MARRI LAXMAN REDDY
INSTITUTE OF TECHNOLOGY & MANAGEMENT
(Approved by AICTE-New Delhi, Accredited by NAAC with 'A' & Affliated to JNTU, Hyderabad)
Recognised Under Section 2(f) & 12(B) of The UGC act, 1956

Department Of Computer Science and Engineering

STUDENT HAND BOOK
FOR
III B.Tech I Sem

COMPUTER SCIENCE AND ENGINEERING

COURSE DESCRIPTION FORM

Course Title	**COMPILER DESIGN**			
Course Code	**A50514**			
Regulation	**R13**			
Course Structure	Lectures	Tutorials	Practicals	Credits
	4	-	-	4
Course Faculty	L DHANA LAKSHMI Assoc.Prof			

COURSE OVERVIEW:

This course is intended to make the students learn the basic techniques of compiler construction and tools that can used to perform syntax-directed translation of a high-level programming language into an executable code. It also discuss various aspects of the run-time environment into which the high-level code is translated. This will provide deeper insights into the more advanced semantics aspects of programming languages, code generation, machine independent optimizations, dynamic memory allocation, and object orientation.

PREREQUISITE(S):

Level	Credits	Periods/ Week	Prerequisites
UG	4	4	Computer Programming, Formal Languages Automata Theory

EVALUATION SCHEME:

S. No	Component	Duration	Marks
1.	I Mid Examination	80 minutes	20
2.	I Assignment	-	5
3.	II Mid Examination	80 minutes	20
4.	II Assignment	-	5
5.	External Examination	3 hours	75

COURSE OBJECTIVES:

I. Be familiar with major concepts of language translation and compiler design.
II. Learn the various parsing techniques and different levels of translation
III. Extend the knowledge of parser by parsing LL parser and LR parser.
IV. Enrich the knowledge in various phases of compiler ant its use, code optimization techniques, machine code generation, and use of symbol table.
V. Be familiar with compiler architecture and with register allocation.
VI. Learn how to optimize and effectively generate machine codes

VII. Provide practical programming skills necessary for constructing a compiler.

COURSE OUTCOMES:

1. Ability to understand the design of a compiler given features of the languages.
2. Ability to implement practical aspects of automata theory.
3. Gain Knowledge of powerful compiler generation tools.

HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes		Level	Proficiency assessed by
PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	H	Exercises
PO2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	H	Exercises
PO3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	H	Assignments
PO4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	S	Projects
PO5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	H	Mini Projects
PO6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.	N	--
PO7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	N	--
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	N	--
PO9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	H	Projects
PO10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	N	--
PO11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	S	Projects
PO12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	N	--

HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes		Level	Proficiency assessed
PSO1	**Applications of Computing**: Ability to use knowledge in various domains to provide solution to new ideas and innovations.	H	Lectures, Assignments
PSO2	**Programming Skills**: Identify required data structures, design suitable algorithms, develop and maintain software for real world problems.	H	Projects

SYLLABUS:

UNIT – I

Overview of Compilation: Phases of Compilation – Lexical Analysis, Regular Grammar and regular expression for common programming language features, pass and Phases of translation, interpretation, bootstrapping, data structures in compilation – LEX lexical analyzer generator

Top down Parsing: Context free grammars, Top down parsing – Backtracking, LL (1), recursive descent parsing, Predictive parsing, Preprocessing steps required for predictive parsing.

UNIT – II

Bottom up parsing: Shift Reduce parsing, LR and LALR parsing, Error recovery in parsing , handling ambiguous grammar, YACC – automatic parser generator.

UNIT – III

Semantic analysis: Intermediate forms of source Programs – abstract syntax tree, polish notation and three address codes. Attributed grammars, Syntax directed translation, Conversion of popular Programming languages language Constructs into Intermediate code forms, Type checker.

Symbol Tables: Symbol table format, organization for block structures languages, hashing, tree structures representation of scope information. Block structures and non block structure storage allocation: static, Runtime stack and heap storage allocation, storage allocation for arrays, strings and records.

UNIT – IV

Code optimization: Consideration for Optimization, Scope of Optimization, local optimization, loop optimization, frequency reduction, folding, DAG representation.

Data flow analysis: Flow graph, data flow equation, global optimization, redundant sub expression elimination, Induction variable elements, Live variable analysis, Copy propagation.

UNIT – V

Object code generation: Object code forms, machine dependent code optimization, register allocation and assignment generic code generation algorithms, DAG for register allocation.

Text books:

1. A.V. Aho . J.D.Ullman, “Principles of compiler design”, Pearson Education.
2. Andrew N. Apple, “Modern Compiler Implementation in C”, Cambridge University Press.

References:

1. John R. Levine, Tony Mason, Doug Brown, “Lex & yacc”, O’reilly.
2. Dick Grune, Henry E. Bal, Cariel T. H. Jacobs, “Modern Compiler Design” Wiley dreamtech.
3. Cooper & Linda, “Engineering a Compiler”, Elsevier.
4. Louden, “Compiler Construction”, Thomson.

COURSE PLAN:

At the end of the course, the students are able to achieve the following course learning outcomes.

Lecture No.	Topics to be covered	Course Learning Outcomes	Reference
1-4	Introduction, structure, Phases of Compilation.	**Understand** the basic compilers and compilation process	T1:1.1-1.8
5-8	Construction of regular grammar from regular expression NFA,DFA, common programming features	**Relate** regular grammar to programming feature	T1:35-3.7
9	Concept of pass and difference between pass and phase.	**Differentiate** Pass and Phases of translation	T1:3.3,T2:2.3
10	Bootstrapping and types of compiler.	**Design** of compiler for a language	T1:4.1
11-13	Lex-Lexical analyzer generator Derivations and parse tree regular expressions v/s context free grammar.	**Identify** Data structure in compilation Using lexical analyzer	T1:4.1
14-16	Backtracking, LL(1),Recursive decent parsing Finding FIRST and FOLLOW.	**Understand** Top down parsing techniques	T1:3.8,T2:2.5 T1:4.1, T2:3.1
17-20	Construction of parse tables, Predictive parsing.	**Construct** the parsing table for given inputs	T1:4.3
21-22	Shift reduce parsing, operator precedence parsing	**Understand** bottom up parsing techniques	T1:4.4
23-25	LR-SLR,LR(0)	**Differentiate** types of LR(0) parsers	T1:4.5
26-28	LALR,CLR.	**Differentiate** types of LR(1) parsers	T1: 4.6
29	Description of error recovery	**Construct** a parse tree for ambiguous grammar	T1: 4.7
30	Yacc parser generator	**Implement** parser generator	T1:4.8
31-32	Abstract syntax tree, three address code	**Implement** the construction of syntax trees	T1:4.9
33-35	Introduction to attributes grammars Syntax directed definitions, applications of SDD, implementing L-attributed SDD's	**Recognize** the semantics of grammar	T1:5.2
36-37	Control flow, back patching, switch statements	**Describe** the forms of intermediate code generation phases	T1:5.1.5.3,5.4
38-40	Rules, type conversions, Overloading, type inference and polymorphic functions.	**List** different types of language constructs	T1:8.1-8.6
41-43	Symbol table format, ordered and unordered symbol tables. Organization for block structures languages	**Summarize** the symbol table	T1:6.1-6.6
44-46	Static, runtime stack and heap storage allocations	**List** different types of storage allocation	T1:7.6
47-48	Storage allocation for arrays, strings and records	**Understand** storage allocations for data structures	T1: 7.7
48-50	Introduction for optimization. Local, global and scope optimization	**Understand** Various optimization techniques	T1:7.8-7.9
51-53	Basic blocks, flow graphs, loops, code	I**mplementation** of basic block	T1:10.1-10.2

	motion, induction variables, reduction in strength	optimization techniques	
54-55	DAG construction, applications	**Construction** of DAG	T1:10.3-10.4
55-57	Data flow analysis of flow graphs. Flow graph, loops in flow graphs Representing data flow information, data flow equations for programming constructs	**Understand** the Data flow analysis	T1:10.5
58-60	Examples for sub expression elimination, Live variable analysis copy propagation and examples	**Implement** optimization on data flow graphs	T1:10.6-10.8 T2:9.1
61-62	Introduction, issues in code generation, object code forms Need of machine dependent code optimization, peephole optimization	**Understand** various code generation techniques	T1:10.9-10.13
63-65	Global register allocation, register assignment for outer loops Rearranging the order, heuristic ordering for DAGs, optimal ordering and labeling algorithm	**Implement** machine dependent optimizations	T1:10.12

MAPPING COURSE OBJECTIVES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Objectives	Program Outcomes												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
I	S	S	S								S		H	S
II		S	H	S	S								S	H
III	H			S	H						S		S	S
IV	S			S	H						S		S	S
V		S		S	H								H	H
VI		H	S						S					S
VII		S			S						H		H	S

S - Supportive **H - Highly Related**

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	H			S							S			
2	S	S	H	S	S						S			
3			H		H						S			

ASSIGNMENT

Course Name	**COMPILER DESIGN**
Course Code	A50514
Class	III B. Tech I Semester
Branch	Computer Science and Engineering
Year	2016-2017
Course Faculty	L DHANA LAKSHMI Assoc.Prof

OBJECTIVES

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education. The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited.

In line with this, Faculty of Institute of Aeronautical Engineering, Hyderabad has taken a lead in incorporating philosophy of outcome based education in the process of problem solving and career development. So, all students of the institute should understand the depth and approach of course to be taught through this question bank, which will enhance learner's learning process.

