003. *Experiments in Microbiology, Plant Pathology and Biotechnology*. 4th Edition. New Age International (P) Limited, New Delhi.
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5. Kannan, N. 2002. *Laboratory manual in general microbiology*. 2nd Edition, Panima Publishing Co., New Delhi.

6. Gunasekaran, P. 2002. *Laboratory manual in microbiology*. 2nd Edition, New Age International (P) Limited, New Delhi.
7. Kalaichelvan, P. T. 2005. *Microbiology and Biotechnology Laboratory manual*. MJP Publishers, Chennai.
8. Murugalatha, N. *et al*. 2012. *Microbiological techniques*. MJP Publishers, Chennai.
9. Goldman, E. and Green, L. H. 2008. *Practical Handbook of Microbiology*. 2nd Edition. CRP Press.
10. Cappuccino, J. and Sherman, N. 2013. *Microbiology: A Laboratory Manual*. 10th Edition. Benjamin-Cummings Publishing Company, Subs Of Addison Wesley Longman, Inc.
11. Chakraborty, P. and Chakraborty, G. 2005. *Practical pathology*. Vol. 33. Kolkata: New Central Book Agency (P) Ltd.

SEMESTER II

IZ2CRT04 -MICROBIAL WASTE MANAGEMENT

36 Hrs

2 Credits

Module 1 **8 Hrs.**

Solid waste- types and sources of solid waste,

Solid waste disposal; sanitary landfills, composting; static pile, aerated pile, and feed reactor, role of microorganisms in composting.

Vermicomposting –biomethanation.

Module 2 **8 Hrs.**

Liquid waste- sources of liquid waste, components of industrial waste water, treatment of liquid waste; microbiology of municipal sewage;

Sewage treatment - primary treatment- screening, sedimentation, floatation, coagulation and flocculation, secondary treatment - trickling filter, activated sludge, oxidation pond and tertiary treatments;

Anaerobic sludge digestion process

Module 3 **4 Hrs.**

Disinfections- chlorination – methods of chlorination- break point chlorination, super chlorination, chloramines, and chlorine dioxide.UV and Ozone treatment.

Disposal of treated sewage

Module 4 **6 Hrs.**

Microbiology of water pollution

Microbial indicators of water pollution, BOD, COD, eutrophication.Microbiological water quality standards.Aspects of water pollution- biofilm, bio corrosion, bio augmentation.Bacteriological techniques for the examination of water – total count, most probable number, membrane filter technique.Water borne diseases

Module 5 **10 Hrs.**

Biodegradation - biodegradation of xenobiotic compounds; stimulating biodegradation, hospital waste management, bioremediation, bio sorption.Bioremediation of hazardous waste, dyes, oil, pesticides;Biodegradation of lignin, cellulose and plastics.

References

Odum, E. P. and Barrett, G. W. 2005. *Fundamentals of Ecology*. 5th Edition. Thomson Brooks/Cole, Belmont, CA.

iel, 1999. *Environment Aspects of Microbiology*. 1st Edition, Bright Sun Publications, Chennai.

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Eriksson, K-E. L., Blanchettee, R. A. and Ander, P. 1990. *Microbial and Enzymatic Degradation of Wood and Wood components*. Springer.

Singh, A., Kuhad R. C. and Ward, O. P. 2009. *Advances in Applied Bioremediation*. Springer.

SEMESTER 1I

IZ2CRT04- MICROBIAL WASTE MANAGEMENT

PRACTICAL -11

36 Hrs

1 Credit

1. Bacterial examination of water by MPN technique and IMVIC test.
2. Bacterial examination of water by membrane filter technique
3. Analysis of water by standard plate count
4. Determination of dissolved oxygen
5. Estimation of BOD water, raw / treated sewage
6. Estimation of COD from water, raw / sewage
7. Determination of total alkalinity of water

References

Aneja, K. R. 2003. *Experiments in Microbiology, Plant Pathology and Biotechnology*. 4th Edition. New Age International (P) Limited, New Delhi.

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Kalaichelvan, P. T. 2005. *Microbiology and Biotechnology Laboratory manual*.MJP Publishers, Chennai.

Murugalatha, N. *et al*. 2012. *Microbiological techniques*. MJP Publishers, Chennai.

SEMESTER 2

IZ2CRT05 - CORE COURSE 5
MEDICIAL MICROBIOLOGY

36 Hrs

2 Credits

Objectives

1. To develop a knowledge of medically important microorganisms and their relevance of infectious diseases
2. To promote understanding of pathogenesis, diagnosis,prevention and control of medically important microorganisms

Module 1. **8 Hrs**

Normal microbial flora of Human body, A systematic study of *Staphylococcus aureus, Streptococcus pyogenes, Escherichia coli, Klebsiella pneumonia, Pseudomonas aeruginosa, Vibriocholerae.*

Module 2 **9 Hrs**

Structure and clinical importance of hepatitis B virus, HIV, influenza virus, polio virus.

Etiology, Epidemiology, Symptomology, Pathogenesis, Diagnosis and treatment of Tuberculosis, Syphilis, Actinomycosis.

Module 3 **8 Hrs**

A brief account on air borne diseases, Respiratory tract infections -Infections of the upper and lower respiratory tract

Module 4 **6 Hrs**

Urinary tract infections, Genital tract infections, sexually transmitted diseases, and nosocomial infections

Module 5 **5 Hrs**

Fungal diseases -Superficial and deep mycoses

Protozoan Diseases : Malaria., amoebic dysentery, Sleeping sickness.

References

Cann, A. J. 2005. *Principles of Molecular Virology*. 4th Edition. Elsevier Academic Press.

Pichare, A. P. and Nagoba,B. S. 2013.*Medical Microbiology: Prep Manual for Undergraduates*. Elsevier India Pvt. Ltd.

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Kayser F. H., Bienz, K. A., Eckert, J. and Zinkernagel, R. M. 2004. *Medical Microbiology*. Berlin: Thieme Medical.

Baron, S. 1996. Medical Microbiology, 4th Edition. Galveston (TX): University of Texas Medical Branch at Galveston

Greenwood, D., Slack, R. C. B., Peutherer, J. F. and Barer, M. R. 2007. *Medical Microbiology: A Guide to Microbial Infections: Pathogenesis, Immunity, Laboratory Diagnosis and Control*. 17th Edition. Elsevier Health Sciences UK.

Topley, W. W. C., Wilson, G. S., Parker, M. T. and Collier, L. H. 1990. *Topley and Wilson's Principles of Bacteriology, Virology and Immunology*. 8th Edition. London: Edward Arnold.

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SEMESTER 2

IZ2CRP02 - CORE COURSE 5
MEDICAL MICROBIOLOGY

(PRACTICALS)

36 Hrs

2 Credits

1. Microbiology of laboratory safety, General concept for specimen collection, handling.
2. Study of the morphology, staining characters, cultural characters and identification of *Staphylococci, Streptococci, E.coli, Klebsiella, Pseudomonas* and *Vibrio,*
3. Test for hemolytic property of bacteria.
4. Isolation and identification of bacteria from clinical samples
5. Culture methods for isolation and identification of fungi- KOH mount preparation, Lacto phenol cotton blue staining, Slide culture technique etc.
6. Study of normal microbial flora of human being

References

Cheesbrough, M. 2006. *District Laboratory Practice in Tropical countries*. 2nd Edition. Cambridge, University Press.

Rowland, S. S., Walsh,S. R., Teel, L. D. and Carnahan, A. M. 1994Pathogenic and Clinical Microbiology: A Laboratory Manual. Lippincott Williams and Wilkins.

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Prince, C. P. 2009. *Practical Manual of Medical Microbiology*. Jaypee Brothers Medical Publishers (p) Ltd., New Delhi.

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Kannan, N. 2002. *Laboratory manual in general microbiology*. 2nd Edition, Panima Publishing Co., New Delhi.

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Chakraborty, P. and Chakraborty, G. 2005. *Practical pathology*. Vol. 33. Kolkata: New Central Book Agency (P) Ltd.

SEMESTER 2

IZ2CRT06 - CORE COURSE 6
AGRICULTURAL MICROBIOLOGY

36 Hrs

Credits 2

Objectives

1. To study the various interactions that exists among microbes and also between microbes and plants
2. To describe the roles and importance of microbes in various areas of agriculture

Module 1 **12 Hrs**

Distribution of microorganisms in soil. Soil microorganisms and microbial interactions mutualism, synergism (protocooperation), commensalisms.Amensalism,competition, parasitism, predation, neutralism. Role of microorganisms in cycling of elements- nitrogen, carbon, sulfur, phosphorus cycles

Module 2 **5 Hrs**

Plant – microbe Interaction -Microorganisms of rhizosphere, rhizoplane, phylloplane and myccorhizae- ectomycorrhizae, endomycorrhizae and vesicular arbuscular myccorrhizae

Biological nitrogen fixation- Biochemistry and physiology of nitrogen fixation, *nif* genes.

Module 3 **8 Hrs**

Microbial diseases of plants

Bacterial diseases**:** Bacterial leaf blight of rice, Citrus canker

Fungal diseases: Root rot of pepper, Downy mildew of grapes, and Tikka disease of groundnut.

Mycoplasmal diseases - Sandal spike, Grassy shoot disease of sugar cane

Viral Disease – TMV

Module 4 **7 Hrs**

Bio fertilizers: Types and importance. Production and quality control: *Rhizobium, Azotobacter, Azospirillum*, Cyanobacteria, mycorrhizae: vesicular arbuscular mycorrhizae. phosphate solubilizing bacteria.

Module 5 **4 Hrs**

BioPesticides: bacterial, viral and fungal pesticides.Biological control of plant diseases.

References

Agrios, G. 2005. *Plant Pathology*. 5th Edition, Academic Press.

Hull, R. 2002. *Matthew's Plant Virology*. 4th Edition, Academic Press.

Atlas, R. N. and Bartha, R. 1998. *Microbial Ecology: Fundamentals & Applications*.4thEdition. Benjamin & Cummings Science Publishing, California.

Subba Rao, M. S. 1995. *Soil microorganisms and plant growth*. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.

Bagyaraj, D. J. and Rangaswami, G. 2005. *Agricultural microbiology*. 2ndEdition, Prentice Hall of India.

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SEMESTER 2

IZ2CRP03 - CORE COURSE 6
AGRICULTURAL MICROBIOLOGY
(PRACTICALS)

36 Hrs

2 Credits

1. Isolation & enumeration of microorganism from soil.
2. Isolation & Cultivation of rhizobium
3. Morphological observation of rhizobium from root nodules
4. Isolation of microorganism from rhizosphere, and calculation of R: S Ratio
5. Study of antagonism between soil microorganisms.
6. Study of symptoms of various plant diseases
   a. Downy mildew of grapes.
   b. Citrus canker
   c.Bacterial leaf blight of rice .

References

Aneja, K. R. 2003. *Experiments in Microbiology, Plant Pathology and Biotechnology*. 4th Edition. New Age International (P) Limited, New Delhi.

Aneja, K. R. 2001. *Experiments in microbiology, plant pathology, tissue culture and mushroom production technology*. 3rd Edition. New Age International (P) Limited.

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Murugalatha, N. *et al*. 2012. *Microbiological techniques*. MJP Publishers, Chennai.

Schmidt, E. L.1967. *A Practical Manual of Soil Microbiology Laboratory Methods*. Food and Agriculture Organization of the United Nations.

Rozar, A. 2002. *Practical Methods for Environmental Microbiology and Biotechnology*.Krishna Prakashan Media Ltd., Meerut.

SEMESTER 3

IZ3CRT07 - CORE COURSE 7
MICROBIAL GENETICS AND RECOMBINANT DNA TECHNOLOGY

54 Hrs
3 Credits

Objectives

1. To learn about bacterial genetics, recombinant DNA, and molecular genetics
2. To understand about the biological processes, using mechanisms of gene regulation as the model.

Module 1 **8Hrs**

Bacterial chromosome, DNA replication in prokaryote. Meselson and Stahl experiment, modes of replication- rolling circle model.

Module 2 **8 Hrs**

Mutagenesis, Spontaneous and induced mutatagenesis, transition, transversion, silent, missense, non-sense, neutral, frame shift and conditional mutations. Forward and reverse mutations.

Module 3 **8 Hrs**

Recombination methods in bacteria: transformation, transduction and conjugation

Module 4. **8 Hrs**

Plasmids, plasmid as cloning vector, brief account on pBR 322, pUC 8, phage vectors- M13, lamda and cosmids

Module 5 **12 Hrs**

Basic steps involved in Recombinant DNA Technology, Isolation of DNA, isolation of vector, enzymes in recombinant DNA technology- type II restriction endonucleases, ligases, S1

nuclease, alkaline phosphatase, terminal transferase, DNA polymerase I, reverse transcriptase. Production of Recombinant DNA, Transformation,

Module 6 **10 Hrs**

Molecular biological techniques,polymerase chain reaction and types, DNA Sequencing- Maxam and Gilbert method, Sangers chain termination method Blotting techniques- southern, northern, and western blotting

References:

Primrose, S., Twyman, R. and Old, B. 2001. *Principles of Gene Manipulation*, 6th Edition, Blackwell Science Ltd.

Chakravarty, A. K. 2013. Introduction to Biotechnology. OUP India.

Chaudhuri, K. 2012. Microbial Genetics. The Energy and Resources Institute, TERI.

Sridhar, S. 2005. Genetics and Microbial Biotechnology.Dominant Publishers and Distributors.

Nicholl, D. S. T. 1994. *An Introduction to Genetic Engineering*. Cambridge University Press.

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Glick, B. R. and Pasternak, J. J. 1994. *Molecular biotechnology*. ASM press. Washington Dc.

Watson, J. D., Gilman, M., Witkowski, J. and Zoller, M. 1992. *Recombinant DNA*. 2nd Edition, Scientific American Books.

Lewin, B. 2000. *Genes VIII*. Oxford University Press. Oxford.

Balasubramanian, D., Bryce, C., Dharmalingam, K., Green, J. and Jayaraman, K. 1996. *Concepts in Biotechnology*. University Press, India.

Trevan, M. D., Boffey, S., Coulding K. H. and Standury, P. 1990. *Biotechnology. The basic principles*. Tata MC Graw Hill Edition.

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Gardner, E. J., Simmons, M. J. and Snustard, D. P. 1991. *Principles of Genetics*. 8th Edition. John Wiley and Sons, NY.

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SEMESTER 3

CORE COURSE7

MICROBIAL GENETICS AND RECOMBINANT DNA TECHNOLOGY

(PRACTICALS)

36 Hrs
0 Credit

1. Isolation of chromosomal DNA from *E.coli*
2. Bacterial transformation
3. Immobilization of yeast cells by sodium alginate method
4. Polymerase chain reaction
5. Blotting techniques
6. Western blotting(Only demonstration)

References

Aneja, K. R. 2001. *Experiments in microbiology, plant pathology, tissue culture and mushroom production technology*. 3rd Edition. New Age International (P) Limited.

Dubey, R. C. and Maheswari, D. K. 2002. *Practical Microbiology*. 2nd Edition, S. Chand & Co., New Delhi.

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Murugalatha, N. *et al*. 2012. *Microbiological techniques*. MJP Publishers, Chennai.

Janarthanan, S.and Vincent, S. 2007. Practical Biotechnology: Methods and Protocols. Orient BlackSwan/Universities Press.

Jane, M., Valan Arasu, M. and Duraipandiyan, V. 2012. Practical Handbook in Microbial Biotechnology. Lambert Academic Publishing.

SEMESTER 3

IZ3CRT08 - CORE COURSE 8
INDUSTRIAL MICROBIOLOGY

54 Hrs
3 Credits

Objectives

1. To study the sources of microorganisms for use in industrial microbiology and biotechnology
2. Discuss the genetic manipulation of microorganism to construct strains that better meet the needs of an industrial or biotechnological process
3. Discuss the preservation of microorganisms
4. Describe the design or manipulation of environments in which desired processes will be carried out
5. Discuss the management of growth characteristics to produce the desired product

Module 1 **14 Hrs**

History, development and scope of industrial microbiology, Industrially important microbes, Strain improvement and selection, Screening of industrially important microorganisms- Primary and Secondary Screening. Strain development .

Module 2 **10 Hrs**

Preservation and storage of microorganisms.Development of inoculum for industrial fermentation. Fermentation media, formulation of media, saccharine materials, starchy materials, cellulosic materials, nitrogenous materials, enhancers and precursors, antifoams.

Industrial sterilization- batch and continuous sterilization.

Module 3 **12 Hrs**

Fermenter, Structure of a typical Batch fermenter, Parts, function of each part, probes, valves, agitators, aerators, baffles, Types of bioreactors:, Types of fermenters: Batch Fermenter , Continuous Stirred Tank Fermenter , Fluidized Bed Fermenter, Solid State Fermenter, Air Lift Fermenter, Tubular Fermenter.

Module 4 **6 Hrs**

Fermentation process: Surface, Submerged and Continuous fermentation .Computer control of fermentation process.

Module 5 **12 Hrs**

Downstream Processing, Intra cellular and extra cellular product recovery.Physical and chemical methods.Cell disruption- methods, solvent extraction, and purification. Product recovery. Drying, Packing and labeling. Market Potential, Good Manufacturing Practices.

References

1. Whitaker, A., Stanbury, P. F. and Hall, S. J. 2009. *Principles of Fermentation Techniques*. Elsevier.
2. Demain, A. L. and Solomon, N. A. 1986. *Manual of Industrial Microbiology*. Oxford University Press, Oxford.
3. Waites, M. J., Morgan, N. L., Rockey, J. S. and Higton, G. 2001. Industrial Microbiology: An Introduction. Blackwell Science Ltd.
4. Prescott, S. C., Dunn, C. G., and Reed, G. 1982. *Prescott and Dunn's Industrial Microbiology*, 4th Edition. AVI Pub. Co., Westport, Conn.
5. Waites, M. J. 2001. *Industrial Microbiology*. Blackwell Science, Oxford.
6. McNeil, B. and Harvey, L. M. 1990. *Fermentation: A Practical Approach.*Oxford; New York: IRL Press.
7. Enfors, S. O. and Häggström, L. 2000. *Bioprocess Technology: Fundamentals and Applications*. Royal Institute of technology, Stockholm, Sweden.
8. Crueger, W., Crueger, A., and Brock, T. D. 1990. *Biotechnology: A Textbook of Industrial Microbiology*. Sinauer Associates.
9. Casida, L. E. 1968. *Industrial Microbiology*. Wiley, New York; London.
10. Okafor, N. 2007. *Modern Industrial Microbiology and Biotechnology*. CRC Press.

SEMESTER III

CORE COURSE 8
INDUSTRIAL MICROBIOLOGY
(PRACTICALS)

36 Hrs
0 Credit

1. Crowded plate technique for screening microbial production of enzymes and antibiotics
2. Solid state fermentation
3. Submerged fermentation
4. **Preservation techniques:**
   a. Serial sub culturing
   b. Over laying with mineral oil
   c. Lyophilization
   d. Liquid nitrogen storage.
   e. Methods for the storage of Fungi
5. Estimation of lactic acid from milk.

References

Aneja, K. R. 2003. *Experiments in Microbiology, Plant Pathology and Biotechnology*. 4th Edition. New Age International (P) Limited, New Delhi.

Aneja, K. R. 2001. *Experiments in microbiology, plant pathology, tissue culture and mushroom production technology*. 3rd Edition. New Age International (P) Limited.

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Kalaichelvan, P. T. 2005. *Microbiology and Biotechnology Laboratory manual*. MJP Publishers, Chennai.

Murugalatha, N. *et al*. 2012. *Microbiological techniques*. MJP Publishers, Chennai.

Goldman, E. and Green, L. H. 2008. *Practical Handbook of Microbiology*. 2nd Edition. CRP Press.

Baltz, R. H., Davies, J. E. and Demain, A. L. 2012. *Manual of Industrial Microbiology and Biotechnology*. 3rd Edition. Washington DC: American Society of Microbiology.

SEMESTER 3

IZ3CRT09 - CORE COURSE 9
FERMENTATION TECHNOLOGY

54 Hrs
3 Credits

Objectives

1. To study the major products or uses of industrial microbiology and biotechnology
2. To understand aout fermentation and subsequent processing approaches available for themanufacture of biological products and the design and operation of these systems.

Module 1 **10 Hrs**

Fermentative production of Pharmaceuticals, production of penicillin and streptomycin. Production of vitamins and growth stimulants, riboflavin, cyanocobalamines and gibberellins

Module 2 **10 Hrs**

Fermentative production of Alcohol, Acetic acid, citric acid, lactic acid, Lysine and glutamic acid, Protease and amylase, Ethanol and Glycerol

Module 3 **15 Hrs**

Production of biofuels – Hydrogen and Methane
Production of Beverages- Beer and Wine
Production of Single cell Protein- Baker's Yeast and Spirullina

Module 4 **9 Hrs**

Industrial applications of enzymes, Enzyme immobilization- methods and applications .

Module 5 **10Hrs**

Microbial recovery of metals- bioleaching of copper, gold and uranium
Microbially enhanced oil recovery (MEOR)

References

Whitaker, A., Stanbury, P. F. and Hall, S. J. 2009. *Principles of Fermentation Techniques*. Elsevier.

Demain, A. L. and Solomon, N. A. 1986. *Manual of Industrial Microbiology*. Oxford University Press, Oxford

Prescott, S. C., Dunn, C. G., and Reed, G. 1982. *Prescott and Dunn's Industrial Microbiology*, 4th Edition. AVI Pub. Co., Westport, Conn.

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Waites, M. J. 2001. *Industrial Microbiology*. Blackwell Science, Oxford.

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SEMESTER 3

CORE COURSE 9
FERMENTATION TECHNOLOGY
(PRACTICALS)

36 Hrs

0 Credit

1. Study of alcoholic fermentation of fruit juice by yeast.
2. Production of citric acid by *Aspergillus niger*
3. Estimation of citric acid.

References

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SEMESTER 4

IZ4CRT10 - CORE COURSE10
FOOD MICROBIOLOGY

54 Hrs
3 Credits

Objectives

1. To study interaction between micro-organisms and food .
2. To discusses the factors affecting the presence of micro-organisms in foods and their capacity to survive and grow.
3. To study recent developments in procedures used to assay and control the microbiological quality of food.

Module1 **10 Hrs**

A brief account of micro-organisms important in food industry- molds, yeasts and bacteria, Factors affecting microbial growth in food, extrinsic, intrinsic, implicit and processing factors.

Module 2 **12 Hrs**

Principles of food preservation - asepsis, removal of microorganisms, anaerobic conditions, high and low temperatures, drying, radiation. Chemical preservatives -food additives.Principles of canning.

Module 3 **12 Hrs.**

A brief account of microbiological basis of spoilage of vegetables, fruits, milk, egg, meat and fish. Microbial role in production of Bread, vinegar, sauerkraut, beer, and wine.Cultivation of mushrooms.

Module 4 **12 Hrs.**

Bacteriological examination of milk.Preservation of milk, pasteurization - different methods. Fermented dairy products- cheese, yoghurt, kefir, butter and butter milk.

Module 5 **8 Hrs.**

Food borne Diseases- Food poisoning and food born infections and intoxication. Mycotoxins - Aflatoxins.Hazard Analysis Critical Control Points (HACCP)

References

Casida, L. E. 1968. *Industrial Microbiology*. Wiley, New York; London.

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Adams, M. R. and Moss, M. O. 2008. *Food Microbiology*, 3rd Edition. RSC Publishers.

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SEMESTER 4

IZ4CRP04 - CORE COURSE10
FOOD MICROBIOLOGY

(PRACTICALS)

36 Hrs
2 Credits

1. Microbiological examination of food
2. Isolation of bacteria from idli batter &curd.
3. Microbiological examination of soft drinks.
4. Standard plate count of milk.
5. Determination of quality of milk sample by methylene blue reduction test.
6. Detection of number of bacteria in milk by breed count.
7. Quality testing of milk by resazurin test.
8. Determination of phosphatase activity of milk.
9. Detection of mastitis through milk test.
10. Cultivation of Edible mushroom (Demo)

References

Aneja, K. R. 2003. *Experiments in Microbiology, Plant Pathology and Biotechnology*. 4th Edition. New Age International (P) Limited, New Delhi.

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Dubey, R. C. and Maheswari, D. K. 2002. *Practical Microbiology*. 2nd Edition, S. Chand & Co., New Delhi.

Kannan, N. 2002. *Laboratory manual in general microbiology*. 2nd Edition, Panima Publishing Co., New Delhi.

Gunasekaran, P. 2002. *Laboratory manual in microbiology*. 2nd Edition, New Age International (P) Limited, New Delhi.

Kalaichelvan, P. T. 2005. *Microbiology and Biotechnology Laboratory manual*. MJP Publishers, Chennai.

Murugalatha, N. *et al*. 2012. *Microbiological techniques*. MJP Publishers, Chennai.

Harrigan, W. F. 1998. Laboratory Methods in Food Microbiology. 3rd Edition.Gulf Professional Publishing.

Yousef, A. E. and Carlstrom, C. 2003. Food Microbiology: A Laboratory Manual, John Wiley and Sons.

Roberts, D. and Greenwood, M. 2003. Practical Food Microbiology. 3rd Edition, Blackwell publishers.

SEMESTER 4

IZ4CRT11 - CORE COURSE 11
DAIRY MICROBIOLOGY

54 Hrs
3 Credits

1. To provide a scientific background to dairy microbiology by re-examining the basic concepts of general food microbiology and the microbiology of raw milk.
2. The role of dairy starter cultures in manufacturing fermented dairy products, developing novel functional dairy products through the incorporation of probiotic strains
3. Offer a practical approach to the following aspects: well-known and newfound pathogens that are of major concern to the dairy industry.

Module I **14 Hrs**

Milk –introduction, composition, microorganisms in milk- bacteria, yeast, mold. Nutritive value of milk.Starter cultures and their biochemical activities- *Streptococcus thermophiles* and *Lactobacillus bulgaricus.*Starter culture preparation.Dairy processing unit operations- clarification, separation, standardization, toning of milk, homogenization.

Module II **10 Hrs**

Bacteriological examination of milk.Preservation of milk, pasteurization - different methods and advantages, sterilization, dehydration, bacteriological standards and grading of milk.

Module III **8 Hrs**

General principles underlying spoilage of milk and milk products, sources for contamination of milk, milk borne diseases, antimicrobial systems in milk.

Module IV **12 Hrs**

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Fermented dairy products- cheese ,cultured buttermilk, bulgarian butter milk, ice cream, lassie, condensed and dry milk products, yoghurt; low lactose milk, kefir and kumiss.

Module V **10 Hrs**

Hygiene in manufacturing milk products, cleaning of dairy equipment's, dairy processing plant sanitation, probiotic role of lactic acid bacteria and fermented milk products, utilization and disposal of dairy byproduct- whey

References

Prajapati, J. B.1995. *Fundamentals of Dairy Microbiology*. Akta Prakashal Nadiad, Gujarat.