ASSIGNMENT – I & II

S. No	Question	Blooms Taxonomy Level	Course Outcome
	UNIT – I		
1.	**Convert** 01*+1 regular expression to finite automata?	Remember	2
2.	**Explain** phases of a compiler. Also write down the output for the following expression after each phase x= y*z+10?	Understand	1
3.	**Explain** the general format of a LEX program with example?	Apply	3
4.	**Define** regular expression? State the rules, which define regular expression?	Apply	2
5.	**Explain** the role lexical analyzer and issues of lexical analyzer?	Understand	1
6.	**Explain** the specification of tokens?	Apply	1
7.	**Define** Symbol table?	Apply	1
8.	**Explain** lexeme? Define a regular set?	Remember	2
9.	**Explain** the differences between pass and phase in detail and explain bootstrapping?	Understand	1
10.	**Consider** the grammar S→0A|1B|0|1 A→0S|1B|1 B → 0A|1S **Construct** left most derivations for parse trees for the sentence. i) 1100101 ii) 0101	Apply	3
11.	**Write** FIRST & FOLLOW, construct predictive parsing table for the following grammar E → T E' E' →+TE' / ε T → FT ' T ' → *FT ' /ε F→ (E) / id	Analysis	2
12.	**Check** the following grammar is LL(1) or not and construct parsing table. S->AaAb/BbBa A-> ε B-> ε	Analysis	3
13.	**Explain** elimination of left recursion in the grammar E->E+T/T T->T*F/F	Analysis	2

S. No	Question	Blooms Taxonomy Level	Course Outcome
	F->(E) /id		
14.	**Explain** top down parsing methods with example?	Understand	3
15.	**Analyze** whether the following grammar is LL(1) or not. Explain your answer with reasons. $S \rightarrow L, R$ $S \rightarrow R$ $L \rightarrow * R$ $L \rightarrow id$ $R \rightarrow L$	Analysis	3
16.	**For** the operators given below, calculate the operator-precedence relations and operator precedence function. id, +, *, $	Apply	3
17.	**Check** whether the following grammar is a LL(1)grammar S→iEtS|iEtSeS|a E →b Also define the FIRST and FOLLOW procedures.	Apply	3
18.	**Define** the necessary conditions to be carried out before the construction of predictive parser?	Remember	4
19.	**Prepare** the predictive parser for the following grammar: $S \rightarrow a\|b\|(T)$ $T \rightarrow T, S\|S$ Write down the necessary algorithms and define FIRST and FOLLOW. Show the behavior of the parser in the sentences, i. (a,(a,a)) ii. (((a,a),a,(a),a)	Apply	4
20.	Consider the following fragment of C code: float i, j; i = i*70+j+2; **Write** the output at all phases of the compiler for above „C" code.	Apply	1
UNIT – II			
1.	**Construct** SLR parsing table for S →CC C → aC / b	Apply	2
2.	**Construct** SLR parsing table for S→ CC C →aC / b	Apply	2
3.	**Explain** Bottom up parsing method	Understand	2
4.	**Explain** shift reduce parsing method for the following grammar $D \rightarrow$ type tlist ; $Tlist \rightarrow tlist,id/id$ $type \rightarrow int/float$ with input string int id, id;	Apply	2
5.	**Explain** the error recovery in parsing.	Understand	2
6.	**State** shift-reduce parsing? Explain in detail the conflicts that may occur during shift-reduce parsing.	Understand	2
7.	**Prepare** a canonical parsing table for the grammar given below $S \rightarrow CC$ $C \rightarrow cC\|d$	Apply	2
8.	For the grammar given below, **calculate** the operator precedence relation and the precedence functions E →E + E|E- E|E * E|E / E|E .E|(E)|-E|id	Understand	3

S. No	Question	Blooms Taxonomy Level	Course Outcome
9.	**Consider** the grammar given below. E→ E + T E →T T→ T * F T →F F→ (E) F→ id Prepare LR parsing table for the above grammar .Give the moves of LR parser on id * id + id.	Apply	2
10.	**Analyze** whether the following grammar is SLR(1) or not. Explain your answer with reasons. $S \rightarrow L,R$ $S \rightarrow R$ $L \rightarrow *R$ $L \rightarrow id$ $R \rightarrow L$	Analysis	2
1.	**State** L – attributed grammars and S- attributed 2grammars with an example?	Apply	2
2.	**Define** triple, Indirect triple, quadruples with examples?	Remember	2
3.	**Explain** Intermediate code representations?	Understand	2
4.	**Brief** about Syntax Directed Translator?	Apply	3
5.	**Explain** Abstract syntax trees with an example?	Understand	2
6.	**Define** type expression? Explain the equivalence of type expressions with an appropriate example?	Analysis	2

7.	**Generate** the three-address code for the following C program fragment
	while(a > b)
	{
	if (c < d)
	x = y + z;
	else
	x = y - z;
	}
		Understand	3

8.	**Explain** Intermediate code generation for Basic block, Control Flow and Boolean Expressions?	Apply	2
9.	**Explain** how declaration is done in a procedure using syntax directed translation?	Apply	2
10.	**List** the various ways of calling the procedures? Explain in detail?	Analysis	3
11.	**Explain** type expression, type system, simple type checker?	Understand	2
12.	**List** different data structures used for symbol table?	Remember	2
13.	**State** general activation record?	Understand	1
14.	**Explain** type checking for different expressions?	Understand	2
15.	a. **Explain** static and stack storage allocations? b. **Explain** the limitations of static allocation?	Understand	1
16.	**Write** short notes on the specification of a simple type checker?	Understand	2
17.	a. **Compare** three different storage allocation strategies? b. **Explain** symbol table organization using hashing?	Understand	1
18.	a. **List** the various attributes of a symbol table? b. **explain** symbol table organization using trees?	Understand	2
19.	**Describe** various forms of target programs?	Remember	1
20.	**Explain** heap storage allocation and static storage allocation?	Understand	2

S. No	Question	Blooms Taxonomy Level	Course Outcome
1.	**Describe** 3 areas of code optimization?	Understand	1
2.	**Define** constant folding?	Understand	1
3.	**List** the advantages of the organization of code optimizer?	Understand	1
4.	**Explain** Local optimization and loop optimization in detail.	Understand	1
5.	**Define** Reduction in strength?	Understand	1
6.	**Define** Common Sub expressions?	Understand	1
7.	**Explain** runtime memory divisions?	Understand	1
8.	**Explain** peephole optimization?	Understand	1
9.	**Explain** in the DAG representation of the basic block with example.	Understand	1
10.	a. **Explain** copy propagation and Dead code elimination? **b. What** is live variable?	Remember	1
11.	a. **Explain** local and global common sub expression elimination? b. **Define** a flow graph. Explain how flow graph can be constructed for a given program?	Remember	1
12.	a. **Explain** code hoisting and elimination of loop invariant statements? b. **Explain** how? Redundant sub expression elimination? can be done at global level in a given program?	Understand	1
13.	a. **Describe** local optimization? b. **Explain** any three principal sources of code optimization?	Understand	2
14.	a. **Explain** strength reduction and code movement? b. **Define** basic block? write an algorithm for partitioning into blocks ?	Understand	2
15.	a. **Describe** peephole optimizations? b. **Explain** about loops in flow graphs ?	Understand	2
16.	a. **Explain** loop optimizations? b. **Describe** elimination of common sub expression and elimination of dead Code?	Understand	2
17.	a. **Explain** natural loops and inner loops of a flow graph with an example. b. **State** purpose of data flow analysis? Explain available expression and reaching definition?	Understand	2
18.	**a. Explain** strength reduction and code movement? **b. Define** basic block? write an algorithm for partitioning into blocks ?	Understand	2
19.	**a. Describe** peephole optimizations? **b. Explain** about loops in flow graphs ?	Understand	2
20.	**Explain** in detail the optimization technique "Strength Reduction"?	Understand	2
	UNIT – V		
1.	**Explain** register allocation and assignment?	Understand	1
2.	**Show** the code sequence generated by the simple code generation algorithm u := a – c v := t + u d := v + u//d live at the end	Apply	1
3.	**Explain** object code forms, generic code algorithm?	Understand	1
4.	**Explain** machine dependent and machine independent optimization?	Understand	1
5.	**List** different data flow properties? Define get reg( ) function?	Apply	1
6.	**Explain** about code generation?	Understand	1
7.	**List** various machine dependent code optimization techniques?	Understand	2
8.	**Explain** the different issues in the design of a code generator?	Understand	2
9.	a. **Describe** various register allocation optimization techniques with an example.	Apply	1

S. No	Question	Blooms Taxonomy Level	Course Outcome
	b. **generate** code sequence for the following expression using code generation algorithm K :=(a-b) + (a-c) + (a-c)		
10.	a. **Explain** about directed acyclic graph (DAG) for register allocation? b. **Discuss** various forms of object code?	Apply	2

TUTORIAL QUESTION BANK

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S. No.	Questions	Bloom's Taxonomy Level	Course Outcome
UNIT-I			
PART – A (SHORT ANSWER QUESTIONS)			
1	**Define** Complier briefly?	Understand	1
2	**Explain** the cousins of compiler?	Understand	1
3	**Define** the two main parts of compilation? What they perform?	Understand	1
4	**Explain how** many phases does analysis consists?	Understand	1
5	**Define** and explain the Loader?	Remember	3
6	**Explain** about preprocessor?	Remember	1
7	**State** the general phases of a compiler?	Understand	3
8	**State** the rules and define regular expression?	Remember	2
9	**Explain** a lexeme and define regular sets?	Remember	2
10	**Explain** the issues of lexical analyzer?	Understand	2
11	**State** some compiler construction tools?	Understand	3
12	**Define** the term Symbol table?	Understand	1
13	**Define** the term Interpreter?	Remember	1

S. No.	Questions	Bloom's Taxonomy Level	Course Outcome
14	**Define** the term Tokens in lexical analysis phase?	Understand	1
15	**Explain** about error Handler?	Understand	1
16	**Define** a translator and types of translator?	Understand	1
17	**Explain** about parser and its types?	Understand	1
18	**Construct** NFA for (a/b)* and convert into DFA?	Remember	2
19	**Define** bootstrap and cross compiler?	Understand	1
20	**Define** pass and phase?	Understand	3
21	**Analyze** the output of syntax analysis phase? what are the three general types of parsers for grammars?	Remember	1
22	**List** the different strategies that a parser can employ to recover from a syntactic error?	Understand	1
23	**Explain** the goals of error handler in a parser?	Understand	3
24	**Explain** why will you define a context free grammar?	Remember	3
25	**Define** context free language. When will you say that two CFGs are equal?	Remember	2
26	**Give** the definition for leftmost and canonical derivations?	Understand	4
27	**Define** a parse tree?	Understand	1
28	**Explain** an ambiguous grammar with an example?	Apply	1
29	**When** will you call a grammar as the left recursive one?	Apply	4
30	**List** different types of compiler?	Remember	1
PART – B (LONG ANSWER QUESTIONS)			
1	**Define** compiler? State various phases of a compiler and explain them in detail.	Understand	1
2	**Explain** the various phases of a compiler in detail. Also writedow the output for the following expression after each phase a: =b*c-d.	Apply	1
3	**Explain** the cousins of a Compiler? Explain them in detail.	Understand	1
4	**Describe** how various phases could be combined as a pass in a compiler? Also briefly explain Compiler construction tools.	Remember	3
5	**For** the following expression Position:=initial+ rate*60 Write down the output after each phase	Apply	1
6	**Explain** the role Lexical Analyzer and issues of Lexical Analyzer.	Remember	1
7	**Differentiate** the pass and phase in compiler construction?	Remember	1
8	**Explain** single pass and multi pass compiler with example?	Understand	1
9	**Define** bootstrapping concept in brief?	Understand	1
10	**Explain** the general format of a LEX program with example?	Understand	3
11	**Construct** the predictive parser the following grammar: S->(L)|a L->L,S|S Construct the behavior of the parser on the sentence (a, a) using the grammar specified above	Apply	1