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SEMESTER 4

IZ4CRP05 CORE COURSE 11
DAIRY MICROBIOLOGY
(PRACTICALS)

36 Hrs
2 Credits

1. Qualitative analysis of milk by standard plate count method .
2. Isolation of coliforms from milk.
3. Detection of number of bacteria in milk by breed count.
4. Quality testing of milk by rezazurin test
5. Methylene blue reduction test for microbial contamination of milk.
6. Determination of phosphatase activity of milk
7. Detection of mastitis through milk test .
8. Isolation of Lactobacilli and Staphylococcus from curd

SEMESTER IV

CORE COURSE 12

RESEARCH METHODOLOGY, BIOPHYSICS AND BIOSTATISTICS

54 Hrs

3 Credits

Objectives

1. To familiarise the learner the basic concept of scientific method in research process.
2. To have a knowledge on various research designs.
3. To develop skill in research communication and scientific documentation.
4. To create awareness about the laws and ethical values in biology.
5. To equip the students with the basic techniques of animal rearing collection and preservation
6. To help the student to apply statistical methods in biological studies.

RESEARCH METHODOLOGY

Module I **13 Hrs**

Basic concepts of research: Meaning, Objectives, Approaches, Types of research.
Research Process: Scientific method in research (eight steps).
Importance of literature reviewing in defining a problem,
Identifying gap areas from literature review.
Research Communication and scientific documentation: Project proposal writing,
Research report writing, (Structure of a scientific paper), Thesis, dissertation, research article.
Presentation techniques: Oral presentation, Assignment, Seminar, Debate, Workshop, Colloquium, Conference
Sources of Information: Primary and secondary sources. Library- Books, Journals, Periodicals, Reviews, Internet.
Search engines Online libraries, e-Books, e-Encyclopedia, Institutional Websites.
Plagiarism

Module II **12 Hrs**

Animal Collection – Tools &techniques

Sampling techniques
- Quadrate
- Line transect

Measurements
- Density
- Abundance
- Frequency

Biodiversity indices – concepts
- Simpson index

Collection methods, techniques and equipments
- Plankton
- Insects
- Fish

Bird

Preservation techniques – Taxidermy

Rearing techniques

Laboratory and field.

Units of measurements- units, SI system, Equivalent weight, normality, molarity

BIOPHYSICS

Module III **14 Hrs**

Basic understanding on principle and uses of the following:

Microscopy

(a) Light microscopy, Bright field (Compound Microscope), Phase contrast, Dark field microscopy, Fluorescence, Polorization microscopy, Video microscopy.

(b) Electron - Scanning (SEM), Transmission (TEM) and STEM

Micrometry – Stage and Eyepiece micrometers

Camera Lucida

Instrumentation

pH Meter

Separation Techniques: Centrifuge, Chromatography, Electrophoresis

Analytical techniques: Colorimeter, Spectrophotometer, X-ray crystallography

BIOETHICS

Module IV **5 Hrs**

Bioethics : Introduction, Animal rights and animal laws in India, Prevention of cruelty to animals Act 1960, Biodiversity Act 2003.

Concept of 3 R – conservation (Refined- to minimize suffering, Reduced – to minimize animals, Replaced – modern tools and alternate means), Animal use in research and education.

Laboratory animal use, care and welfare, Animal protection initiatives- Animal Welfare Board of India, CPCSEA, ethical commitment. Working with human: Consent,harm, risk and benefits.

BIOSTATISTICS **10 Hrs**

Module V

Sample & Sampling techniques: Collection of data, classification of data, frequency distribution tables, graphical representation: - Bar diagrams, Histogram, Pie diagram and Frequency curves - Ogives.

Measures of Central Tendency: Mean, Median, Mode (Problem - Direct method only)

Measures of dispersion: Range, Quartile Deviation, Mean Deviation, Standard Deviation, Standard error. (Merits & demerits and problems on SD).

Correlation: Definition, Types of correlation.(mention in brief)

Test of Hypothesis and Test of Significance: Basic concept, Levels of significance, test of significance, Procedure for testing hypothesis, types of hypothesis- Null hypothesis and Alternate hypothesis.

References

1. Gupta K.C, Bhamrah, H.S and G.S.Sandhu (2006) Research Techniques in Biological Sciences. Dominant Publishers and Distributors, New Delhi.

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3. Rastogi, V.B (2009) Fundamentals of Biostatistics, Ane Books Pvt. Ltd. New Delhi.

4. Ackoff, R.L. (1962) Scientific Method, New York : John Wiley Press.

5. Aggarwal. S.K.(2009) Foundation Course in Biology, 2nd Ed.. Ane's Student Edition. Ane Books Pvt. Ltd.

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9. Day, R.A. (1993). How to write and publish a scientific paper. Cambridge University Press.

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20. Ruxton, G.D. and Colegrave, N. (2006), Experinmental design for the life sciences. Oxford University Press.

21. Sateesh, M.K. (2008) Bioethics and Biosafety; I.K. International Publishing House .

22. Taylor D.J. Green N.P.O and Stout G.W. (2008). Biological science (3rd edition- R.S. Oper Ed). Cambridge University press.

RESEARCH METHODOLOGY, BIOPHYSICS AND BIOSTATISTICS

(PRACTICAL) 2 credits

PART A. RESEARCH METHODOLOGY

Animal collection Tools, Techniques & Estimation

1. Quadrate study
2. Transect study
3. Sampling Methods
4. Species area curve
5. Simpson index

PART B - BIOPHYSICS

1. Study of simple and compound light microscopes
2. Micrometry –calibration and measurement of microscopic objects –low power
3. Camera Lucida (draw a few diagrams using Camera Lucida)
4. Paper chromatography (demonstration only)
5. Instrumentation – demonstration (write notes on principle, equipment and its use)

   pH Meter, Colorimeter/ Spectrophotometer, Centrifuge

PART C BIOSTATISTICS

1. MS Excel : To create mean and median, Construction of bar diagram, Pie diagram and Line graphs.
2. MS Access: To create grade of students
3. Internet: Access a web page on any biological topic.
4. Frequency distribution of the given samples to find out arithmetic mean, median, mode.
5. Range and standard deviation for a biological data
6. Correlation using any biological data.
7. Graphical representation of data. Construction of bar diagrams, Histograms, Pie diagram and Line graphs.

SEMESTER V.

CORE COURSE 13

ENVIRONMENTAL BIOLOGY AND HUMAN RIGHTS

54 Hrs

Objectives

To instill the basic concepts of Environmental Sciences, Ecosystems, Natural Resources, Population, Environment and Society

To make the students aware of natural resources, their protection, conservation, the factors polluting the environment, their impacts and control measures.

To teach the basic concepts of toxicology, their impact on human health and remedial measures

To create a consciousness regarding Biodiversity, environmental issues & conservation strategies

To develop the real sense of Human rights – its concepts & manifestations

MODULE 1 ECOSYSTEM 12 Hrs

Basic concepts of ecosystem Components of ecosystem: Abiotic (Sunlight, temperature, soil, water, atmosphere) and Biotic components (Producers, consumers, decomposers), Ecological pyramid- number, biomass, energy, **Functions of ecosystem**: Productivity-Food chain-Food web-Energy flow-Laws of Thermodynamics.Types of Ecosystem: Terrestrial-Forest-Grassland-Desert, Aquatic-Marine-Fresh water, Wetland &Biome **Concept of limiting factors:** Liebig's and Shelford's laws of limiting factors.

Biogeochemical cycles: Concept, gaseous and sedimentary cycles, Carbon cycle, Nitrogen cycle. **Renewable resources (**solar,wind, hydroelectric, biomass and geothermal) **and Non renewable resources** (mineral and metal ore, fossil fuels)

MODULE 2 CONCEPTS OF POPULATION AND COMMUNITY 8 Hrs

Concept of population: Population attributes- Population growth forms, Basic concepts of growth rates, density, natality, mortality, growth curves

Animal interactions: Positive- Commensalism- Mutualism-Protocooperation, Negative-Predation-Parasitism-Competition-Antibiosis

Characteristics of a community: Species diversity- richness, eveness, stratification, dominance, ecological indicators, Ecotone and Edge effect, Keystone species, Concepts of Ecological Niche and Guild, Ecological succession, community evolution- climax.

MODULE 3 BIODIVERSITY AND ENVIRONMENTAL ISSUES 16 Hrs

Introduction to Biodiversity: Types of biodiversity- Alpha, Beta and Gamma diversity. **Concept and importance of Biodiversity**: Levels of Biodiversity-Species diversity, Genetic diversity, Microbial, Ecosystem diversity, India as a mega-diversity nation, Biodiversity hotspots

Global Environmental Issues: Ozone depletion, Greenhouse effect, Global warming, Climate change, Carbon trading, carbon credit; Carbon sequestration, Acid rain, Oil spills, Nuclear accidents, IPCC/UNFCC.

National Environmental issues: Deforestation, forest fire, pollution(air, water, soil, noise thermal, nuclear- brief account only) solid waste management, sewage, drinking water crisis and water logging,

Toxic products and disaster: Types of toxic substances – degradable, non degradable, Impact on human – case studies: Endosulphan tragedy, Bhopal disaster

Flood, drought, cyclone, earthquake and landslide (Management and mitigation)

Local Environmental issues: Landscape alteration, sand mining, quarrying, changing crop pattern, conversion of paddy lands,

Threats to water resources of Kerala: Degrading Mangrove and wetland ecosystems of Kerala, RAMSAR sites, Marine ecosystem crisis- pollution, overfishing etc. Impact of tourism on Environment.

MODULE 4 CONSERVATION OF BIODIVERSITY 12 Hrs

Protected area concept – Sanctuary, National Park, Biosphere reserve, Core Zone, Buffer Zone, Corridor concept. Conservation reserves

Concept of threatened fauna – IUCN categories - extinct, extinct in the wild, critically endangered, endangered, vulnerable, near threatened, least concern and data deficient. Red and Green Data Books.

Man–animal conflict (Tiger, Elephant, Dog, Monkey) – causes and concern

Water conservation- rainwater harvestiong, watershed management

Environment education

Environmental laws (Brief account only): The Water (Prevention and Control of Pollution) Act, 1974, The Air (Prevention and Control of Pollution) Act, 1981, Indian Forests Act (Revised) 1982. The Environment (Protection) Act, 1986, Hazardous Wastes (Management and Handling) Rules, 1989, The Forest (Conservation) Act, 1980, The Wildlife Protection Act, 1972, Biodiversity Act, 2002.

MODULE 5 HUMAN RIGHTS 6 Hrs

Introduction, main concepts associated with Human Rights, Different types of human rights, Manifestations & phenomena, Role of agencies in promoting human rights, Mechanisms for checking violations of human rights, National human right commission, Constitutional provisions related to Human rights.

References:

Erach Bharucha 2008 (UGC). Text Book of Environmental Studies of Undergraduate course. University Press.

J.B Sharma (2009), Environmental studies' - 3rd Ed. University science Press

Misra S.P., Pandy S.N. 2009Essential Environmental Students, Ane books Pvt. Ltd.

P.D Sharma (2012), Ecology and Environment' - 11th Ed. Rastogi Publications

R.B Singh & Suresh Mishra PaulamiMaiti (1996), Biodiversity – Perception, Peril and Preservation' — PHI Learning , Environmental Law in India: Issues and Responses

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Paul R.C., 2000.Situations of Human Rights in India. Efficient offset printers. ·
Arun kumar Palai(1999) National Human Rights Commission of India, Atlantic publishers
Sharma P.D. (2005)Environmental biology and Toxicology, Rastogi publication
MeeraAsthana and Astana D.K.1990 Environmental pollution and Toxicology Alka printers.
Odum, E.P. 1971.Fundamentals of Ecology.W.B. Saunders College Publishing,Philadelphia
Alan Beeby, 2006 Anne – Maria Brennan First Ecology, Ecological principles and Environmental issues . International students edition Sec. edition Oxford University Press.
Robert Ricklefs (2001). The Ecology of Nature. Fifth Edition. W.H. Freeman and Company.
Stiling Peter (2002). Ecology: Theories and applications. Prentice Hall of India pvt.Ltd. New Delhi.
Landis, Wayne and Hing-hoYu, Baca Raton, 1995. Introduction to Environmental Toxicology: Impacts of chemicals upon Ecological systems: Lewis Publishers.

SEMESTER 5

PRACTICAL

ENVIRONMENTAL BIOLOGY & TOXICOLOGY

36HRS **CREDIT 1**

1. Estimation of dissolved Oxygen
2. Estimation of carbon di oxide
3. Estimation of soil organic carbon (Demonstration only)
4. Identification of marine/ fresh water planktons
5. Counting of plankton using plankton counting chamber
6. Study of equipments - Sechi disc, Plankton net
7. Study of sandy shore fauna, rocky shore fauna.
8. Study of animal Association
9. Visit to any two important areas of bio diversity: 1. Forest, 2.Sea shore, 3. Mangrove, 4. Wet lands, 5. Bird sanctuary, 6. Wild life sanctuary, 7. Sacred groves
10. Field study (compulsory)

SEMESTER V.

CORE COURSE 14

CELL BIOLOGY AND GENETICS

54 Hrs

Credits 3

Objectives

1. To understand the structure and function of the cell as the fundamentals for understanding the functioning of all living organisms.
2. To make aware of different cell organelles, their structure and role in living organisms.
3. To develop critical thinking, skill and research aptitudes in basic and applied biology
4. To emphasize the central role of genes and their inheritance in the life of all organisms.

CELL BIOLOGY **22 HRS**

Module I **6 Hrs**

Introduction of cell and Diversity of cells: History, Cell theory, Prokaryotes, Eukaryotes, Mycoplasmas, Virus, Virions and Viroids, Prions.

Cell membrane & Permeability: Molecular models of cell membrane (Sandwich model, Unit membrane model, Fluid mosaic model). Cell properties - permeability, Transport [Diffusion, Osmosis, Passive transport, Active transport, bulk transport], Cell coat and Cell recognition.