<table>
<tr><th>S. No.</th><th>Questions</th><th>Bloom's Taxonomy Level</th><th>Course Outcome</th></tr>
<tr><td>12</td><td>Explain the algorithm for finding the FIRST and FOLLOW positions for a given non-terminal.
Consider the grammar,
E ->TE
E->+TE|@
T ->FT
T->*FT|@
F->(E)|id.
Construct a predictive parsing table for the grammar given above. Verify whether the input string id + id * id is accepted by the grammar or not.</td><td>Understand</td><td>3</td></tr>
<tr><td>13</td><td>Prepare the predictive parser for the following grammar:
S->a|b|(T)
T ->T, S|S
Write down the necessary algorithms and define FIRST and FOLLOW. Show the behavior of the parser in the sentences.
i.(a,(a,a))
ii.(((a,a),a,(a),a)</td><td>Apply</td><td>3</td></tr>
<tr><td>14</td><td>Explain operator grammar? Draw the precedence function graph for the following table.
<table>
<tr><td></td><td>A</td><td>(</td><td>)</td><td>,</td><td>$</td></tr>
<tr><td>a</td><td></td><td></td><td>></td><td>></td><td>></td></tr>
<tr><td>(</td><td><</td><td><</td><td>=</td><td><</td><td></td></tr>
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<tr><td>,</td><td><</td><td><</td><td>></td><td>></td><td></td></tr>
<tr><td>$</td><td><</td><td><</td><td></td><td></td><td></td></tr>
</table></td><td>Understand</td><td>3</td></tr>
<tr><td>15</td><td>Analyze whether the following grammar is LR(1) or not. Explain your answer with reasons.
S-> L,R
S-> R
L -> * R
L-> id
R-> L.</td><td>Analysis</td><td>2</td></tr>
<tr><td>16</td><td>Difference between nondeterministic and deterministic finite automata</td><td>Understand</td><td>3</td></tr>
<tr><td>17</td><td>Construct regular grammar from regular expression</td><td>Understand</td><td>1</td></tr>
<tr><td>18</td><td>Explain the problems in top down parsing</td><td>Understand</td><td>2</td></tr>
<tr><td>19</td><td>Explain top down parsing algorithm in detail</td><td>Understand</td><td>3</td></tr>
<tr><td>20</td><td>Demonstrate left factoring with example</td><td>Understand</td><td>2</td></tr>
<tr><td colspan="4">PART – C (PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS)</td></tr>
<tr><td>1</td><td>Consider the following fragment of C code:
float i, j;
i = i*70+j+2;
Write the output at all phases of the compiler for above C code.</td><td>Apply</td><td>1</td></tr>
<tr><td>2</td><td>Construct an NFA for regular expression R= (aa | b) * ab convert it into an equivalent DFA.</td><td>Remember</td><td>2</td></tr>
</table>

S. No.	Questions	Bloom's Taxonomy Level	Course Outcome
3	**Describe** the languages denoted by the following regular expressions. i. (0+1)*0(0+1)(0+1) ii. 0*10*10*10*	Remember	2
4	**Explain** with one example how LEX program perform lexical analysis for the following PASCAL patterns Identifiers, Comments, Numerical constants, Keywords, Arithmetic operators?	Apply	3
5	**Check** whether the following grammar is a LL(1)grammar S-> iEtS|iEtSeS|a E-> b Also define the FIRST and FOLLOW.	Apply	2
6	**Consider** the grammar below E->E+E|E-E|E*E|E/E|a|b Obtain left most and right most derivation for the string a+b*a+b.	Apply	2
7	**Define** ambiguous grammar? Test whether the following grammar is ambiguous or not. E->E+E|E-E|E*E|E/E|E↑|(E)|-E|id	Apply	2
8	**State** the limitations of recursive descent parser?		3
9	**Convert** the following grammar into LL(1)grammar S->ABC A->aA|C B->b C->c.	Apply	3
10	**Write** a recursive descent parser for the grammar. bexpr->bexpr or bterm|bterm bterm->bterm and bfactor|bfactor bfactor->notebfactor|(bexpr)|true|false. Where ,or, and , not,(,),true, false are terminals of the grammar.	Apply	1
UNIT – II			
PART – A (SHORT ANSWER QUESTIONS)			
1	**Define** the term handle used in operator precedence?	Understand	1
2	**Define** LR(0) items in bottom up parsing?	Remember	1
3	**State** the disadvantages of operator precedence parsing?	Remember	1
4	**Explain** LR(k) parsing stands for ?	Understand	2
5	**Explain** why LR parsing is attractive one and explain?	Understand	1
6	**Define** goto function in LR parser with an example?	Understand	1
7	**Explain** why SLR and LALR are more economical to construct Canonical LR?	Understand	1
8	**Explain** about handle pruning?	Understand	1
9	**Explain** types of LR parsers?	Understand	1
10	**List** down the conflicts during shift-reduce parsing.	Remember	1
11	**Define** shift reduce parsing in detail	Understand	1
12	**Explain** conflicts in shift reduce parsing	Understand	1
13	**Explain** reduce conflicts with example	Understand	1
14	**Explain** precedence relations in detail	Understand	1
15	**Define** operator grammar with example	Understand	1
16	**Consider** the grammar E -> E + E|E *E|(E)| id Show the sequence of moves made by the shift-reduce parser on the input id1+id2*id3 and determine whether the given string is accepted by the parser or not.	Apply	2

S. No.	Questions	Bloom's Taxonomy Level	Course Outcome
17	i) **State** shift-reduce parsing? Explain in detail the conflicts that may occur during shift-reduce parsing. ii)For the grammar given below, calculate the operator precedence relation and the precedence functions E-> E + E|E- E|E * E|E / E|E E|(E)|-E|id	Understand	1
18	**Prepare** a canonical parsing table for the grammar given below S-> CC C->cC|d	Analysis	1
19	**Analyze** whether the following grammar is SLR(1) or not. Explain your answer with reasons. S -> L,R S -> R L -> * R L -> id R -> L.	Apply	1
20	i) **Consider** the grammar given below. E -> E + T E -> T T -> T * F T -> F F -> (E) F -> id Prepare LR parsing table for the above grammar .Give the moves of LR parser on id * id + id ii) Briefly explain error recovery in LR parsing.	Apply	1
21	**Explain** handle pruning in detail with example	Understand	1
22	**Demonstrate** stack implementation in implementation of shift reduce Parsing	Understand	1
23	**Explain** ways to determine precedence relations between pair of terminals	Understand	1
24	**Explain** operator precedence parsing algorithm	Understand	1
25	**Explain** LR parsers in detail with example	Understand	1
PART – B (LONG ANSWER QUESTIONS)			
1	Consider the grammar E->E + E|E *E|(E)| id.**Show** the sequence of moves made by the shift-reduce parser on the input id1+id2*id3 and determine whether the given string is accepted by the parser or not.	Apply	2
2	i) **State** shift-reduce parsing? Explain in detail the conflicts that may occur during shift-reduce parsing. ii)For the grammar given below, **calculate** the operator precedence relation and the precedence functions E -> E + E|E- E|E * E|E / E|E E|(E)|-E|id	Understand	2
3	**Prepare** a canonical parsing table for the grammar given below S-> CC C -> cC|d	Analysis	2
4	**Analyze** whether the following grammar is SLR(1) or not. Explain your answer with reasons. S->L,R S-> R L-> * R L-> id R -> L.	Apply	2

<table>
<tr><th>S. No.</th><th>Questions</th><th>Bloom's Taxonomy Level</th><th>Course Outcome</th></tr>
<tr><td>5</td><td>Consider the grammar given below.
E -> E + T

E -> T

T -> T * F

T -> F

F->(E)

F-> id

Prepare LR parsing table for the above grammar .Give the moves of LR parser on id * id + id
ii) Briefly explain error recovery in LR parsing.</td><td>Apply</td><td>2</td></tr>
<tr><td>6</td><td>Explain handle pruning in detail with example</td><td>Understand</td><td>2</td></tr>
<tr><td>7</td><td>Demonstrate stack implementation in implementation of shift reduce Parsing</td><td>Understand</td><td>2</td></tr>
<tr><td>8</td><td>Explain ways to determine precedence relations between pair of terminals</td><td>Understand</td><td>2</td></tr>
<tr><td>9</td><td>Explain operator precedence parsing algorithm</td><td>Understand</td><td>3</td></tr>
<tr><td>10</td><td>Explain LR parsers in detail with example</td><td>Understand</td><td>2</td></tr>
<tr><td colspan="4">PART – C (PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS)</td></tr>
<tr><td>1</td><td>Explain the common conflicts that can be encountered in a shift-reduce parser?</td><td>Apply</td><td>3</td></tr>
<tr><td>2</td><td>Explain briefly, precedence functions. Construct the precedence graph using the following precedence tables.
<table>
<tr><td></td><td>+</td><td>*</td><td>)</td><td>Id</td><td>$</td></tr>
<tr><td>f</td><td>2</td><td>3</td><td>4</td><td>4</td><td>0</td></tr>
<tr><td>g</td><td>1</td><td>3</td><td>4</td><td>5</td><td>0</td></tr>
</table></td><td>Apply</td><td>2</td></tr>
<tr><td>3</td><td>Explain LALR parsing, justify how it is efficient over SLR parsing.</td><td>Remember</td><td>2</td></tr>
<tr><td>4</td><td>Analyze whether the following grammar is CLR(1) or not. Explain your answer with reasons
S -> L,R
S->R
L-> * R
L-> id
R -> L.</td><td>Analysis</td><td>2</td></tr>
<tr><td>5</td><td>Discuss error recovery in LL and LR parsing.</td><td>Remember</td><td>2</td></tr>
<tr><td>6</td><td>Construct SLR (1) Parsing table for following grammar
s-> xAy/xBy/xAz
A->as/q
B->q</td><td>Remember</td><td>2</td></tr>
<tr><td>2</td><td>Construct SLR (1) Parsing table for following grammar
s->0s0/1s1/10</td><td>Remember</td><td>1</td></tr>
<tr><td>2</td><td>Construct SLR (1) Parsing table for following grammar
s->aSbS/bsas/E</td><td>Remember</td><td>1</td></tr>
<tr><td>2</td><td>Construct LALR (1) Parsing table for following grammar
s->Aa/bAc/dc/bda
A->d</td><td>Remember</td><td>1</td></tr>
</table>