Module II **10 Hrs**

Cell Organelles : Structure and functions of following cell organelles: Endoplasmic reticulum - Structure and functions. Ribosomes (Prokaryotic and Eukaryotic) Golgi complex - Structure and functions. Lysosomes - Polymorphism - GERL concept, functions. Mitochondria - Structure and functions. Nucleus: Structure and functions of interphase nucleus, Nuclear membrane, pore complex, structure and functions of nucleolus

Chromosomes – Structure & organization, Heterochromatin, Euchromatin, Nucleosomes, Polytene chromosomes-Balbiani rings, Endomitosis, Lamp brush chromosomes.

Module III **6 Hrs**

Cell Communication: Basic principles of cell communications,Cell signaling(in brief), Types of signaling, Mention signaling molecules (neurotransmitters, hormones, Growth Factors, Cytokines Vitamin A and D derivatives),

Cell Division: Cell cycle - G_1, S, G_2 and M phases,.Mitosis and Meiosis.The difference between Mitosis and Meiosis.

References:

1 Zoological Society of Kerala Study material. 2002. *Cell Biology, Genetics and Biotechnology*

2. Karp, G. (2010). *Cell and Molecular Biology: Concepts and Experiments*. VI Edition. John Wiley and Sons.Inc.

3. Koshy Thomas & Joe Prasad Mathew (Editors) (2011) *Cell Biology and Molecular Biology*.

4. Sarada K & Mathew Joseph (Editors) (1999) *Cell Biology, Genetics and Biotechnoloy*,

.5. Thomas A.P (Editor) (2011) *Cell & Molecular Biology The Fundamentals*. Green leaf publications. TIES. Kottaya

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8. Ali, S (2014) The Cell: Organization Function and Regulatory Mechanisms ,Pearson

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GENETICS **32 Hrs**

Module I **10 Hrs**

MendelianGenetics: Mendel's experiments- Monohybrid Cross, Dihybrid Cross, Mendel's Laws, Test Cross, Back Cross and Reciprocal Cross. Chromosome Theory of Inheritance

Interaction of genes: Allelic: Incomplete Dominance (Four O Clock Plant).Co- Dominance (Skin colour in Cattle) Lethal Alleles: Dominant lethal gene[Creeper chicken] and recessive lethal gene
[cystic fibrosis].
Non Allelic: Complementary (Flower colour in Sweet Pea), Supplementary (Coat colour in mice), Epistasis - dominant (Plumage in poultry) and recessive (Coat colour in mice). Polygenes (Skin colour inheritance in man), Pleiotropism (Vestigial wing gene in Drosophila).

Multiple alleles – ABO Blood group system, Rh group and its inheritance. Erythroblastosis foetalis.

Module II **12 Hrs**

Sex determination: Chromosome theory of sex determination (Autosome and Sex chromosomes), male heterogamy and female heterogamy, (xx-xy, xx-xo, ZZ-ZW, ZZ-ZO), Genic Balance theory of Bridges. Barr bodies, Lyon's hypothesis, Gynandromorphism, sex mosaics, intersex (Drosophila), Hormonal [free martin in calf] and Environmental (Bonelia) influence on Sex determination

Recombination and Linkage: Linkage and recombination of genes based on Morgan's work in Drosophila, Linked genes, Linkage groups, Chromosome theory of Linkage, Types of linkage- complete and incomplete. Recombination, cross over value, chromosome mapping. [Definition]

Sex Linked inheritance : Characteristics of Sex Linked inheritance, X Linked inheritance of man (Hemophilia), Y linked inheritance [Holandric genes] , Incompletely Sex Linked genes or pseudoautosomal genes (Bobbed bristles in *Drosophila*), Sex limited genes (Beard in man) and Sex influenced genes (inheritance of baldness in man).

Module III **10 Hrs**

Mutation: Types of mutations - Somatic, germinal, spontaneous, induced, autosomal and allosomal, chromosomal mutations, structural and numerical changes. Gene mutations. [Addition, Deletion and substitution].

HumanGenetics: Karyotyping, Normal Human chromosome Complement, Pedigree analysis, Aneuploidy and Non- disjunction. Autosomal abnormalities (Down syndrome, Cry du chat syndrome) Sex chromosomal abnormalities (Klinefelters syndrome, Turner's syndrome) Single gene disorder (Brief mention) Autosomal single gene disorder [sickle cell anaemia), Inborn errors of metabolism such as phenylketonuria, alkaptonuria, , Albinism. Multifactorial traits – polygenic disorder- cleft lip and cleft palate.

Genetic Counseling, Eugenics and Euthenics -Brief account only

References:

1. Gardner, J.E., Simmons, J.M and Snustad D.P..(2007). *Principles of Genetics* (8th edn.). John Wiley and Sons, India.
2. Klug, W.S and Cummings,M.R. (2011). *Concepts of Genetics* (7th edn).Pearson Education Inc.India.
3. Sarada K & Mathew Joseph (Editors) (1999) *Cell Biology, Genetics and Biotechnology*,
4. Shirly Annie Oommen, Sampath Kumar S., and Jinsu Varghese (Editors) (2012), *Gene toGenome*. Zoological Society of Kerala, Kottayam.
5. Singh,B.D.(2006). *Biotechnology*.Kalyani Publishers, New Delhi.
6. Thomas A. P (Editor), (2012). *Genetics and Biotechnology- The Fundamentals. Green Leaf Publications*, TIES, Kottayam.
7. Vijayakumaran Nair K. (2012). *Genetics and Biotechnology*. Academica, Trivandrum.
8. Benjamin Lewin. (2004). *Gene VIII*.Oxford University Press.
9. Brown C.H., Campbell I and Priest F, G. (1987). *Introduction of Biotechnology*. Blackwell Scientific Publishers, Oxford.
10. Das, H.K. (2007). *Text Book of Biotechnology*. Willey India Pvt. Ltd. New Delhi.
11. Hartl, L.D. and E.W.Jones. (2009). *Genetics: Analysis of Genes and Genomes* (7th edn) Jones and Barlett Publishers Inc, USA.
12. Primrose, S.B., Twyman, R.M. and Old, R.W. (2001). *Principles of Gene Manipulation* (6th edn.) Blackwell Science Ltd., London.
13. Sobti, R.C. and Pachauri, S.S. (2009). *Essentials of Biotechnology*. Ane's Book Pvt. Ltd.New Delhi.

14. Sinnat Dunn & Dobzhansky 1959. Principles of Genetics (T.M.H. New Delhi)

SEMESTER V

PRACTICAL

CELL BIOLOGY AND GENETICS

36 Hrs

2 Credits

PART A: CELL BIOLOGY

1. Squash preparation of onion root tip for mitotic stages
2. Mounting of polytene chromosome (Drosophila/Chironomous.) Demonstration
3. Tissues (permanent slides of epithelial tissues, striated muscle, smooth muscle, cartilage, bone)
4. Identification of cell organelles
5. Preparation of temporary whole mount.
6. Preparation of permanent whole mount (demonstration)
7. Preparation of human blood smear and identification of Leucocytes

PART B : GENETICS

1. Genetic problems on Monohybrid, Dihybrid Crosses and Blood group inheritance
2. Study of normal male and female human karyotype (use photographs or Xerox copies)
3. Abnormal human karyotypes - Down, Edwards , Klinefelter and Turner syndromes (use photographs or Xerox copies)
4. Sexing of Drosophila.
5. Study of Barr body in human buccal epithelium

SEMESTER V

CORE COURSE - 15: EVOLUTION, ETHOLOGY & ZOOGEOGRAPHY

54 Hrs

Credits 3

Objectives:

- To acquire knowledge about the evolutionary history of earth - living and nonliving
- To acquire basic understanding about evolutionary concepts and theories
- To study the distribution of animals on earth, its pattern, evolution and causative factors
- To impart basic knowledge on animal behavioural patterns and their role

Prerequisite:

- Basic knowledge on principles of inheritance and variation
- Knowledge on molecular basis of inheritance
- Basic understanding on the mechanism and factors affecting evolution
- Knowledge on origin and evolution of man

PART I - EVOLUTION **30 Hrs**

Module I - Origin of life **8 Hrs**

Theories - Panspermia theory or Cosmozoic theory, Theory of spontaneous generation (Abiogenesis or Autogenesis), Special creation, Biogenesis, Endosymbiosis.

Chemical evolution - Haldane and Oparin theory, Miller-Urey experiment;

Direct evidences of evolution – Recapitulation Theory of Haeckel, Fossilization, Kinds of fossils, fossil dating, Homologous organs and analogous organs.

Module II - Theories of organic evolution **9 Hrs**

Lamarckism and its Criticism, Weismann's Germplasm theory, Darwinism and its Criticism, Neo-Darwinism, Theory of De Vries,

Population genetics and evolution: Hardy-Weinberg Equilibrium, gene pool, gene frequency. Factors that upset Hardy-Weinberg Equilibrium, Effects of genetic drift on population: Bottleneck effect and founder effect

Module III – Nature of evolution **13 Hrs**

Species and Speciation: Species concept, subdivisions of species (sub species, sibling species, cline and deme), Speciation: Types of speciation, Phyletic speciation (autogenous and allogenous transformations), True speciation, Instantaneous and gradual speciation, allopatric and sympatric speciation

Isolation: Types of isolating mechanisms-Geographic isolation (mention examples) and Reproductive isolation. Role of isolating mechanisms in evolution

Microevolution, Macroevolution (Adaptive radiation -Darwin finches) Mega evolution, Punctuated equilibrium, Geological time scale, and Mass extinction (brief account only). Evolution of Horse

PART II - ETHOLOGY **14 Hrs**

Module 1V – Introduction 1 Hr

Definition, History and scope of ethology

Module V – Learning, imprinting and behaviour **9 Hrs**

Types of learning with examples; patterns of behaviors – types of rhythms, navigation, homing instinct, hibernation, aestivation; pheromones- types and their effect on behavior, hormones and their action on behavior (aggressive and parental behavior)

Module VI – Social organization **4 Hrs**

Social organization in insects (ants) and mammals (monkey), Courtship behaviour and reproductive strategies

PART III - ZOOGEOGRAPHY **10 Hrs**

Module VII – General Topics **4 Hrs**

Continental drift theory, Types and means of animal distribution, Factors affecting animal distribution; insular fauna – oceanic islands and continental islands,

Module VIII - Zoogeographical realms **6 Hrs**

Palaearctic region, Nearctic region, Neotropical region, Ethiopian region, Oriental region, Australian region (brief account with physical features and fauna, Wallace's line, Weber's line, Biogeography of India with special reference to Western Ghats

References:

EVOLUTION

1. Barton, N. H., Briggs, D. E. G., Eisen, J. A., Goldstein, D. B. and Patel, N. H. (2007). Evolution.Cold Spring, Harbour Laboratory Press.
2. Barnes, C.W. (1988). Earth, Time and Life. John Wiley &Sons, NewYork
3. Bendall, D. S. (ed.) (1983). Evolution from Molecules to Man. Cambridge University Press, U.K.
4. Bull J.J and Wichman H.A..(2001). Applied Evolution.Annu. Rev. Ecol. Syst. 32:183-217
5. Campbell, N. A. and Reece J. B. (2011). Biology. IX Edition, Pearson, Benjamin, Cummings.

6. Chattopadhyay Sajib. (2002). Life Origin, Evolution and Adaptation.Books and Allied (P) Ltd. Kolkata, India.
7. Douglas, J. F (1997). Evolutionary Biology.Sinauer Associates.
8. Goodwin,B. (1996). How the Leopard Changed its Spots: The Evolution of Complexity. Simon & Schuster, NY,USA.
9. Hall, B. K. and Hallgrimsson, B. (2008), Evolution. 4th Edition; Jones and Bartlett Publishers.
10. Coyne J.A. and Allen Orr H. (2004). Speciation, Sinauer Associates
11. Ridley, M. (2004), Evolution 3rd Edition. Blackwell Publishing
12. Rob Desalle and Ian Tattersall (2008). Human Origins: What Bones and Genomes Tell Us about Ourselves. Texas A&M University Press, USA.
13. Strickberger, M.W.2000. Evolution. Jones and Bartlett, Boston.

ETHOLOGY

1. Agarwal. V. K. (2009). Animal Behaviour.S.Chand and Company Pvt. Ltd., New Delhi.
2. Bonner, J.T. (1980). The Evolution of Culture in Animals. Princeton University Press.NJ, USA.
3. David McFarland. (1999). Animal Behaviour. Pearson Education Ltd. Essex, England.
4. Dawkins, M.S. (1995).Unravelling Animal Behaviour. Harlow: Longman.
5. Dunbar, R. (1988). Primate Social Systems. Croom Helm, London.
6. Gundevia J.S. and Singh H.G. (1996), A Text Book of Animal Behaviour. S. Chand and Company Pvt. Ltd., New Delhi.
7. Aubrey M. and Dawkins M.S. (1998). An Introduction to Animal Behaviour. Cambridge University Press,UK.
8. Sherman P.W and Alcock J., (2001) Exploring Animal Behaviour- Readings from American Scientist 3rd Edn. Sinauer Associates Inc. MA,USA. (Module 10 & 11).
9. Wilson, E.O. (1975). Sociobiology.Harvard University Press, Cambridge, Mass. USA.(Module 9).

ZOOGEOGRAPHY

1. Briggs, J.C. (1996). Global Biogeography. Elsevier Publishers.(Module VI and VII).
2. Chandran Subash M.D. (1997). On the ecological history of the Western Ghats.Current Science, Vol.73, No.2.146-155.
3. Chundamannil Mammen.1993, History of Forest management in Kerala. Report No.89. Kerala Forest Research Institute, Peechi, India.