S. No.	Questions	Bloom's Taxonomy Level	Course Outcome
7	**Construct** LALR (1) Parsing table for following grammar s->Aa/aAc/Bc/bBa A->d B->d	Remember	2
	UNIT – III		
	PART – A (SHORT ANSWER QUESTIONS)		
1	**State** the benefits of using machine-independent intermediate form?	Remember	2
2	**List** the three kinds of intermediate representation?	Understand	2
3	**Explain how** can you generate three-address code?	Understand	2
4	**Define** syntax tree? Draw the syntax tree for the assignment statement. a :=b * -c + b * -c.	Apply	2
5	**Explain** postfix notation?	Remember	2
6	**Explain** the usage of syntax directed definition?	Apply	2
7	**Define** abstract or syntax tree?	Understand	2
8	**Show** the DAG for a: =b *-c + b * -c?	Apply	2
9	**Translate** a or b and not c into three address code?	Apply	2
10	**Define** basic blocks?	Understand	1
11	**Discuss** back-end and front-end?	Understand	1
12	**Define** the primary structure preserving transformations on basic blocks?	Understand	1
13	**List** common methods for associating actual and formal parameters?	Understand	1
14	**List** various forms of target programs?	Remember	1
15	**Define** back patching?	Understand	1
16	**List** different data structures used for symbol table?	Remember	3
17	**Explain** the steps to search an entry in the hash table?	Understand	3
18	**List** the different types of type checking? Explain?	Understand	3
19	**Explain** general activation record?	Understand	3
20	**State** the difference between heap storage and hash table?	Understand	3
	PART – B (LONG ANSWER QUESTIONS)		
1	**Explain** with an example to generate the intermediate code for the flow of control statements?	Apply	1
2	**List** the various ways of calling the procedures? Explain in detail?	Analysis	2
3	**Explain** 3addresscodes and mention its types. How would you implement the three address statements? Explain with suitable examples?	Apply	2
4	**Explain** how declaration is done in a procedure using syntax directed translation?	Apply	2
5	a) **Write** a note on the specification of a simple type checker. b) **Define** a type expression? Explain the equivalence of type expressions with an appropriate example.	Analysis	1

S. No.	Questions	Bloom's Taxonomy Level	Course Outcome

6	**Generate** the three-address code for the following C program fragment
	while(a > b)
	{
	if (c < d)
	x = y + z;
	else
	x = y - z;
	}
		Understand	1

7	**Generate** the code for the following C statements using its equivalent three address code. a = b + 1 x = y+3 y = a/b a = b+c	Understand	1
8	**Describe** the method of generating syntax directed definition for control Statements?	Understand	2
9	**Explain** procedure calls with suitable example?	Understand	1
10	**Explain** Intermediate code generation for Basic block, Control Flow and Boolean Expressions?	Apply	1
11	**Write** about Quadruple and Triple with its structure?	Apply	1
12	**Explain** different schemes of storing name attribute in symbol table.	Understand	1
13	**Write** the advantages and disadvantages of heap storage allocation strategies?	Apply	2
14	**Distinguish** between static and dynamic storage allocation?	Understand	2
15	**Differentiate** between stack and heap storage?	Understand	2
16	**Demonstrate** semantic actions in semantic analysis	Understand	2
17	**Explain** translations on parse tree semantic analysis	Understand	1
18	**Explain** type checking in semantic analysis	Understand	2
19	**Explain** symbol table management in compiler design	Understand	2
20	**Demonstrate** hash tables by symbol table management	Understand	2
PART – C (PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS)			
1	**Suppose** that the type of each identifier is a sub range of integers, for expressions with operators +, -, *, div and mod, as in Pascal. Write type-checking rules that assign to each sub expression the sub range its value must lie in.	Understand	1
2	**Define** type expression? Write type expression for the following type i.Functions whose domains are functions from integers to pointers to integers and whose ranges are records consisting of an integer and a character.	Understand	1
3	**Write** an S-attributed grammar to connect the following with prefix rotator. L→E E→ E+T|E-T|T T→ T*F|T/F|F F→ P↑F|P P→ (E) P→ ID	Apply	1

S. No.	Questions	Bloom's Taxonomy Level	Course Outcome
4	**Construct** triples of an expression: a *- (b + c).	Apply	2
5	**Explain** SDD for Boolean expression with and without back patching?	Remember	2
6	**Explain why** are quadruples preferred over triples in an optimizing compiler?	Remember	2
7	**Explain** about reusing the storage space for names?	Remember	2
8	**Define** self-organizing lists? How can this be used to organize a symbol table? Explain with an example?	Apply	2
9	**Discuss** and analyze about all allocation strategies in run-time storage environment?	Understand	3
10	**Define** activation records? Explain how it is related with run-time storage organization?	Remember	3
11	Only one occurrence of each object is allowable at a given moment during program execution. **Justify** your answer with respect to static allocation?	Apply	3
12	**Explain** the use of Symbol table in compilation process? List out various attributes stored in the symbol table?	Understand	3
13	**List** the advantages and disadvantages of Static storage allocation strategies?	Understand	1
14	**Explain** the data structure used for implementing Symbol Table?	Understand	1
15	**Explain** the following: i) Static and Dynamic Checking of types ii) Over loading of Operators & Functions	Understand	1
1	**Explain** the principle sources of optimization?	Understand	2
2	**Explain** the patterns used for code optimization?	Understand	1
3	**Define** the 3 areas of code optimization?	Understand	1
4	**Define** local optimization?	Understand	1
5	**Define** constant folding?	Understand	1
6	**List** the advantages of the organization of code optimizer?	Understand	1
7	**Define** Common Sub expressions?	Understand	1
8	**Explain** Dead Code?	Understand	1
9	**Explain** the techniques used for loop optimization and Reduction in strength?	Understand	1
10	**Mention** the issues to be considered while applying the techniques for code Optimization?	Understand	1
11	**List** the different data flow properties?	Understand	1
12	**Explain** inner loops?	Understand	1
13	**Define** flow graph?	Understand	1
14	**Define** a DAG? Mention its Apply?	Understand	1
15	**Define** peephole optimization?	Understand	1
16	**Explain** machine instruction for operations and copy statement?	Understand	1
17	**Analyze** global data flow?	Understand	1
18	**Explain** about live variable analysis**?**	Understand	1
19	**Define** the term copy propagation?	Understand	2

S. No.	Questions	Bloom's Taxonomy Level	Course Outcome
20	**Explain** data flow equation?	Understand	2
1	**Explain** the principle sources of code optimization in detail?	Understand	1
2	**Explain** peephole optimization?	Understand	1
3	**Discuss** about the following i. Copy propagation ii. Dead code elimination iii. Code motion	Understand	1
4	**Explain** in the DAG representation of the basic block with example.	Understand	1
5	**Explain** Local optimization and loop optimization in detail	Understand	1
6	**Write** about Data Flow Analysis of structural programs?	Understand	1
7	**Explain** various Global optimization techniques in detail?	Understand	1

8	**Generate** target code for the given program segments:
	main()
	{
	int i=4,j;
	j = i + 5;
	}
		Apply	1

9	**Discuss** algebraic simplification and reduction in strength?	Understand	1
10	**Explain** the various source language issues?	Understand	1
11	**Explain** in detail the issues in design of a code generator?	Understand	1
12	**Demonstrate** the simple code generator with a suitable example?	Apply	1
13	**List** the different storage allocation strategies? Explain.	Understand	1
14	(a) **Write** the procedure to detect induction variable with example? (b) With example **Explain** dead code elimination?	Understand	2
15	(a) **Explain** how loop invariant computation can be eliminated? (b) **Explain** how "Redundant sub-expression eliminates" can be done in a given program?	Understand	2
16	**Explain** reachable code in code optimization	Understand	2
17	**Explain** characteristics of peep hole optimization	Understand	2
18	**Explain** depth first search in data flow analysis	Understand	2
19	**Explain** node splitting in data flow analysis	Understand	2
20	**Explain** depth first ordering in iterative algorithms	Understand	2
1	**Explain** how loop invariant computation can be eliminated?	Apply	3
2	**Describe** the procedure to compute in and out values using data flow equations for reaching definition in structured programs?	Apply	3

S. No.	Questions	Bloom's Taxonomy Level	Course Outcome

3	**Consider** the following part of code.
	int main()
	{
	int n,k=0;
	scanf("%d",&n);
	for(i=2;i<n;i++)
	{
	if((n%I)==0)break;
	}
	k=1;
	if(i==n)
	printf("number is prime");
	else
	printf("number is not printed");
	}
	Identify the basic blocks in the given program & Draw the domination tree for the program
		Understand	1

4	**Construct** the DAG for the following basic block. D:=B*C E:=A+B B:=B+C A:=E-D	Apply	1

5	**Consider** the following program which counts the prime from 2 to n using the sieve method on a suitable large array, begin read n
	for i:=2 to n do
	a[i]:=true
	count=0;
	for i:=2 to n**.5 do
	if a[i]then
	begin
	count:=2*I to n j=j+1 do
	a[j]:=false end
	i. print count end
	ii. Propagate out copy statements wherever possible.
	iii. Is loop jamming possible? If so, do it.
	iv. Eliminate the induction variables wherever possible
		Apply	1

6	**Write** an algorithm to eliminate induction variable?	Apply	1
7	**Explain** how the following expression can be converting in a DAG. a+b*(a+b)+c+d	Apply	
8	**State** loop invariant computations? Explain how they affect the efficiency of a program?	Understand	1
9	**Explain** how "Redundant sub-expression Eliminates" can be done at global level in a given program?	Understand	1
10	**Explain** role of DAG in optimization with example?	Understand	1
1	**Explain** about machine dependent and machine independent optimization?	Remember	1
2	**Explain** the role of code generator in a compiler?	Understand	1
3	**Write** in detail the issues in the design of code generator.	Apply	1
4	**Show** the code sequence generated by the simple code generation	Apply	1

S. No.	Questions	Bloom's Taxonomy Level	Course Outcome
	Algorithm u := a – c v := t + u d := v + u//d		
5	**Explain** the instructions and address modes of the target machine?	Understand	2
6	**Identify** the register descriptor target code for the source language statement "(a-b) + (a-c) + (a-c);" The 3AC for this can be written as t := a – b	Understand	2
7	**Mention** the properties that a code generator should possess.	Apply	
8	**Explain** how do you calculate the cost of an instruction?	Understand	2
9	**Explain** how will you map names to values?	Understand	2
10	**Generate** the code for x: =x+1 for target machine?	Understand	2
11	**Explain** the input taken by code generation algorithm	Understand	2
12	**Mention** the applications of DAG	Apply	2
13	**Describe** register descriptors in detail	Understand	2
14	**Describe** address descriptors in detail	Understand	2
15	**Demonstrate** global register allocation with example	Understand	2

1	a) **Explain** the concept of object code forms?
	b) **Generate** optimal machine code for the following C program.
	main()
	{
	int i, a[10];
	while (i<=10)
	a[i] =0;
	}
		Apply	2

2	**Explain** Machine dependent code optimization in detail with an example?	Understand	2
3	(a) **Discuss** various object code forms? (b) **Write** a short note on code generating algorithms?	Understand	2
4	**Write** about target code forms and explain how the instruction forms effect the computation time?	Understand	2
5	**Consider** the following basic block of 3-address instructions: a := b + c x := a + b b := a – d c := b + c d := a – d y := a – d **Write** the next-use information for each line of the basic block?	Apply	2
6	**Demonstrate** register allocation by graph coloring	Understand	1
7	**Explain** the steps involved in Dag construction	Understand	1
8	**Demonstrate** code generation algorithm in detail	Understand	1
9	**Explain** the principle of dynamic programming in detail	Understand	1