4. Daniels, R.J.R and Vencatesan J. (2008), Western Ghats Biodiversity. People Conservation; Rupa& Co. New Delhi. India.
5. Mani, M.S. (1974). Ecology and Biogeography of India; The Hague: .Dr. W. Junk b.v. Publishers,
6. Nair, C.S. (1991). The Southern Western Ghats: A Biodiversity Conservation Plan. INTACH, New Delhi.
7. Ramesh, B.R and R Gurukkal (2007), Forest Landscapes of the Southern Western Ghats, India- Biodiversity, Human Ecology and management Strategies. (French Institute of Pondicherry) India.
8. Tiwari, S. (1985), Readings in Indian Zoogeography (vol.1). Today & Tomorrow Printers & Publishers

PRACTICAL

EVOLUTION, ETHOLOGY & ZOOGEOGRAPHY

36 Hrs

Credit 1

1. Identification of Zoogeographical realms using map
2. Study on endemic species of each realm
3. Show the discontinuous distribution of (lung fishes, camel, elephant)
4. Providing a map trace the route of HMS Beagle
5. Providing a map mark any two continental/oceanic islands.: Greenland, Madagascar, New Zealand, New Guinea, Maldives, Iceland, Hawaii – any two
6. Contributions of scientists (showing photos) - Any four
7. Identification of different stages of horse evolution
8. Study on Homology and Analogy
9. Study on connecting links (*Peripatus*, Archaeopteryx, *Protopterus*, Echidna)
10. Pheromone traps
11. Skinner box & T Maze
12. Experiment to demonstrate phototaxis and chemotaxis using Drosophila/House fly
13. Identification of behaviour (Grooming/courtship dance of flamingos/stickle back fish/ Tail wagging dance/ Aggressive behaviour/ Auto/Allo grooming, Flehmen response) showing pictures (Any five)

SEMESTER V.

CORE COURSE 16.

HUMAN PHYSIOLOGY BIOCHEMISTRY, AND ENDOCRINOLOGY

54 Hrs

Credits 3

Objectives:

1. This course will provide students with a deep knowledge in biochemistry, physiology and endocrinology.

2. Defining and explaining the basic principles of biochemistry useful for biological studies for illustrating different kinds of food, their structure, function and metabolism.

3. Explaining various aspects of physiological activities of animals with special reference to humans.

4. Students will acquire a broad understanding of the hormonal regulation of physiological processes in invertebrates and vertebrates.

5. By the end of the course, students should be familiar with hormonal regulation of physiological systems in several invertebrate and vertebrate systems.

6. This also will provide a basic understanding of the experimental methods and designs that can be used for further study and research.

7. The achievement of above objectives along with periodic class discussions of current events in science, will benefit students in their further studies in the biological/physiological sciences and health-related fields, and will contribute to the critical societal goal of a scientifically literate citizenry.

HUMAN PHYSIOLOGY 31 Hrs

Module I **8 Hrs**

Nutrition: Nutritional requirements – carbohydrates, proteins, lipids, minerals (Ca, P, Fe, I), vitamins (sources and deficiency disorders). Importance of dietary fibre and antioxidants.Balanced diet, Recommended Dietary Allowance (RDA). Nutrition during pregnancy and lactation, Infant nutrition, Malnutrition(PEM).

Digestion: Anatomy and histology of digestive glands (liver, pancreas, salivary, gastric and intestinal). Digestion and absorption of carbohydrates, proteins and fats.Nervous and hormonal control of digestion.

Module II **8 Hrs**

Respiration: Phases of respiration (external respiration, gas transport and internal respiration). Respiratory pigments: Haemoglobin, Myoglobin (Structure and Function). Transport of respiratory gases - transport of oxygen, oxyhaemoglobin curve, factors affecting oxyhaemoglobin curve, transport of carbon dioxide,(chloride shift). Control of respiration.Respiratory disturbances (Hypoxia, Hypercapnia, Asphyxia).Physiological effect of smoking, carbon monoxide poisoning, Oxygen therapy and artificial respiration.

Circulation: ESR, Haemopoiesis, blood pressure, ECG. Haemostasis (blood coagulation) – clotting factors, intrinsic and extrinsic pathways, anticoagulants and its mechanism of action.Cardiovascular diseases (Jaundice, Atherosclerosis, Myocardial infarction, Thrombus, Stroke).Angiogram and angioplasty.

Module III **5 Hrs**

Excretion: **H**istology of Bowman's capsule and tubular part. Urine formation – glomerular filtration, tubular reabsorption, tubular secretion.Urine concentration – counter current mechanism. Acid – base balance, hormonal regulation of kidney function. Renal disorders (kidney stone, acute and chronic renal failure, and dialysis). Homeostasis: Definition, concept and importance in biological system. Thermal regulation and thermal adaptation in homeotherms.

Module IV **10 Hrs**

Nerve physiology: Ultra structure of neuron. Nerve impulse production (resting membrane potential, action potential), transmission of impulse along the nerve fiber, interneuron (synaptic) transmission, neuromuscular junction and transmission of impulses.Neurotransmitters (acetyl choline, adrenalin, dopamine).EEG. Memory, Neural disorders (brief account on Dyslexia, Parkinson's disease, Alzheimer's disease, Epilepsy).

Muscle physiology: Ultra structure of striated muscle, muscle proteins (myosin, actin, tropomyosin, troponin), Muscle contraction and relaxation-Sliding Filament Theory, cross bridge cycle, biochemical changes and ATP production in muscle, Cori cycle. Kymograph, Simple muscle twitch, muscle fatigue, tetanus, rigor mortis.

BIOCHEMISTRY **15 Hrs**

Module V **5 Hrs**

Carbohydrates: Basic structure, biological importance and classification of monosaccharides, oligosaccharides, polysaccharides with examples.

Proteins: Basic structure and classification of amino acids; structure, biological importance and classification of proteins with examples.

Lipids: Structure of fatty acid, saturated and unsaturated fatty acid, biological importance and classification of lipids with examples.

Vitamins and minerals: Major fat soluble and water soluble vitamins. Important minerals and trace elements required for living organisms. Biological importance of vitamins and minerals.

Enzymes: Chemical nature of enzymes, enzyme activation, enzyme inhibition, allosteric enzymes, isoenzymes, co-enzymes. Michaelis–Menten enzyme kinetics.

Module VI **10 Hrs**

Carbohydrate metabolism: Glycogenesis, Glycogenolysis, Gluconeogenesis, Hexose monophosphate Shunt, Glycolysis, Citric Acid Cycle, Electron Transport Chain and ATP synthesis. Ethanol metabolism.

Protein metabolism: Deamination, Transamination, Transmethylation, Decarboxylation, Ornithine cycle.

Lipid metabolism: Biosynthesis of fatty acids, Beta oxidation, physiologically important compounds synthesized from cholesterol.

ENDOCRINOLOGY

Endocrinology and reproduction **8 Hrs**

Module VII **8 Hrs**

Endocrine physiology: Hormones – classification and mechanism of hormone action. Major endocrine glands(Histology is not included) their hormones, functions and disorders (hypothalamus, pituitary gland, pineal gland, thyroid gland, parathyroid gland, islets of Langerhans, adrenal gland),. Homeostasis and feedback mechanism.

References:

Biochemistry by U.Satyanarayana and U Chakrapani**.**Elsevier; 4 edition (2013)

Outlines of Biochemistry by S.C.Rastogi. CBSPublishers (4)

Medical biochemistry by N.V. Bhagavan, fourth edition Academic Press, 2002

Introduction to Biological chemistryby Awapara J. Prentice Hall.1968

Harper's Illustrated Biochemistry by Harper. 29th edition (Lange basic science.)

Biochemistry by Lehninger.Palgrave - Macmillan (2007)

Text Book of Medical Physiology : Guyton, 13th edition; Elsevier

Comparative Animal Physiology : Prosser and Brown, Saunders (1962)

Textbook of Physiology : Prof. A K Jain, Publisher: Avichal Publishing Company

Textbook of Medical Physiology : Geetha N. Paras Medical Publishers, 3rd edition.

Textbook of human physiology : Sarada Subramanyam and K. Madhavankutty, S. Chand & Company Ltd, 2014

Textbook of Endocrinology : Williams, R.H.Elsevier, 12th edition.

General and Comparative Endocrinology: Barrington, E.J.W. Oxford University Pres

Endocrine Physiology : Martin, C.R.Oxford University Press.

PRACTICAL

HUMAN PHYSIOLOGY, BIOCHEMISTRY AND ENDOCRINOLOGY

36 Hrs

Credit1

HUMAN PHYSIOLOGY

1). Determination of haemoglobin content of blood

2). Total RBC count using Haemocytometer

3). Total WBC count using Haemocytometer

4). Estimation of microhaematocrit

5). Effect of hypertonic, hypotonic and isotonic solutions on the diameter of RBC.

6). Instruments: Kymograph, Sphygmomanometer and Stethoscope (principle and use)

7). Measurement of blood pressure using sphygmomanometer(demonstration only)

BIOCHEMISTRY

1. Qualitative analysis of protein, glucose, starch and lipids.
2. Chromatography – Determination of Rf value of amino acids and identification of amino acids (Identify the Amino Acids using different solvent front and solute front)

ENDOCRINOLOGY

1. Cockroach – Corpora cardiaca &Corpora allata (Demonstration)
2. Effect of adrenalin on heart beat of Cockroach (Demonstration)

SEMESTER VI.

CORE COURSE 17

DEVELOPMENTAL BIOLOGY

54 Hrs

3 Credits

Objectives:

1. To achieve a basic understanding of the experimental methods and designs that can be used for future studies and research.
2. To provide the students with the periodicclass discussions of current events in science which will benefitthem in their future studies in the biological/physiological sciences and health-related fields
3. To contribute tocritical societal goal of a scientifically literate citizenry.

Module1 **10 Hrs**

Introduction: Definition, Scope of developmental biology, sub-divisions (descriptive, comparative, experimental and chemical), historical perspectives, basic concepts and theories.

Reproductive Physiology: Gonads- anatomy of testis and ovary, spermatogenesis, oogenesis, gonadal hormones and their functions. Hormonal control of human reproduction - Female reproductive cycles (Estrous cycle, Menstrual cycle). Structure of mammalian sperm and egg, Pregnancy, parturition and lactation.Reproductive health and importance of sex education.

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Egg types: Classification of eggs based on the amount, distribution and position of yolk. Mosaic and regulative, cleidoic and noncleidoic eggs.Polarity and symmetry of egg.

Fertilization: Mechanism of fertilization-(Encounter of spermatozoa and Ova, Approach of the Spermatozoon to the Egg, Acrosome Reaction and Contact of Sperm and Ovum, Activation of Ovum, Migration of Pronuclei and Amphimixis,), Significance of fertilization, Polyspermy, Parthenogenesis- Different types and significance.

Module II **14 Hrs**

Cleavage: Types, planes and patterns of cleavage, Cell lineage of Planaria. Influence of yolk on cleavage.

Blastulation: Morula, blastula formation, types of blastula with examples.

Fate maps: Concept of fate maps, construction of fate maps (artificial and natural), structure of a typical chordate fate map. Significance of fate map.

Gastrulation: Major events in gastrulation. Morphogenetic cell movements. Influence of yolk on gastrulation. Exogastrulation.Concept of germ layers and derivatives.

Cell differentiation and gene action: Potency of embryonic cells (Totipotency, Pleuripotency, Unipotency of embryonic cells). Determination and differentiation in embryonic development, Gene action during development with reference to Drosophila (maternal effect genes), Zygotic genes.

Module III **20 Hrs**

Embryology of Frog: Gametes, fertilization, cleavage, blastulation, fatemap, gastrulation, neurulation, notogenesis. Differentaition of Mesoderm and Endoderm, Development of eye.Metamorphosis of frog, Hormonal and environmental onrol.

Embryology of chick: Structure of egg, fertilization, cleavage, blastulation, fate map, gastrulation. Development and role of Primitive streak, Salient features of 18hour, 24 hour, 33 hour & 48 hour chick embryo.Extra embryonic membranes in chick.

Human development: Fertilisation, cleavage, blastocyst, implantation, placenta. Gestation, parturition and lactation.Human intervention in reproduction, contraception and birth control. Infertility, Invitro fertilization (test tube baby)

Module IV **5 Hrs**

Experimental embryology: Spemann's constriction experiments, Organizers and embryonic induction. Embryo transfer technology, cloning, stem cell research. Ethical issues.

Teratology / Dysmorphology, Developmental defects: Teratogenesis, important teratogenic agents.(Radiations, chemicals and drugs, infectious diseases) genetic teratogenesis in human beings,

Developmental defects: Prenatal death (miscarriage and still birth). Intrauterine Growth Retardation (IUGR).

Module V **5 Hrs**

General topics: Classification and functions of placenta in mammals. Prenatal diagnosis (Amniocentesis, Chorionic villi sampling, Ultra sound scanning, Foetoscopy, Maternal serum alpha-fetoprotein, Maternal serum beta-HCG).Regeneration in animals.

References:

Balnisky B.I 1981 An Introduction to Embryology, W.B. Saunders and Co.

Majumdar N. N - Vetebrate embryology

Vijayakumarn Nair K.and P. V George. A manual of developmental biology, Continental publications , Trivandrum

Taylor D J, Green NPO & G W Stout. Biological Science, third edition.Cambridge university press.

Dutta, Obstrestics , Church Livingston 17 Ed

Harrison ,Harriosns Book of Internal Medicine Chruch Livingston 17th Ed.