S. No.	Questions	Bloom's Taxonomy Level	Course Outcome
10	**Explain** code generation by tree rewriting in detail	Understand	1
1	**Explain** how the instruction forms effect the computation time?	Apply	3
2	**Explain** how the nature of the object code is highly dependent on the machine and the operating system?	Apply	3
3	**Explain** why Next-use information is required for generating object code?	Apply	3
4	Efficient code generation requires the Remember of internal architecture of the target machine. **Justify** your answer with an Example?	Understand	3

5	**Generate** optimal machine code for the following wing c program.
	main()
	{
	int i,a[10];
	while(i<=10)
	a[i]=0;
	}
		Apply	3

6	**Generate** 3 address code for below code X = (a+b)- /((c+d)-e)	Apply	3

7	**Generate** 3 address code for below code
	For(i=1;i<=10;i++)
	If(a<b) then x = y + z
		Apply	3

8	**Generate** 3 address code for below code
	If a < b then
	While c > d do
	x = x+y
	else
	do
	p = p+q
	while e<=f
		Apply	3

9	**Generate** 3 address code for below code X = 1 X = y X = x++	Apply	3

10	**Generate** 3 address code for below code
	main( )
	{
	int i;
	int a[10];
	While(i<=0)
	a[i]=0;
	}
		Apply	2

Prepared by: **HOD, COMPUTER SCIENCE AND ENGINEERING**

COMPUTER SCIENCE AND ENGINEERING

COURSE DESCRIPTION FORM

Course Title	**OPERATING SYSTEMS**			
Course Code	**A50510**			
Regulation	**R13 - JNTUH**			
Course Structure	Lectures	Tutorials	Practicals	Credits
	4	-	-	4
Course Faculty	CH V V N RAJU Asst.Prof			

COURSE OVERVIEW:

This course provides a comprehensive introduction to operating system design concepts, data structures and algorithms. The course is designed to provide in-depth critique on the problems of resource management and scheduling, concurrency and synchronization, memory management, file management, peripheral management, protection and security. This course is intended to discuss the topics in a general setting not tied to any one particular operating system. Throughout the course, the study of practical aspects that pertain to the most popular operating systems such as Unix/Linux and Windows are considered as case studies.

PREREQUISITE(S):

Level	Credits	Periods/ Week	Prerequisites
UG	4	4	Data Structures and Algorithms, Computer Architecture

III. MARKS DISTRIBUTION:

Sessional Marks	University End Exam Marks	Total Marks
Midterm Test There shall be two midterm examinations. Each midterm examination consists of essay paper, objective paper and assignment. The essay paper is for 10 marks of 60 minutes duration and shall contain 4 questions. The student has to answer 2 questions, each carrying 5 marks. The objective paper is for 10 marks of 20 minutes duration. It consists of 10 multiple choice and 10 fill-in-the blank questions, the student has to answer all the questions and each carries half mark.	75	100

IV. EVALUATION SCHEME:

S. No	Component	Duration	Marks
1.	I Mid Examination	80 minutes	20
2.	I Assignment	-	5
3.	II Mid Examination	80 minutes	20
4.	II Assignment	-	5
5.	External Examination	3 hours	75

V. COURSE OBJECTIVES:

At the end of the course, the students will be able to:

I. Be familiar with the fundamental principles of the operating system, its services and functionalities.
II. Master the concepts of processes, inter-process communication, synchronization and scheduling.
III. Be familiar with different types of memory management viz. virtual memory, paging and segmentation.
IV. Be familiar with analyzing the performance of memory management techniques in various real-time scenarios.
V. Master the concepts of data input/output, storage and file management.
VI. Be familiar with deadlocks and distinguish the techniques for deadlock detection, prevention, recovery.
VII. Be familiar with the need for protection in computer systems and the available techniques for protection.

COURSE OUTCOMES:

1. Apply optimization techniques for the improvement of system performance.
2. Ability to understand the synchronous and asynchronous communication mechanisms in their respective OS.
3. Learn about minimization of turnaround time, waiting time and response time and also maximization of throughput with keeping CPU as busy as possible.
4. Ability to compare the different OS

VII. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes		Level	Proficiency assessed by
PO1	**Engineering Knowledge** Appl the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization the solution of complex engineering problems.	H	Assignments, Tutorials
PO2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	H	Assignments
PO3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that		

	meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	S	Mini Projects
PO4	**Conduct investigations of complex problems**: Use research-based knowledge and research Methods design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	S	Projects
PO5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	S	Projects
PO6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.	N	--
PO7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	N	--
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and	N	--
	responsibilities and norms of the engineering practice.		
PO9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	N	--
PO10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and	N	--

	design documentation, make effective presentations, and give and receive clear instructions.		
PO11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	N	--
PO12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	S	Lectures, Projects

N - None **S - Supportive** **H - Highly Related**

VIII. SYLLABUS:

UNIT - I

Operating System Introduction: Operating Systems objectives and functions, Computer System Architecture, OS Structure, OS Operations, Evolution of Operating Systems - Simple Batch, Multi programmed, time-shared, Personal Computer, Parallel, Distributed Systems, Real-Time systems, Special-Purpose Systems, Operating System services, User OS interface, System Calls, Types of System Calls, System Programs, Operating System Design and Implementation, OS Structure, Virtual Machines.

UNIT – II

Process and CPU Scheduling - Process Concepts-The Process, Process State, Process Control Block, Threads, Process Scheduling-Scheduling Queues, Schedulers, Context Switch, Preemptive Scheduling, Dispatcher, Scheduling Criteria, Scheduling algorithms, Multiple-Processor Scheduling, Real-Time Scheduling, Thread Scheduling, Case Studies: Linux, Windows.

Process Coordination-Process Synchronization, The Critical Section Problem, Peterson'solution, Synchronization Hardware, Semaphores, and Classic Problems of Synchronization, Monitors, Case Studies: Linux, Windows.

UNIT – II Memory Management and Virtual Memory – Logical & Physical Address Space, Swapping, Contiguous Allocation, Paging, Structure of Page Table, Segmentation, Segmentation with Paging, Virtual Memory, Demand Paging, Performance of Demanding Paging, Page Replacement, Page Replacement Algorithms, Allocation of Frames, Thrashing.

UNIT – IV File System Interface – The Concept of File, Access methods, Directory Structure, File System Mounting, File Sharing, Protection, File System Implementation – File System Structure, File System Implementation, Allocation methods, Free-Space Management, Directory Implementation, Efficiency and Performance.

Mass Storage Structure – Overview of Mass Storage Structure, Disk Structure, Disk Attachment, Disk Scheduling, Disk Management, and Swap space Management.

UNIT – V Deadlocks – System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection and Recovery from Deadlock

Protection – System Protection, Goals of Protection, Principles of Protection, Domain of Protection, Access Matrix, Implementation of Access Matrix, Access Control, Revocation of Access Rights, Capability-Based Systems, Language-Based Protection.

Text books:

1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, "Operating System Principles", 8e, Wiley Student Edition.
2. W. Stallings, "Operating Systems - Internals and Design Principles", 6e, Pearson.

References:

1. S. Godbole, "Operating Systems", 2e, TMH.
2. P. C. P. Bhatt, "An Introduction to Operating Systems", PHI.
3. S. Haldar and A. A. Aravind, "Operating Systems", Pearson Education.
4. T. W. Doeppner, "Operating Systems in Depth", Wiley.

IX. COURSE PLAN:

At the end of the course, the students are able to achieve the following course learning outcomes:

Lecture No.	Topics to be covered	Course Learning Outcomes	Reference
1 - 2	**Operating System Introduction:** Operating Systems Objectives & Functions, Computer System Architecture, OS Structure And Operations	**Understand** the importance of OS and its functions	T2: 2.1 T1: 1.1 - 1.5
3 - 4	Evolution of Operating Systems - Simple Batch, Multi programmed, time-shared, Personal Computer, Parallel, Distributed Systems, Real-Time systems, Special-Purpose Systems	**Associate** the types of operating systems with real-life applications	T2: 2.2
5 - 6	OS Services, User OS Interface, Systems Calls, Types of Systems Calls, System Programs	**Interpret** the OS services and system calls	T1: 2.1 - 2.5
7 - 8	OS Design & Implementation, OS Structure, Virtual Machines	**Explain** the benefits of building abstract layers in hierarchical fashion and virtualization	T1: 2.6 - 2.8
9 - 10	**Process & CPU scheduling:** Process Concepts, Process Scheduling - Scheduling Queues, Schedulers, Context Switch, Preemptive Scheduling, Dispatcher	**Compare** and **contrast** the common algorithms used for both preemptive and non-preemptive scheduling of tasks in operating systems	T1: 3.1 - 3.4 T2: 3.1 - 3.4

11 - 13	Scheduling Criteria, Scheduling Algorithms		T1: 5.2 - 5.3
14	Multiple Processor Scheduling, Real-Time Scheduling	**Examine** appropriate scheduling algorithm for real-life applications	T1: 5.5 T2:10.1-10.2
15	Thread Scheduling	**Infer** advantages of threads over processes	T1: 5.4
16	Case Studies - Linux, Windows	**Associate** the process management in real operating systems	T1:5.6, 21.4 T2: 8.3 - 8.5
17 - 19	**Process coordination:** Process Synchronization, The Critical - Section Problem, Peterson's Solution, Synchronization Hardware	**Summarize** the range of mechanisms that can be employed at the operating system level to realize concurrent systems and describe the benefits of each.	T1: 6.1 - 6.4
20 - 21	Semaphores & Classical Problems of Synchronization, Monitors	**Understand** classical problems of synchronization	T1: 6.5 - 6.7
22	Case Studies: Linux, Windows	**Discuss** process synchronization in real operating systems	T2: 6.7 - 6.8, 6.10
23 - 24	**Memory Management & Virtual Memory:** Logical & Physical Address Space, Swapping, Contiguous Memory Allocation	**State** basics of memory management	T1: 8.1 - 8.3
25 - 26	Paging, Structure of Page Table	**Demonstrate** the concepts of memory management such as paging and segmentation	T1: 8.4 - 8.5
27	Segmentation, Segmentation with Paging		T1: 8.6
28 - 29	Virtual Memory, Demand Paging,	**Illustrate** the benefits of virtual	T1: 9.1 -

	Performance of Demand Paging	memory and demand paging	9.2
30 - 32	Page Replacement, Page Replacement Algorithms	**Order** the page replacement algorithms according to their	T1: 9.4
33	Allocation of Frames, Thrashing	performance	T1: 9.5 - 9.6
34	**File system Interface:** Concept of File, Access Methods, Directory Structures	Summarize the full range of considerations that support file systems. Compare and contrast different approaches to file organization, recognizing the strengths and weaknesses of each.	T1:10.1-10.3
35 - 36	File System Mounting, File Sharing, Protection, File System Structure, Implementation	**Outline** the issues of file system implementation	T1:10.4-10.6 T1:11.1-11.2
37 - 38	File Allocation Methods	**Define** file allocation methods and	T1: 11.4
39 - 40	Free-Space Management, Directory Implementation, Efficiency and Performance	performance metrics	T1: 11.3, 11.5 -11.6
41 - 42	**Mass Storage Structure:** Overview, Disk Structure, Disk Attachment	**Distinguish** between various techniques for disk management	T1:12.1-2.4
43 - 44	Disk Scheduling and Management, Swap-Space Management		T1:12.5-12.6
45	**Deadlocks:** System Model, Deadlock Characterization	Explain conditions that lead to deadlock and differentiate between	T1: 7.1 - 7.2

		deadlock, starvation, and race	
		conditions.	
46 - 48	Methods of Handling Deadlocks, Deadlock Prevention and Avoidance	**Understand** the difference between preventing and avoiding deadlocks.	T1: 7.3 - 7.5
49 - 50	Dead Lock Detection, Recovery from Deadlock		T1: 7.6 - 7.7
51 - 52	**Protection:** System Protection, Goals of Protection, Principles of Protection, Domain of Protection	**Quote** the goals and principles of system protection	T1:14.1-14.3
53 - 54	Access Matrix, Implementation of Access Matrix, Access control, Revocation of Access Rights	**Clarify** the different types of access control	T1:14.4-14.7
55 - 56	Capability- Based systems, Language - Based Protection	**Match** appropriate protection system for the needs	T1:14.8-14.9

MAPPING COURSE OBJECTIVES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Objectives	Program Outcomes												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
I	S	S	S								S		H	S
II		S	H	S	S								S	H
III	H			S	H						S		S	S
IV	S			S	H						S		S	S
V		S		S	H								H	H
VI		H	S						S					S
VII		S			S						H		H	S

S - Supportive **H - Highly Related**

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM

OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	H			S							S		S	
2	S	S	H	S	S						S			

ASSIGNMENT

Course Name	:	**Operating System**
Course Code	:	**A50510**
Class	:	III B. Tech I Semester
Branch	:	Computer Science and Engineering
Year	:	2016 – 2017
Course Faculty	:	CH V V N RAJU Asst.Prof

OBJECTIVES:

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education. The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited.

In line with this, Faculty of Institute of Aeronautical Engineering, Hyderabad has taken a lead in incorporating philosophy of outcome based education in the process of problem solving and career development. So, all students of the institute should understand the depth and approach of course to be taught through this question bank, which will enhance learner's learning process.

ASSIGNMENT – I & II

S. No.	Questions	Blooms Taxonomy Level	Course Outcome
	UNIT - I		
1	**Explain** in detail the types of system calls provided by a typical operating system?	Understand	1
2	**Compare** Tightly coupled systems and loosely coupled systems.	Understand	1
3	**Define** Operating System Operations and Structures	Knowledge	1
4	**Compare** and contrast Multiprogramming, Multitasking and Multiprocessing.	Apply	1
5	a. **Define** an operating system? State and explain the basic functions or services of an operating system. b. **List** the differences between multiprogramming and Time-sharing systems.	Understand Knowledge	1
6	Briefly **Explain** various managements of operating systems and their responsibilities in detail?	Understand	1
7	**Explain** about context switching with necessary diagram?	Understand	1
8	**Define** the system structure of Modern Operating System?	Understand	1
9	Briefly **Compare** the different operating system structures?	Apply	1
10	**Compare** Batch operating system and Time Sharing operating system?	Apply	1

S. No.	Questions	Blooms Taxonomy Level	Course Outcome
11	**Explain** how do clustered systems differ from multiprocessor systems? What is required for two machines belonging to a cluster to cooperate to provide a highly available service?	Understand	1
12	**List** and discuss the various services provided by the operating system?	Knowledge	1
13	**Explain** the advantages and disadvantages of using the system calls interface for manipulating both files and devices?	Understand	4
14	**Distinguish** between the client-server and peer-to-peer models of distributed systems?	Understand	1
	UNIT – II		
1	**Define** Monitor? Compare it with semaphore. Explain in detail a monitor with notify and broadcast using an example.	Knowledge	2
2	**Differentiate** I/O bound program and CPU bound program?	Understand	2
3	**Define** semaphore? Explain the application of semaphore.	Knowledge	2
4	**Give** short note about the following : a. Binary Semaphores. b. b. Bounded Waiting.		2
5	**List** out the various process states and briefly explain with a state diagra m.	Knowledge	2
6	a. **Describe** process scheduling? Explain the various levels of scheduling. b. **Compare** and contrast pre-emptive and non-pre-emptive	Understand Analyze	2

	algorithm.		
7	**Explain** how the concurrent processes cooperate by sharing and by communication	Understand	2
8	**Discuss** about the actions taken by the kernel to context switch between the processes?	Understand	2
9	**List** five services provided by an operating system that are designed to make it more convenient for users to use the computer system. In what cases it would be impossible for user-level programs to provide these services? Explain.	Knowledge	2
10	**State** the purpose of short-term, medium-term and long term schedulers. Also discuss the differences among them.	Knowledge	2
11	**Describe** the following a. Virtual Machine b. Process state c. Process Control Block	Knowledge	2
12	**Define** Process? Explain different Process States?	Knowledge	2
13	**Describe** the following a. Race Condition b. Process Interaction	Knowledge	2
	UNIT – III		
1	**Describe** the file system of UNIX?	Knowledge	1
	Compare the main memory organization schemes of contiguous-	Apply	2
	memory allocation, segmentation, and paging with respect to the		

2	following issues: A. external fragmentation B. internal fragmentation C. ability to share code across processes		
3	**Describe** Belady's anomalous behaviour of FIFO.	Understand	2
4	**Define** thrashing? Explain the different methods to avoid thrashing.	Knowledge	2
5	**Explain** about addresses binding for a user program and discuss multi step processing of a user program?	Understand	2
6	**State** and explain about Virtual memory concept with neat diagram.	Knowledge	6
7	**Explain** how double buffering improves the performance than a single buffer for I/O?	Understand	6
8	**Explain** the basic concepts of segmentation with neat diagrams?	Understand	7
9	**Differentiate** between logical I/O and device I/O?	Understand	7
10	**Differentiate** between internal and external fragmentation. Which one occurs in paging scheme?	Understand Understand	6
11	**Discuss** briefly about Swapping concept with necessary Examples.	Understand	7
12	Consider the following page-reference string: 1,2,3,4,2,1,5,6,2,1,2,3,7,6,3,2,1,2,3,6 **Calculate** the number of page faults would occur for the following replacement algorithms, assuming frame size is 4. Remember that frames are initially empty. (i)LRU replacement (ii)FIFO replacement (iii)Optimal replacement	Apply	6
13	**Explain** briefly about Paging with neat diagram.	Understand	6
14	**Discuss** LRU-Approximation page replacement?	Understand	6

UNIT – IV			
1	**Discuss** about a. Disk Management b. Swap -Space Management	Understand	7
2	**Describe** the following Directory Implementation methods: a. Linear List b. Hash Table	Knowledge	7
3	**Discuss** the Criteria for choosing file origination?	Understand	7
4	**Define** buffering, caching and spooling.	Knowledge	7
5	**Describe** indexed file, indexed sequential file organization?	Knowledge	7
6	**Explain** the following File concepts: a. File Attributes. b. File Operations. c. File Types. d. Internal File Structure.	Understand	7
7	a. **Discuss** about N- step- SCAN policy for disk scheduling. b. **Explain** how double buffering improves the performance than a single buffer for I/O.	Understand Understand	7
8	**List** and Explain three Blocking Methods?	Knowledge	7
9	**Explain** shortest Process Next scheduling with an example?	Understand	7
10	**Explain the** relationship between a pathname and a working directory?	Understand	7
11	**Discuss** about N-Step scan policy for disk scheduling?	Understand	7
12	**Discuss** in detail the performances issues of secondary storage management?	Understand	7

13	**Compare** and contrast chained allocation with indexed allocation technique of file allocation	Apply	7
14	**List** the various disk space allocation strategies. Explain clearly the contiguous allocation technique.	Knowledge	8
15	**Describe** briefly a. The methods of file accessing. b. b. Two level directory structure.	Knowledge	7
16	**Explain** about the protection strategies provided for files. a. Types of access b. Access control list (ACL)	Understand	8

	c. Three classifications-owner, group & universe		
	d. Other protection approaches-passwords		
	UNIT – V		
1	**Explain** the working of banker's algorithm for deadlock avoidance with	Understand	9
	suitable examples.		
2	a. **Explain** the critical section? Describe the different solution	Understand	9
	available to avoid race conditions?		
	b. **Explain** about Mutual exclusion?		
3	**Explain** the Banker's algorithm for deadlock avoidance.	Understand	9
	Deadlock avoidance definition		
	Data structures used		
	Safety algorithm		
	Resource request algorithm		
4	**Describe** the access matrix model used for protection.	Understand	11
5	**Relate** the terms race condition, atomic transaction, critical	Apply	9

	section and mutual exclusion.		
6	**Describe** Resource-Allocation graph? Explain how resource graph can be used for detecting deadlocks.	Understand	9
7	**Discuss** deadlock detection in detail.	Understand	9
8	**Explain** briefly about resource allocation graph with examples.	Understand	9
9	**State** and explain the methods involved in recovery from deadlocks	Knowledge	9
10	**Explain** the conditions for the deadlock to occur? How can a deadlock be prevented?	Understand	9

ASSIGNMENT

Course Name	:	**Operating System**
Course Code	:	**A50510**
Class	:	III B. Tech I Semester
Branch	:	Computer Science and Engineering
Year	:	2016 – 2017
Course Faculty	:	CH V V N RAJU Asst.Prof

OBJECTIVES:

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.ASSIGNMENT – I & II

S. No.	Questions	Blooms Taxonomy Level	Course Outcome
	UNIT - I		
1	**Explain** in detail the types of system calls provided by a typical operating system?	Understand	4
2	**Compare** Tightly coupled systems and loosely coupled systems.	Understand	1
3	**Define** Operating System Operations and Structures	Knowledge	1
4	**Compare** and contrast Multiprogramming, Multitasking and Multiprocessing.	Apply	1
5	a. **Define** an operating system? State and explain the basic functions or services of an operating system. b. **List** the differences between multiprogramming and Time-sharing systems.	Understand Knowledge	1
6	Briefly **Explain** various managements of operating systems and their responsibilities in detail?	Understand	1
7	**Explain** about context switching with necessary diagram?	Understand	1
8	**Define** the system structure of Modern Operating System?	Understand	1
9	Briefly **Compare** the different operating system structures?	Apply	1
10	**Compare** Batch operating system and Time Sharing operating system?	Apply	1