Berril, N.J and Kars G. Developmental biology, Mc Graw Hills

Gibbs. Practical guide to developmental biology**.**

Gilbert S. F - Developmental biology

PRACTICAL

DEVELOPMENTAL BIOLOGY

36 Hrs

Credit 1

Model/Chart/ Slide may be used

1. Embryological studies- Blastula (frog, chick)
2. Embryo transfer, cloning, gastrula (frog, chick)
3. Amniocentesis

4. Embryotransfer technology, cloning
5. Study of placenta- pig and man
6. 18 hour, 24 hour, 33 hour and 48 hour chick embryo.
7. Candling method.
8. Vital staining- demonstration.
9. Male and female reproductive organs in cockroach
10. Calculate the fecundity of fish.
11. Calculate the gonado-somatic index of given fish.

SEMESTER VI.

3 Credits

ZY6CRT11 - CORE COURSE 18

IMMUNOLOGY

54 hrs

3 Credits

Objectives

1. Microbiology is designed to introduce graduate students to the basics of bacteria, fungus and virus their outline classification.
2. To provide pathogens that are the etiological agents of the significant infectious diseases worldwide.
3. The course will focus on the basic mechanisms of microbial pathogenesis with emphasis on the host-microbe interactions and the treatments to combat these diseases.
4. Immunology is designed to provide a basis of terminology relevant to the basic concepts of immunology. It commences with the important components (cell, tissues; antibodies; immunoglobulins) involved in host defense against infectious agents.

IMMUNOLOGY

Module I **14 Hrs**

Introduction to Immunology: Innate and acquired immunity, passive (natural and artificial) and active immunity (natural and artificial).Mechanisms of innate immunity - barriers, inflammation, phagocytosis.

Lymphoid organs: Primary (thymus, bone marrow) and secondary lymphoid organs (lymph nodes, spleen).

Lymphocytes: T and B cells, Natural killer cells, memory cells, macrophages.

Module 2 12 Hrs

Types of antigen, immunoglobulin structure, classes and functions of immunoglobulins. **Monoclonal & polyclonal Antibodies** Antibody mediated immune response (humoral immunity), Cell mediated immune response.

Module 3 8 Hrs

Antigen – antibody reactions, precipitation test, agglutination test, VDRL WIDAL, ELISA.,Complement Fixation Test

Module 4 12 Hrs

Auto immune diseases: Pernicious Anemia, Rheumatoid Arthritis. Immunodeficiency - AIDS. Hyper sensitivity- Type I, (E.g. Anaphylaxix) II(Transfusion reaction) , III (Arthus reaction) and IV (Mantaux Test) (in brief) .

Module 5 8 Hrs

Vaccines

Brief history of vaccination,Types of vaccines (BCG,DPT,Polio vaccine and TAB vaccine, DNA vaccines, Toxoids ,adjuvants

1. Ananthanarayan R & Jayaram Paniker C K. (2009) *Text Book of Microbiology* Orient Longman Private Ltd.
2. Kuby J, Kindt T., Goldsby R. and Osborne B. (2007). *Kuby immunology*
3. Microbiology and Immunology, Study Material Series published by Zoological Society of Kerala
4. Sharma K. (2005) *Manual of Microbiology: Tools and Techniques*, Ane books

References

1. Colemen: (2002). *Fundamentals of Immunology*
2. Darla J. Wise & Gordon R. Carter: (2004): *Immunology A Comprehensive Review Iowa state University Press*. A Blackwell science company,
3. Hans G. Sch, *Legal General Microbiology*, Seventh Ed. Cambridge Low Price Ed.
4. Helen Hapel, Maused Harney Siraj Misbah and Next Snowden: (2006) *Essentials of Clinical Immunology* Fifth Ed. Blackwell Publishing Company,
5. Heritage, J, E.G.V. Evaus and R.A.Killungten (2007): *Introductory Microbiology* Cambridge University Press

6. Ivan Roitt I (2002) *Essentials of Immunology* ELBS.

SEMESTER VI

IMMUNOLOGY

(PRACTICAL)

72 hrs
2 Credits

1. Determination of ABO blood groups and Rh factor (Antigen – antibody Reaction)
2. Widal Test(Slide)
3.VDRL (Slide)

SEMESTER VI.

CORE COURSE 19
BIOTECHNOLOGY, BIOINFORMATICS & MOLECULAR BIOLOGY,

BIOTECHNOLOGY **20 Hrs**

Module I **11 Hrs**

Introduction: Scope, Brief History, Scope and Importance

Tools and Techniques in Biotechnology: Enzymes (restriction endonucleases, ligases, linkers & adapters), Vectors-[Plasmids, Phage vectors, Cosmids, Artificial Chromosomes] Host cells. Basic steps & techniques in rDNA technology

Gene Libraries, Construction of genomic library and cDNA Library. PCR technique and DNA amplification, Brief description of screening methods – Probes, Nucleic Acid hydridization, In situ Hybridization, Fluorescence in situ Hybridization (FISH), Colony hybridization. Methods of transfer of desired gene into target cell.Blotting Techniques- Southern, Northern, Western blotting.DNA Finger printing (DNA Profiling) and its application. Molecular markers - RFLP

Module II **9 Hrs**

Animal Cell Culture: Brief account on methods, substrates, media and procedure of animal cell culture, Stem Cells, types and potential use, Organismal Cloning- reproductive & therapeutic- brief account only.

Applications of Biotechnology: Applications in Medicine(insulin, growth hormone, gene therapy), Agriculture(GM plants and biopesticides),Environment(bioremediation), Industry (Single Cell Protein) and applications of Fermentation Technology- lactic acid, vitamins, food and beverages.

Potential Hazards of Biotechnological Inventions: Risks related to genetically modified organisms (GMO) and biologically active products, Biological warfare & Biopiracy. Protection of biotechnological inventions.Intellectual Property Rights, Patenting and patent protection.

References

1. Singh B.D Biotechnology 2002. Kalyan Publishers New Delhi.

2. Brown C.H., Campbell I & Priest F, G. 1987. Introduction of Biotechnology (Blackwell scientific publishers Oxford).

3. Colin Ratledge Bijorn Kristiansesn, 2008. Basic Biotechnology 3 rd ed. Cambridge University.

4. Janarathanan S & Vincent S. 2007. Practical Biotechnology, Method of Protocols. University Press.

5. John E. Smith. Biotechnology Cambridge Low priced ed. (Third Ed) 2005 Madingan, Martinko and Parker 2002, Biology of Microorganisms, Brock Eighth Ed. Prentice Hall.

6. Singh B.D. Biotechnolgy 2002, Kalyan Publishers New Delhi.

7. Sudha Gangal 2007. Biotechnology Principles and & practice of Animal Tissue culture, Universities Press.

BIOINFORMATICS **14 Hrs**

Module III **8 Hrs**

Introduction: Definition, importance and role of bioinformatics in life sciences. Computational Biology.

Biological databases: Nucleotide sequence databases (NCBI- GENBANK, DDBJ and EMBL). Protein databases - structure and sequence databases (PDB, SWISSPROT and UNIPROT). Introduction to Sequences alignments: Local alignment and Global alignment, Pair wise alignment (BLAST and FASTA] and multiple sequence alignment. Phylogenetic Tree construction and Analysis

Module IV **6 Hrs**

Molecular visualization software - RASMOL. Basic concepts of Drug discovery pipe line, computer aided drug discovery and its applications. Human Genome Project.

MOLECULAR BIOLOGY **20 Hrs**

Module V **8 Hrs**

Nature of Genetic Materials: Discovery of DNA as genetic material – Griffith's transformation experiments. Avery Macarty and Macleod, Hershey Chase Experiment of Bacteriophage infection, Prokaryotic genome; Eukaryotic genome.Structure and.types of DNA & RNA.DNA replication. Modern concept of gene (Cistron, muton, recon, viral genes)., Brief account of the following-- Split genes (introns and exons), Junk genes, Pseudogenes, Overlapping genes, Transposons.

Module VI **12 Hrs**

Gene Expressions: Central Dogma of molecular biology and central dogma reverse, one gene-one enzyme hypothesis, One gene-one polypeptide hypothesis Characteristics of genetic code, Contributions of Hargobind Khorana.

Protein synthesis [prokaryotic]: Transcription of mRNA, Reverse transcription, post transcriptional modifications, Translation, Post translational modifications.

Gene regulations: Prokaryotic(inducible & repressible systems) Operon concept -Lac operon and Tryptophan operon, Brief account of Eukaryotic gene regulation.

References

1. Bruce Albert, Bray Dennis, Levis Julian, Raff Martin, Roberts Keith and Watson James (2008). Molecular Biology of the Cell, V Edition, Garland publishing Inc., New York and London.
2. De Robertis, E.D.P. and De Robertis, E.M.F. (2006).Cell and Molecular Biology.VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
3. Gupta, P. K (2002) Cell and Molecular Biology, (2ed), , Rastogi Publications., Meerut
4. James Darnell. (1998) Molecular Biology. Scientific American Books Inc
5. Thomas AP(Editor). 2011 Cell &Molecular Biology The Fundamentals. Green leaf publications .TIES Kottayam
6. Zoological Society of Kerala Study material. (2011) Cell and Molecular Biology

PRACTICAL

BIOTECHNOLOGY, BIOINFORMATICS & MOLECULAR BIOLOGY

BIOTECHNOLOGY

1. Identify and comment on the item provided: (Western blotting / Southern blotting / Northern blotting / PCR)

BIOINFORMATICS

1. Download/use print out/pictures of genome sequences of any 2 organisms. Identify and mention the characteristic features of both.
2. Download/ use print out/pictures of a protein sequence , identify it & comment on its amino acid composition
3. Download / use print out/pictures of a macromolecule. Write a brief note on the bioinformatics tool used to visualize its structure.

MOLECULAR BIOLOGY

1. Identify and comment on its molecular composition / structural orientation / functional significance (Any tissue / Cell organelles/ DNA, DNA replication, RNA different types using models or diagrams) 2. Write down the procedure involved in DNA isolation

V1 SEMESTER.
CORE COURSE 20
OCCUPATIONAL ZOOLOGY .
(APICULTURE, VERMICULTURE, QUAIL FARMING & AQUACULTURE)

54 Hrs

Credits 3

Objectives:

1. To equip the students with self employment capabilities.
2. To provide scientific knowledge of profitablefarming.
3. To make the students aware of cottage industries.

Module 1. APICULTURE **18 Hrs**

Definition, Different species of honey bees, Organization of honey bee colony, Social life and adaptation of honey bees. Communication among honey bees. Bee keeping methods and equipments, Management and maintenance of an apiary, Growth period, honey flow period and dearth period Division of the colony, uniting two colonies, , replacing old queen with new queen, swarming management, monsoon management. Enemies of bees. Diseases of bees,.Bee pasturage. Uses of honey bees, By-products of honey bees, Honey and wax composition. Testing the quality of honey.Extraction of wax, Uses of honey and wax.Royal jelly, Propolis. Apitherapy, Agencies supporting apiculture.

Activity :Visitto an apiculture unit.
Field visit and report submission - 10 Hrs
Field visit and report submission on any two items are taken for internal evaluation.

MODULE: 2. VERMICULTURE **8 Hrs**

Introduction, Ecological classification of earth worms. Species of earth worms used for vermicultre, Reproduction & life cycle, Role of earth worm in solid waste management, in agriculture, in medicine etc. Preparation of vermibed, Maintenance & monitoring, Preparation of vermicompost, Preparation of vermiwash.

Activity : Submission of a report after preparing a vermiculture unit or visiting a vermicomposting unit.

MODULE: 3.QUAIL FARMING (*Coturnix coturnix*) **4 hrs**

Introduction, care of quail chicks, care of adult quails, care of breeding quails, ration for quail, care of hatching eggs, health care, use of quail egg and meat.Sources of quality chicks.

MODULE: 4. AQUACULTURE. 24 Hrs

Advantages and salient features of aquaculture, Types of Aquaculture, Biotic and abiotic features of water, Importance of algae in aquaculture, Common cultivable fishes of Kerala, Fish diseases, Composite fish culture, Integrated fish culture, Carp culture, Prawn culture Mussel culture Pearl culture. Processing & Preservation.

Aquarium management - Setting up of an aquarium, Biological filter & Aeration, Breeding of gold fish, gourami (Osphronemus), fighter and Guppy (live bearer). Nutrition and types of feed for aquarium fishes, Establishment of commercial ornamental fish culture unit. Fish Transportation - Live fish packing and transport Common diseases of aquarium fishes and their management. Aquaponics (a brief introduction only).

Activity – Setting up of an Aquarium

Field visit – Visiting an Aquaculture farm

References:

NPCS Board, The complete book on Bee keeping and honey processing, NIIR Project consultancy services, 106E, Kamala nagar, Delhi- 110007.

Shukla G.S, & Updhyay V.B, Economic zoology ,Rastogi Publ. Meerut.

Pradip.V.Jabde , Text book of applied zoology, 2005

Applied Zoology, Study Material Zoological Society of Kerala , CMS college Campus

Clive. A Edwards, Norman. Q. & Rhonda. 2011. Vermitechnology: earthworms, organic waste & environmental management.

Chauhan, H.V.S. Poultry, Disease, diagnosis and treatment, Wiley eastern Ltd Delhi.

Otieno.F.O 2014. Quail farming: markets & market strategies

Pillai T.V.R., Aquaculture, principles and practices.

Ronald j. Roberts (1978) Fish pathology , Cassel Ltd London.

Cowey C. B. *et. al*. (1985) Nutrition and feeding in fishes, academy press.

Farm made aquafeeds. FAO fisheries Technical paper, 343.

Harisankar J. Alappat& A. Bijukumar, Aquarium Fishes. B. R. Publ. Corporation, Delhi.

MPEDA, A hand Book on AquafarmingOrnamentalfishes, MPEDA, Kochi.