S. No.	Questions	Blooms Taxonomy Level	Course Outcome
11	**Explain** how do clustered systems differ from multiprocessor systems? What is required for two machines belonging to a cluster to cooperate to provide a highly available service?	Understand	1
12	**List** and discuss the various services provided by the operating system?	Knowledge	1
13	**Explain** the advantages and disadvantages of using the system calls interface for manipulating both files and devices?	Understand	4
14	**Distinguish** between the client-server and peer-to-peer models of distributed systems?	Understand	1
	UNIT – II		
1	**Define** Monitor? Compare it with semaphore. Explain in detail a monitor with notify and broadcast using an example.	Knowledge	2
2	**Differentiate** I/O bound program and CPU bound program?	Understand	2
3	**Define** semaphore? Explain the application of semaphore.	Knowledge	2
4	**Give** short note about the following : a. Binary Semaphores. b. b. Bounded Waiting.		2
5	**List** out the various process states and briefly explain with a state diagram	Knowledge	2

6	**a.Describe** process scheduling? Explain the various levels of scheduling. b. **Compare** and contrast pre-emptive and non-pre-emptive algorithm.	Understand Analyze	2
7	**Explain** how the concurrent processes cooperate by sharing and by communication	Understand	2
8	**Discuss** about the actions taken by the kernel to context switch between the processes?	Understand	2
9	**List** five services provided by an operating system that are designed to make it more convenient for users to use the computer system. In what cases it would be impossible for user-level programs to provide these services? Explain.	Knowledge	2
10	**State** the purpose of short-term, medium-term and long term schedulers. Also discuss the differences among them.	Knowledge	2
11	**Describe** the following a. Virtual Machine b. Process state c. Process Control Block	Knowledge	2
12	**Define** Process? Explain different Process States?	Knowledge	2

13	**Describe** the following a. Race Condition b. Process Interaction	Knowledge	2
	UNIT – III		
1	**Describe** the file system of UNIX?	Knowledge	1
2	**Compare** the main memory organization schemes of contiguous-memory allocation, segmentation, and paging with respect to the following issues: A. external fragmentation B. internal fragmentation C. ability to share code across processes	Apply	4
3	**Describe** Belady's anomalous behaviour of FIFO.	Understand	2
4	**Define** thrashing? Explain the different methods to avoid thrashing.	Knowledge	2
5	**Explain** about addresses binding for a user program and discuss multi	Understand	3

	c. Three classifications-owner, group & universe		
	d. Other protection approaches-passwords		
	UNIT – V		
1	**Explain** the working of banker's algorithm for deadlock avoidance with	Understand	3
	suitable examples.		3
2	a. **Explain** the critical section? Describe the different solution	Understand	3
	available to avoid race conditions?		3
	b. **Explain** about Mutual exclusion?		3
3	**Explain** the Banker's algorithm for deadlock avoidance.	Understand	2
	a. Deadlock avoidance definition		
	b. Data structures used		
	c. Safety algorithm		
	d. Resource request algorithm		
4	**Describe** the access matrix model used for protection.	Understand	1
5	**Relate** the terms race condition, atomic transaction, critical section and mutual exclusion.	Apply	1
6	**Describe** Resource-Allocation graph? Explain how resource graph can be used for detecting deadlocks.	Understand	2
7	**Discuss** deadlock detection in detail.	Understand	1
8	**Explain** briefly about resource allocation graph with examples.	Understand	1
9	**State** and explain the methods involved in recovery from deadlocks	Knowledge	2
10	**Explain** the conditions for the deadlock to occur? How can a deadlock be prevented?	Understand	3

TUTORIAL QUESTION BANK

Course Title	**OPERATING SYSTEMS**			
Course Code	**A50510**			
Regulation	**R13 - JNTUH**			
Course Structure	Lectures	Tutorials	Practicals	Credits
	4	-	-	4
Course Faculty	CH V V N RAJU Asst.Prof			

OBJECTIVES:

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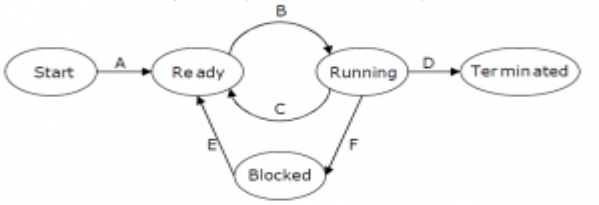
S. No.	Question	Blooms Taxonomy Level	Course Outcomes
	UNIT – I		
	PART – A (Short Answer Questions)		
1	**Define** operating system?	Knowledge	1
2	**Discuss** batch systems?	Understand	1
3	**List** any four functions of operating system?	Knowledge	1
4	**Define** system call?	Knowledge	1
5	**List** any four types of system calls?	Knowledge	1
6	**Distinguish** between user mode and kernel mode operations of the operating system?	Understand	1
7	**List** the advantages of multiprogramming?	Knowledge	1
8	**Distinguish** between multiprogramming and multitasking?	Understand	1
9	**Define** interrupt?	Knowledge	1
10	**Define** distributed systems?	Knowledge	1
11	**Define** real-time operating system?	Knowledge	1
12	**Define** virtual machine?	Knowledge	1
13	**List** the memory hierarchy available in operating system?	Knowledge	1
14	**Define** multiprocessor system?	Knowledge	1
15	**Describe** the different types of multiprocessing?	Knowledge	1
16	**Describe** the different types of multiprocessor systems?	Knowledge	1
17	**Define** kernel?	Knowledge	1

18	**Define** time-sharing systems?	Knowledge	1
19	**Describe** the use of fork () and exec () system calls?	Knowledge	1
20	**Define** privileged instructions?	Knowledge	1
21	**State** the differences between system call and system program?	Knowledge	1
22	**State** the five major activities of an operating system in regard to process management?	Knowledge	1
23	**State** the main advantage of the layered approach to system design? What are the disadvantages of using the layered approach?	Knowledge	1
24	**List** the contemporary operating systems that use the microkernel approach?	Knowledge	1
25	**List** the various OS components?	Knowledge	1
26	**State** the challenges in designing a distributed operating system?	Knowledge	1
	PART-B (Long Answer Questions)		
1	**State** and explain various types of computer systems?	Knowledge	2
2	a) **Define** an operating system? State and explain the basic functions or services of an operating system? b) **Explain** the differences between multiprogramming and time-sharing systems?	Understand	2
3	**Explain** how protection is provided for the hardware resources by the operating system?	Understand	2
4	**Describe** the system components of an operating system and **explain** them briefly?	Understand	2
5	**Describe** the operating system structures?	Knowledge	2
6	**Discuss** the following structures of OS?		2
7	**Explain** briefly system calls with examples?	Understand	2
8	**Define** the essential properties of the following operating systems?		2
9	a) **Explain** the architecture of an operating system? b) **Draw** and explain the architecture of windows 2000 and traditional UNIX?	Understand	2
10	Computer system architecture deals about how the component of a computer system may be organized? **Discuss** in detail about different architectures of a computer system?	Understand	2
11	Does an operating system generally need to keep about running processes in order to execute them? **Explain** in detail.	Understand	2
12	**Discuss** the view of an operating system as a resource manager?	Understand	2
13	**Distinguish** between multiprogramming, multitasking and multiprocessing?	Understand	2
14	**Explain** how operating system services are provided by system calls?	Understand	2
15	**Describe** the functionalities listed below? a) Batch programming b) Virtual Memory c) Time sharing	Knowledge	2
16	**Distinguish** between the client-server and peer-to-peer models of distributed systems?	Understand	2
	PART-C (Problem Solving and Critical Thinking)		
1	How does the distinction between kernel mode and user mode function as a rudimentary form of protection (security) system? **Justify.**	Apply	1
2	**Explain** using a simple system call as an example (e.g. getpid, or uptime), what is generally involved in providing the result, from the point of calling the function in the C library to the point where that function returns?	Understand	1
3	In a multiprogramming and time-sharing environment, several users share the system simultaneously. This situation can result in various security problems? a) **Explain** two such problems? b) Can we ensure the same degree of security in a time-shared machine as we have in a dedicated machine? **Explain** your answer.	Apply	1

4	**Explain** why must the operating system be more careful when accessing input to a system call (or producing the result) when the data is in memory instead of registers?	Understand	1
5	**Discuss** how a multi-threaded application can be supported by a user- level threads package. It may be helpful to consider (and draw) the components of such a package, and the function they perform?	Understand	1
6	**Explain** why do you think that idleness in CPU occurs?	Knowledge	1
7	**Explain** If you run the same program twice, what section would be shared in the memory?	Knowledge	1
8	**Explain** the difference between interrupt and exception?	Understand	1
9	**Differentiate** between tightly coupled systems and loosely coupled systems.	Apply	1
10	**Explain** Is OS is a resource manager? If so justify your answer	Knowledge	1
	UNIT – II		
	PART – A (Short Answer Questions)		
1	**Define** process. what is the information maintained in a PCB?	Knowledge	2
2	**Define** process state and mention the various states of a process?	Knowledge	2
3	**Describe** context switching?	Knowledge	2
4	**Explain** the use of job queues, ready queues and device queues?	Understand	2
5	**Distinguish** between thread with process?	Understand	2
6	**Explain** benefits of multithreaded programming?	Understand	2
7	**Explain** different ways in which a thread can be cancelled?	Understand	2
8	**Distinguish** between user threads and kernel threads?	Understand	2
9	**Define** CPU scheduling?	Knowledge	2
10	**List** the various scheduling criteria for CPU scheduling?	Knowledge	2
11	**Distinguish** between preemptive and non-preemptive scheduling techniques?	Understand	2
12	**Define** turnaround time?	Knowledge	3
13	**List** different types of scheduling algorithms?	Knowledge	1
14	**State** critical section problem?	Knowledge	1
15	**State** the requirements that a solution to the critical section problem must satisfy?	Knowledge	1
16	**Define** race condition?	Knowledge	2
17	**Define** semaphores. Mention its importance in operating system?	Knowledge	2
18	**State** two hardware instructions and their definitions which can be used for implementing mutual exclusion?	Knowledge	2
19	**Explain** bounded waiting in critical region?	Understand	2
20	**Distinguish** between semaphore and binary semaphore?	Understand	1
21	**Define** monitor?	Knowledge	1
22	**Describe** entry and exit sections of a critical section?	Knowledge	1
23	**State** the real difficulty with the implementation of the SJF CPU scheduling algorithm?	Knowledge	1
24	**State** the factors on which the performance of the Round Robin CPU scheduling algorithm depends?	Knowledge	2
25	**Name** the algorithms used for foreground and background queue scheduling in a multilevel queue-scheduling algorithm?	Knowledge	2
26	**State** the assumption behind the bounded buffer producer consumer problem?	Knowledge	2
	PART-B (Long Answer Questions)		
1	**Explain** the reasons for process termination?	Understand	1
2	**Discuss** the following process, program, process state, process control	Understand	1
3	**Explain** the process state transition diagram with examples.	Understand	1