Amber Richards. 2014. Aquaponics at home.

Pradip.V.Jabde. 1993. Text book of applied zoology
Venkitaraman, P.R,1983, Text book of Economic zoology(SudharsanaPuubl. Kochi)
Addison Webb, Bee Keepingfor profit and pleasure, Agrobios Ltd.
Edwards.C.A.&Lafty, J.R.1972 Biology of earthworms(Chapman & Hall Led.London)
Applied Zoology, Study Material Zoological Society of Kerala , CMS college Campus
George cust& Peter Bird, Tropical Fresh water Aquaria, Hamlyn London.
Verreth J. Fish larval nutrition, Chapman & Hall Publ.
Bone Packer. 2014. Aquaponic system

PRACTICAL

Occupational Zoology

36 Hrs

Credit 1

1. General Identification, Economic importance, Morphology, scientific names and common names of the following

   a. Economic important and morphology of culturable fishes (Catla, Rohu, Grass carp, Common carp, Silver carp, *Etroplus suratensis*, *Oreochromis /Tilapia, Mugil cephalus* and *Anabas Testudineus*)

   b. Identification and morphology of ornamental fishes (gold fish, fighter, Gourami, Angel fish, Guppy

   c. Two species of earthworms used in Vermiculture

   d. Four species of honey bees

   e. Economic importance and morphology of shell fishes (Any three species of prawn, two marine mussels, two oysters one rock oyster - *Crasostria* and pearl oyster - *Pinctada fucata* and freshwater mussel - *Lamellidens marginalis*).

2. Castes of bees

3. Principle & uses of - Aquarium filters, Aquarium aerator, Aquarium plants,Oven, Pelletiser, Screw Press, die plate

4. Identification and study of fish parasites and diseases (five numbers each) using slides/pictures

5. Bee keeping equipments, Beehive, Smoker, honey extractor, Queen Cage,
6. Bees wax, Honey, Vermicompost (Identification-Uses)
7. Formulation of artificial feed for aquarium fishes – demonstration
8. Tests for determining the adulteration in honey.
9. Mounting of pollen basket
10. Mounting of mouth parts of honey bee
11. Separation of cocoon from worm castings.

SEMESTER V. OPEN COURSES (FOR OTHER STREAMS)

1. VOCATIONAL ZOOLOGY 72 Hrs

4hrs/Week, Credits 3

Objectives

- To develop critical thinking skill and research aptitude among students, by introducing the frontier areas of the biological science.
- To emphasize the central role that biological sciences plays in the life of all organisms.
- To introduce the student to some of the present and future applications of bio-sciences
- To acquire basic knowledge and skills in aquarium management, Quail farming, vermicomposting and apiculture for self-employment
- To learn the different resources available and to develop an attitude towards sustainability
- Give awareness to society about need for waste management and organic farming

Module 1 Aquarium management 12 Hrs

General introduction to Aquarium, Aims and types of aquarium (material, size and shape), Requirements of an aquarium - filtration of waste, physical, chemical and biological; Setting an aquarium (self-sustainable with biological filters), Major indigenous aquarium fishes of Kerala.

Activity: Setting up of a freshwater aquariumand rearing of aquarium fishes

Module 2 Ornamental Fish Culture 20 Hrs

Introduction to ornamental fishes: Present status of ornamental fish culture in India with special reference to Kerala, Breeding of Gold fish, Fighter, Gourami (*Osphroneus),* and Guppy (live bearer). Nutrition and types feed for aquarium fishes,Use of live fish feed organisms in Ornamental fish culture. Methods and techniques involved in the formulation of fish feed. Fish Transportation: Live fish packing and transport, Common diseases of aquarium fishes and their management**.** Establishment of commercial ornamental fish culture unit,

Activity: field visit to an ornamental fish breeding Centre to understand breeding practices of various aquarium fishes.

Module 3Quail farming (*Coturnix coturnix*) 10 Hrs

Introduction, care of quail chicks, care of adult quails, care of breeding quails ,ration for quail, care of hatching eggs, health care, use of quail egg and meat, Sources of quality chicks.

Activity: Visit to a quail farm or viewing a quail documentary to familiarize the quail farming practices

Module 5Vermiculture and composting 12 Hrs

Introduction, ecological classification of earth worms, Life history, Species of earth worms used for vermicultre, Preparation of vermibed; Preparation of vermicompost, Preparation of vermiwash, Maintenance and management of vermicomposting unit, Role of vermiculture in solid waste management.

Activity: - Preparation of a vermiculture unit or visit to a vermicomposting unit.

Module 6Apiculture 18 Hrs

Definition, Uses of bees, species of bees cultured, organization of honey bee colony, bee keeping methods (modern method only) and equipments, management and maintenance of an apiary-growth period, dividing the colony, uniting two colonies, replacing old queen with new queen, honey flow period, Bee pasturage, Death period, Enemies of bees, Bee diseases, uses of honey and wax, Apitherapy, Propolis, Royal jelly, Agencies supporting apiculture.

Activity: Identify different types of honey bees and rearing equipments

Field visit and report Submission

Field visit and report writing on any two items are taken for internal evaluation, instead of assignment and seminar. Conduct a workshop on various cultural practices and the preparation of byproducts.

References:

Applied Zoology, Study Material Zoological Society of Kerala, CMS College Campus, Kottayam.

Addison Webb (1947), Bee Keeping- for profit and pleasure, Museum Press, agro bios India Ltd.

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Joy P.J., George Abraham K., Aloysius M. Sebastian and Susan Panicker (Eds) (1998) Animal Diversity, Zoological Society of Kerala, Kottayam

Michael B. New; Alber G.J. Tacon (1994) Farm made aquafeeds FAO fisheries technical paper No.343, Rome, FAO. 1994

Nalina Sundari, M.S and Santhi, R (2006) Entomology. MJP Publishers

NPCS Board of Consultants & Engineers, Chennai.(2015) The complete book on Bee keeping and honey processing, 2nd Edition, NIIR Project consultancy services, 106- E kamala Nagar Delhi – 110007.

Ronald j. Roberts (1978) Fish pathology , Cassel Ltd London .

Vijayakumaran Nair, K, Manju, K.G. and Minimol, K. C.(2015) Applied Zoology, Academia press, Thiruvananthapuram

OPEN COURSE (FOR OTHER STREAMS)

2. PUBLIC HEALTH AND NUTRITION

72 Hrs

4hrs/Week

Credits 3

Objectives:

- To inculcate a general awareness among the students regarding the real sense of health.
- To understand the role of balanced diet in maintaining health.
- To motivate them to practice yoga and meditation in day-to-day life.

PART I HEALTH, EXERCISE & NUTRITION

Module 1 Definition and Meaning of Health **10 Hrs**

Dimensions and Determination of Health

Physical Activity and Health benefits

Effect of exercise on body systems – Circulatory, Respiratory, Endocrine, Skeletal and Muscular

Programmes on Community health promotion (Individual, Family and Society)

Dangers of alcoholic and drug abuse, medico-legal implications

Module 2 Nutrition and Health **10 Hrs**

Concept of Food and Nutrition, Balanced diet

Vitamins, Malnutrition, Deficiency Disease

Determining Caloric intake and expenditure

Obesity, causes and preventing measures

Role of Diet and Exercise, BMI

Module 3 Safety Education in Health promotion **8 Hrs**

Principles of Accident prevention

Health and Safety in daily life.

Health and Safety at work.

First aid and emergency care.

Common injuries and their management.

Modern life style and hypokinetic diseases.

Diabetese, Cardiovasculard disorders-Prevention and Management.

Module 4 Life Skill Education 8 Hrs

Life skills, emotional adjustment and well being,. Yoga, Meditation and Relaxation, Psychoneuroimmunology

PART II PUBLIC HEALTH AND SANITATION

Module 5 Public health and water quality. 11 Hrs

Potable water, Health and Water quality

Faecal bacteriae and pathogenic microorganisms transmitted by water.

Determination of sanitary quality of drinking water, water purification techniques

Module 6 Public health and diseases 15 Hrs

Water borne dseases-Cholera and Typhoid.Prevention of Water borne diseases.

Food borne diseases and Prevention

Botulinum, Salmenellosis, Hepatitis A

Vector borne diseases & Control measures

Chikungunya , Filariasis and Dengu fever

Zoonotic disease-Leptospirosis & its control

Emerging diseases - Swine flue (H1N1), bird flue (H5N1), SARS, Anthrax

Re-emerging diseases –TB, Malaria

Health Centre visit & Report Presentation 10 Hrs

References:

Gladys Francis & Mini K.D., (Editors) (2012), Microbiology, Zoological Society of Kerala, Kottayam.

Greenberg, Jerol S and Dintiman George B (1997) Wellness Creating a life of Health and Fitness , London Allyn and Bacon Inc.

K Park, (2008) Park's Text Book of Preventive and Social Mediine 18th Edition. Banarasidass Bhenot Publication

Norman Bezzaant HELP First Aid for everyday emergencies. Jaico Publishing House, Bombay, Delhi

Tom Sanders and Peter Emery. (2004) Molecular basis of human nutrition: Taylor & Francis Publishers Ane Book

Pelczar M.J. Jr. E.C.S. Chane & N.R. Krieg, Microbiology (Concept & Applications). 5th edition. Tata McGraw Publishing Company Ltd.

SEMESTER V.

OPEN COURSE (FOR OTHER STREAMS)

3. MAN, NATURE AND SUSTAINABLE DEVELOPMENT

72 Hrs
4Hrs/Week
Credits 3

Objectives:

1. To understand how Man originated and attained present status
2. To learn the basic concepts of Ecosystems and its functioning
3. To study the use and abuse of nature by Man
4. To learn the different resources available on earth
5. To study global environmental problems and its impact on human well being
6. To appreciate the perspectives of Man on nature and learn the strategies for conservation
7. To familiarize with sustainable development and develop an attitude for sustainability

Module I. Man in Nature **10 Hrs**

Introduction

Evolution of Man

Out of Africa and Candelabra Model

The Fossils and the Molecular Evidences

Hunter-Gatherer and the Agriculturist

Speech and Languages

Cultural Evolution

Altruism and Morality

Module II.The Biosphere **10 Hrs**

Earth-Continents and Continental drift

Concept of Landscapes and Habitats

Lithosphere- Forest (Tropical and Temperate)

Grasslands, Deserts and Montane

The Biomes of the World

Hydrosphere- Oceans, Estuaries

Freshwater

Water the Elixir of Life

Atmosphere- Structure and stratification

Module III.Dominance of Man on Earth **7 Hrs**

Industrial Revolution

Human Population Growth

Resource Utilization

Environmental Consequences

Modern Agriculture and Green Revolution

Environmental Impacts

Imperialism and its Ecological Root

Module IV.Natural Resources **7 Hrs**

Renewable and Non- renewable

Biodiversity

Importance of Biodiversity -the Six E ^{S}

Hotspots of Biodiversity

Biotic Richness of India

Monoculture and loss of Genetic Diversity

Extinction Crisis, IUCN and Red Data Book

Module V.Global Environmental Issues Threatening Natural Resources and Human Life

10 Hrs

Deforestation, Landscape alterations, Soil erosion, Flood and Drought, Desertification, Overexploitation, Pollution (Air, Water and Soil- Pollutants and Consequences only),

Acid rain, Ozone depletion, Greenhouse effect and Global Warming (use case studies to illustrate the points) Waste disposal (Biodegradable and Non-degradable eg. Plastic and E- waste), Oil spill Energy - Production, Consumption and its Impact on Environment Quality of the Environment and Human Health

Module VI.Man's Perspective on Nature **10 Hrs**

Eco Spirituality, Eco-theology and Eco-feminism

Community initiatives

Indigenous People's Perspective (tribal and traditional communities)

Native American, Amazonian, Australian Aborigines, Bishnoi Contributions of -John Muir, Aldo Leopold, Thoreau, Rachel Carson Edward Abbey, Arne Ness, Carolyn Merchant,Vandana Shiva

Module VII. Global Strategies for Conservation **8 Hrs**

UN conference on Man and Environment-1972

UNEP and its Contributions

The World Conservation Strategy-1980

World Commission on Environment and Development

The Earth Summit -1992

The UNFCC and IPCC

Conservation Strategies in India-MoEF

Legal System- Mention Major Conservation Acts

People's Participation in Conservation:

Chipko Movement and Narmada Bachao Andolan,

Silent Valley

Module VIII Sustainable Development **10 Hrs**

Definition and Concept

Principles and Goals

Environment versus Development Debate

Johannesburg Conference -2002

Strategies for Sustainable development

Sustainable Development in the era of Globalization

Gandhian Environmentalism

Education for Sustainable Development (UNESCO-ESD)

Building a Sustainable society

Sustainable life styles

References:

Conroy,G.C. 1997.*Reconstructing Human Evolution: A Modern Synthesis*. Norton, NY, USA.

Encyclopedia Britannica .1987 .*Evolution.* Macropedia Vol.18 Knowledge in Depth pp930-979. Encyclopedia Britannica Inc.UK

Harrison, Lawrence E. and Samuel P. Huntington. 2000. *Culture Matters: How Values Shape Human Progress*. Basic Books. Perseus.

Rob DeSalle and Ian Tattersal.2008. *Human Origins:What Bones and Genomes Tell Us about Ourselves.* Texas A&MUniversity Press, USA.

Strickberger, M.W.2000. *Evolution*. Jones and Bartlett, Boston.

Forman, R.T and M. Gordaon. 1986. *Landscape Ecology.* John Wiley &Sons, NY,USA.

Miller, Tyler. G. (Jr) 2005. *Essentials of Ecology*. Thomson Brooks/cole.

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Richard T. Wright &Bernard J.Nebel.2002.*Environmental Science-Toward a Sustainable Future.*Pearson Education Inc.NY,USA.

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Bharatiya Vidya Bhavan, Mumbai, India.

Chandran, Subash M .D.1997. On the ecological history of the Western Ghats. *Current Science*, Vol.73, No.2.146-155.

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Donella H.Meadows et al.1972.*The Limits to Growth*. Universe Books Ny,USA.

Encyclopedia Britannica .1987 .*Evolution.* Macropedia Vol.18 Knowledge in Depth pp930-979. Encyclopedia Britannica Inc.UK

Foley,R.1987.*AnotherUniqueSpecies:PatternsinHumanEvolutionary cology*.Longman,Harlow,UK.

Forman, R.T and M. Gordaon. 1986. *Landscape Ecology.* John Wiley &Sons, NY,USA.

Gandhi,M.K.-Writings on Ecology

Gore A.1993.*Earth in Balance*.Penguin Books, NY.USA.

Gregory Cochran and Henry Harpending.2009.*The 10,000 Year Explosion: How Civilization Accelerated Human Evolution*. Basic Books

Hardin, Garrett. 1968. "The Tragedy of the Commons," *Science*, 162(1968): 1243-1248.

Harrison, Lawrence E. and Samuel P. Huntington. 2000. *Culture Matters: How Values Shape Human Progress*. Basic Books. Perseus.

Herman Daly. 1990."Toward Some Operational Principles of Sustainable Development".*Ecological Economics* 2:1-6.

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SEMESTER VI.

ZOOLOGY CORE CHOICE BASED COURSES

FOR B.Sc. ZOOLOGY PROGRAMME

ELECTIVE I

ECOTOURISM & SUSTAINABLE DEVELOPMENT

72 Hrs

4hrs/week

Credits 3

Objectives:

1. To introduce the concepts, principles and applications of tourism and its sustainability
2. To critically analyse the cost and benefits of ecotourism, including related laws and policies, community involvement and future trends
3. To develop an appreciation among students with respect to tourism development from the sustainability perspective
4. To equip the students with basic knowledge for the emerging ecotourism industry

Module I. Fundamentals of Tourism **12 Hrs**

Introduction- Tourism, concepts and definitions

History, types, Characteristics

The facilitating sectors

Attractions

Geography, heritage

Wildlife, nature

Quality Control

Module II. Major areas of eco-tourism **10 Hrs**

Concepts, practices and case studies for each:

Marine tourism

Wildlife tourism

Adventure tourism

Module III. Emerging trends in eco-tourism **10 Hrs**

Cultural tourism

Pilgrimage tourism

Farm tourism

Backwater tourism

Health tourism

Module IV. Problems and prospects of eco-tourism **10 Hrs**

Economics and benefits of ecotourism

Cultural issues and negative aspects of ecotourism

Environmental Impacts of Tourism

Module V. Sustainable tourism **12 Hrs**

Quality, Standards

Systems of sustainable tourism: environmental, sociocultural, Economical

Environment and conservation: basic principles

Current practices of eco-conservation in tourism industry

Sustainable tourism and society

Community based ecotourism

Eco-development committee (EDC) of Periyar Tiger Rerserve

People initiatives

Module VI. Eco-tourism guides **8 Hrs**

Ecotourism guiding and case studies

Activity

Field visit to Ecologically relevant places & Report writing **10 Hrs**

References:

Bruner, E.M. 2005. *Culture on tour: ethnographies of travel*. The University of Chicago Press.

Ghimire, K.B. and M. Pimbert. 1997. Social change and conservation: environmental politics and impacts of national parks and protected areas. London: Earthscan Publications.

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Ratandeep Sing. 2003. National Ecotourism and Wildlife tourism: Policies and guidelines. Kanishka Publishers, New Delhi

ELECTIVE COURSE

2. AGRICULTURAL PEST MANAGEMENT 72 Hrs

4 Hrs/week - 3 Credits

Objectives

1. To acquire basic skills in the observation and study of nature.
2. To impart basic awareness regarding pest problem and crop loss due to their dominance.

3. To inculcate interest in adopting biological control strategies for pest control.
4. To understand various pests affecting our local crops and select the best method for their control
5. To acquire basic knowledge and skills in agriculture management to enable the learner for self-employment.

Module I **I5 Hrs**

Pest and crop loss: Introduction, historical perspective-origin of pest, Evolution of pest. Causes of pest outbreak- biotic, abiotic and genetic factors.Modern agricultural practices and pest problem - high yielding varieties, monoculture, fertilizers, pesticides, irrigation, and cultural practices.

Module II **5 Hrs**

Pest categories: Types of pests- insect pest and non-insect pest.

Insect pest: insect structure and function-external features (body parts), mouth parts of phytophagous insects, internal anatomy, growth, development, reproduction, life cycle and metamorphosis (one example each from ametabolous, hemimetabolous and holometabolous insect), diapause. types of insect pests-key pests, occasional pests, potential pests.

Non insect pests: General features, different types-Rodents(mention the nature of crop loss by them),Mites-Main types of mites; plant injury caused by mite, millipedes and centipedes, slugs and snails (mention the damage of invasive Giant African Snail).

Activity: Identify a minimum of 5 invasive species (plant / animal) in your locality and make a report on their ecological impact.

Module III **7 Hrs**

Pest and plants: Plant feeding insects-plant host range, types of injury, relationship of pest injury and yield.

Host plant resistance: Characterization of resistance, mechanism of resistance (antixenosis, antibiosis, tolerance), biophysical, biochemical and genetic bases of resistance.

Module IV **20 Hrs**

Pest control-principles and practices: Types of control-cultural control, biological control, chemical control, integrated pest management, miscellaneous control.

Cultural control: Water management, tillage, sanitation, plant diversity, crop rotation, planting time, harvesting practices etc

Biological control: Parasitoids and predators, control by insect pathogens. Techniques in biological control-conservation, introduction and augmentation. Biopesticides

Chemical control: Origin of chemical control, chemistry, mode of action and nomenclature (organochlorines, organophosphates, carbamates, synthetic pyrethroids, miscellaneous group) of pesticides, pesticide formulations and pesticide appliances (sprayers and dusters). Brief mention of attractants, repellents, chemosterilants and pheromones

Activity 1: Conduct a workshop on preparation of biopesticides of various types suitable for kitchen garden and agricultural fields.

Integrated Pest Management (IPM)

Miscellaneous control: Mechanical (hand picking, exclusion by screens and barriers, trapping, clipping, pruning etc), physical (hot and cold treatment, moisture, light traps etc), sterility principle

Module V **25 Hrs**

Bionomics and control of major pests of crops and stored grains: Biology, life cycle and nature of damage by different pests of following crops and their control

Pests of paddy: *Leptocorisa acuta*, *Scirpophaga incertulas*, Spodoptera mauritia, *Orseolia oryzae*, *Nilaparvata lugens*

Pests of coconut: *Oryctes rhinoceros, Rhyncophorus ferrugineus*, *Opisina arenosella, Aceria guerreronis*

Pests of Banana: Cosmopolites sordidus, Pentalonianigronervosa

Pests of vegetables - Brinjal: Leucinodesorbonalis, Euzopheraperticella, Henosepilachnavigintioctopunctata, Urentiushystricellus

Gourds -Bactoceracucurbitae, Anadevidiapeponis, Epilachna spp. Raphidopalpafoveicollis, Baristrichosanthis

Pest of stored grains: Sitophilusoryzae, Corcyra cephalonica Triboliumcastraneum, Trogodermagranarium, Callasobruchuschinensis

Activity 2: Conduct a poster exhibition on various types of pests of paddy, coconut, banana and vegetable varieties of Kerala.

Activity 3: Collect different types of pest of stored grains from the local provision shops or houses and make a taxonomic study and prepare a powerpoint presentation on them.

Activity 4: Visit a minimum of 5 kitchen gardens in the neighborhood and enlist the common traditional pest control measures used in them.

Activity 5: Organise awareness classes on the ill effects of chemical pesticides and manure on human health with the support of local examples.

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ELECTIVE COURSE

3. VECTOR AND VECTOR BORNE DISEASES

72 Hrs

3 Credits

Objectives:

Module I **10Hrs**

Introduction: Vector : mechanical and biological vector, Reservoirs, Host-vector relationship, Vectorial capacity, Host Specificity.

Insect vectors: Mosquitoes, flies, fleas, lice, ticks and bugs- General account of ecology morphology and mouth parts

Module I1 **6 Hrs**

Salient features and distribution of mosquito species:*Anopheles, Aedes, Culex, and Mansonia*.

Module II1 **25 Hrs**

Study of Vector Borne disease[Life cycle and pathology]: Mosquito-borne diseases – Malaria, Dengue, Chikungunya, Filariasis. Sand fly-borne diseases – Leishmaniasis, Phlebotomus fever. Tse- tse fly – sleeping sickness. House fly borne diseases :typhoid fever, cholera, dysentery, anthrax, Myiasis, . Flea-borne diseases – Plague, Typhus fever. Louse-borne diseases –Relapsing fever, Trench fever, Vagabond's disease, Phthiriasis.

Module IV **13 Hrs**

Introduction to Vector control: Aims, objectives and advantages.History and background, recent trends, alternatives to the use of insecticides (chemical & microbial), types of vector control - selective, integrated and comprehensive vector control.

Control measures of mosquitoes, sand fly, tsetse fly and domestic flies

Module V **8 Hrs**

Introduction to epidemiology: History, Definition, scope and uses of epidemiology. Epidemiology and public health. Achievements in epidemiology: Smallpox Methyl mercury poisoning Rheumatic fever and rheumatic heart disease Iodine deficiency diseases Tobacco use, asbestos and lung cancer, Hip fractures. HIV/AIDS, SARS.

Field report on two case studies of epidemiology in India. **10 Hrs**

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ELECTIVE COURSE

4. NUTRITION, HEALTH AND LIFESTYLE MANAGEMENT

72 Hrs.

3 Credits

Objectives:

1. To provide students with a general concept of health and the parameters that define health and wellness.
2. To understand principles of nutrition and its role in health.
3. To familiarize the students regarding food safety, food laws & regulations.
4. To provide knowledge and understanding regarding life style diseases.
5. To promote an understanding of the value of good life style practices, physical fitness and healthy food habits for life style disease management.

Module I **15 Hrs**

Nutrition and health: Nutritional requirements of man, classification of major nutrients including protein,vitamins and minerals, water, role of fibre, biological value of food components, food groups and sources, balanced diet, RDA, BMI, BMR, Calorie intake and expenditure, Healthy eating pyramid, Nutrition in infancy, preschool, school, adolescent, pregnancy, lactation and old age. Nutrition in diseases and special conditions. Food safety: Nutrition education, food sanitation and hygiene, food adulteration and consumer protection.

Module II **18 Hrs**

Understanding of health: Define health, basic concepts, dimensions of health, basic parameters of health care. (Health Parameters: Individual normal standards, devices.1. Blood pressure, 2. Brain activities and sleep, 3.Focus or attention, 4.Pulse, 5. Body temperature,

6. Daily physical activities, 7. Electrocardiogram (ECG), 8.Cardiac fitness 9. Stress,

10. Haematological parameters, 11. BMI

Module III **15 Hrs**

Introduction to Life style diseases

Common life style diseases: Alzheimer's disease and other neural disorders, asthma, cancer, cardio vascular diseases - including hypertension, Atherosclerosis and stroke, chronic obstructive pulmonary disease, Diabetes Mellitus or Type 2 Diabetes, kidney disorders and chronic renal failure, constipation, depression, gastro-intestinal disturbances including diarrhoea and peptic ulcer, liver cirrhosis and other liver diseases, obesity, osteoporosis, occupational lifestyle diseases.

Modern lifestyle disorders: sleeping habits, junk food, poor eating habits, anxiety, food poisoning

Module IV **10 Hrs**

Causes of lifestyle diseases: Defects of modern food habits and unbalanced diet options, food adulteration, environmental pollution, poor life style choices, drug abuse, tobacco smoking, alcohol and drug consumption, lack of adequate exercise, wrong body posture, disturbed biological clock, stressful environmental conditions

Module V **14 Hrs**

Prevention and control of life style diseases:

Healthy life style habits and practices, healthy eating habits, exercise and fitness, good sleep patterns, a strict no to alcohol, drugs, and other illegal drugs. Uncontrollable factors like age, gender, heredity and race.

Healthy diet: disease prevention through appropriate diet and nutrition, avoiding foods that are high in fats, salt and refined products. Avoid junk food and replace by natural food/

organic food.

Physical exercise: Moderate exercise for fitness of body, walking, stretching, right postures of sitting & standing, relaxation and cutting down of stress, sports, aerobic exercise and yoga.

Health literacy as a public health goal: Awareness programs in schools, colleges and through mass media.

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DEPT. OF ZOOLOGY

B.Sc TIME TABLE – 2021 – 2022

DAY	CLASS	I	II	III	IV	V
MONDAY	I DC					
	II DC					
	IIIDC	MVS	MVS	SNR	VK ↔	SNR
TUESDAY	I DC					
	II DC		MVS	SNR		
	IIIDC	MVS	VK	VK	SNR ↔	MVS
WEDNESDAY	I DC				VK ↔	MVS
	II DC	SNR				
	IIIDC	VK	VK	MVS	SNR ↔	VK
THURSDAY	I DC					SNR
	II DC					
	IIIDC	SNR	SNR	VK	MVS	MVS
FRIDAY	I DC				VK	
	II DC		VK ↔	MVS		
	IIIDC	MVS	SNR	SNR	SNR ↔	MVS

SNR : Dr. Smitha N R - 16 hours

MVS: Dr. Manju V Subramanian – 16 hours

VK: Dr. Vineeth Kumar T V - 14 hours

Total 44 hours