4	**Discuss** the attributes of the process. **Describe** the typical elements of process control block?	Understand	1
5	**Explain** the principles of concurrency and the execution of concurrent processes with a simple example?	Understand	2
6	**Describe** dining-philosophers problem? Device an algorithm to solve the problem using semaphores?	Understand	2
7	**Explain** the infinite buffer producer/consumer problem for concurrent processing which uses binary semaphores?	Understand	2
8	Define monitor? Distinguish between monitor and semaphore. **Explain** in detail a monitor with notify and broadcast functions using an example?	Understand	2
9	List out the various process states and briefly **explain** the same with a state diagram?	Understand	1
10	a) Describe process scheduling? **Explain** the various levels of scheduling. b) **Distinguish** pre-emptive and non-pre-emptive scheduling algorithms?	Understand	1
11	**Discuss** about following? a) Process b) Components of process c) Program versus process d) Process states	Understand	1
12	**Discuss** the following? a) CPU-I/O burst cycle b) CPU schedule c) Pre-emptive and non-preemptive scheduling d) Dispatcher	Understand	2
13	**Explain** the concept of multi-threading? Discuss the following multi-threading models. a) Many-to-one b) One-to-one c) Many-to-many d) Two-level	Understand	1
14	**Explain** the issues that may rise in multi-threading programming. Discuss about each in detail?	Understand	1
15	**Discuss** the following CPU scheduling algorithms a) Round robin b) Multilevel- queue scheduling c) Multi-level feedback queue scheduling	Understand	1
16	A scheduling mechanism should consider various scheduling criteria to realize the scheduling objectives? **List** out all the criteria.	Knowledge	2
17	Define semaphore? **Explain** the method of application of semaphore for process synchronization?	Understand	3
18	**Explain** the Readers and Writers problem and its solution using the concept of semaphores?	Understand	2
19	**Explain** the uses of the following: a. Mutex object b. Semaphore object c. Waitable timer object	Understand	2
20	**Write** short notes about the following: a. Binary Semaphores b. Bounded Waiting	Knowledge	2
PART-C (Problem Solving and Critical Thinking)			

<table>
<tr><td>1</td><td>Suppose we have a single processor system, and jobs arrive at a rate of 10 jobs a Seconds, suppose each job takes an average of 50 milli-seconds to complete. Assure that both distributions are exponential. State the expected number of jobs in the system and the average time in the system?</td><td>Apply</td><td>1</td></tr>
<tr><td>2</td><td>Suppose the following jobs arrive for processing at the times indicated, each job will run the listed amount of time.
<table><tr><th>Jobs</th><th>Arrival Time</th><th>Burst Time (in secs)</th></tr><tr><td>1</td><td>0.0</td><td>8</td></tr><tr><td>2</td><td>0.4</td><td>4</td></tr><tr><td>3</td><td>1.0</td><td>1</td></tr></table>Give Gantt chart illustrating the execution of these jobs using the non-pre-emptive FCFS and SJF scheduling algorithms. Compute the average turnaround time and average waiting time of each job for above algorithms.</td><td>Apply</td><td>1</td></tr>
<tr><td>3</td><td>Consider system with five processor P0 to P4 and 3 resources A, B and C, Resources type A has 10 instances, B has 5 instances and C has 7 instances. The snapshot at time T0 is
<table><tr><th></th><th colspan="3">ALLOTED</th><th colspan="3">MAX</th></tr><tr><th></th><th>A</th><th>B</th><th>C</th><th>A</th><th>B</th><th>C</th></tr><tr><td>P0</td><td>0</td><td>1</td><td>0</td><td>7</td><td>5</td><td>3</td></tr><tr><td>P1</td><td>2</td><td>0</td><td>0</td><td>3</td><td>2</td><td>2</td></tr><tr><td>P2</td><td>3</td><td>0</td><td>2</td><td>9</td><td>0</td><td>2</td></tr><tr><td>P3</td><td>2</td><td>1</td><td>1</td><td>2</td><td>2</td><td>2</td></tr><tr><td>P4</td><td>0</td><td>0</td><td>2</td><td>4</td><td>3</td><td>3</td></tr></table>Now the process P1 request one additional resource type A and two instances of C. Determine whether this new site is safe or not.</td><td>Apply</td><td>1</td></tr>
<tr><td>4</td><td>Explain the advantage of using semaphores over Test And Set () and Swap () functions. Describe the use of wait() and signal() functions on semaphore and how these can provide the solution to the Critical section problem?</td><td>Understand</td><td>1</td></tr>
<tr><td>5</td><td>Consider the following set of processes with the length of the CPU burst time given in milliseconds
<table><tr><th>Process</th><th>BurstTime</th><th>Priority</th></tr><tr><td>P1</td><td>10</td><td>3</td></tr><tr><td>P2</td><td>1</td><td>1</td></tr><tr><td>P3</td><td>2</td><td>3</td></tr><tr><td>P4</td><td>1</td><td>4</td></tr><tr><td>P5</td><td>5</td><td>2</td></tr></table>The processes are assumed to have arrived in the order p1, p2, p3, p4, p5 all at time 0.
a) Draw four Gantt charts illustrating the execution of these processes using FCFS, SJF, anon pre-emptive priority (a smaller priority number implies a higher priority) and RR (quantum=1) scheduling.
b) What is the turnaround time of each process for each of the scheduling algorithms in part?
c) What is the waiting time of each process for each of the scheduling algorithms in part? Which of the schedules in part a results in the minimal average waiting time?</td><td>Apply</td><td>1</td></tr>
<tr><td>6</td><td>Consider three processes (process id 0, 1, 2 respectively) with compute time bursts 2, 4 and 8 time units. All processes arrive at time zero. Consider the longest remaining time first (LRTF) scheduling algorithm. In LRTF ties are broken by giving priority to the process with the lowest process id. The average turnaround time is?</td><td>Apply</td><td>2</td></tr>
</table>

7	**Consider** three CPU-intensive processes, which require 10, 20 and 30 time units and arrive at times 0, 2 and 6, respectively. How many context switches are needed if the operating system implements a shortest remaining time first scheduling algorithm? Do not count the context switches at time zero and at the end	Apply	2
8	**Explain** the following process state transition diagram for a uniprocessor system, assume that there are always some processes in the ready state 	Understand	2
9	**Explain** Four jobs to be executed on a single processor system arrive at time 0 in the order A, B, C, D. their burst CPU time requirements are 4, 1, 8, 1 time units respectively. The completion time of A under round robin scheduling with time slice of one time unit is?	Apply	3
10	**Explain** Which scheduling algorithm allocates the CPU first to the process that requests the CPU first?	Understand	3
	UNIT – III		
	PART – A (Short Answer Questions)		
1	**Explain** the main function of the memory-management unit?	Understand	2
2	**Distinguish** between logical address and physical address?	Understand	2
3	**Describe** dynamic loading and dynamic linking?	Knowledge	2
4	**Distinguish** between compile time, load time and execution time address binding?	Understand	2
5	**Define** swapping?	Knowledge	2
6	**List** dynamic storage allocation strategies in contiguous memory allocation scheme?	Knowledge	2
7	**Distinguish** between MFT and MVT?	Understand	2
8	**Distinguish** between internal and external fragmentation?	Understand	3
9	**Define** compaction?	Knowledge	3
10	**List** and define non-contiguous memory allocation schemes?	Knowledge	3
11	**Distinguish** between paging and segmentation?	Understand	3
12	**State** the purpose of TLB?	Knowledge	2
13	**Explain** the basic approach of page replacement?	Understand	2
14	**Distinguish** between page table and inverted page table?	Understand	2
15	**State** the benefits of a virtual memory system?	Knowledge	2
16	**Distinguish** between demand paging and pure demand paging?	Understand	3
17	**Explain** the calculation of effective access time of a demand-paged memory system?	Understand	3
18	**Explain** page fault and its effect on the performance of the demand paged memory system?	Understand	3
19	**Explain** the need for page-replacement.?	Understand	1
20	**List** various page replacement algorithms?	Knowledge	1
21	**Distinguish** between local and global page replacement strategies?	Understand	1
22	**Distinguish** between equal and proportional frame allocation strategies?	Understand	2
23	**Explain** the concept of thrashing and why thrashing should be avoided in a system?	Understand	2
	PART-B (Long Answer Questions)		

1	**Describe** the following? a) Virtual Memory b) Cache Memory c) Auxiliary Memory	Understand	1
2	**Explain** in detail the requirements that memory management technique needs to satisfy?	Understand	1
3	**Explain** a) Paging b) Page table structure c) Translation look-aside buffer d) Segmentation	Understand	2
4	**Explain** why the "principle of locality" is crucial to the use of virtual memory? What is accomplished by page buffering?	Understand	2
5	**Discuss** briefly the swapping concept with necessary examples?	Understand	1
6	**Describe** contiguous memory allocation concept with advantages and disadvantages?	Knowledge	1
7	**Differentiate** the main memory organization schemes of contiguous-memory allocation, segmentation, and paging with respect to the following		2
8	**Differentiate** between internal and external fragmentation and Which one occurs in paging scheme?	Understand	3
9	**Explain** briefly about paging with neat diagram?	Understand	1
10	**Discuss** the following a) Hierarchical paging b) Inverted page Tables	Understand	1
11	Draw and **explain** the working procedure of paging hardware in detail?	Understand	1
12	**Explain** the basic concepts of segmentation with neat diagrams?	Understand	1
13	**Define** page fault? When does a page fault occur? Describe the action taken by OS when page fault occurs?	Knowledge	2
14	**State** and explain about virtual memory concept with neat diagram?	Knowledge	2
15	**Differentiate** between paging and segmentation?	Understand	2
16	**Explain** briefly the performance of demand paging with necessary examples?	Understand	2
17	**Explain** the basic Scheme of page replacement and about the various page replacement strategies with examples?	Understand	3
18	**Explain** the Readers and Writers problem and its solution using the concept of semaphores?	Understand	1
19	**Explain** the uses of the following: a. Mutex object b. Semaphore object c. Waitable timer object	Understand	2
20	**Write** short notes about the following: a. Binary Semaphores b. Bounded Waiting	Knowledge	3
21	**Explain** the Readers and Writers problem and its solution using the concept of semaphores?	Understand	2
PART-C (Problem Solving and Critical Thinking)			
1	Suppose you have 16M bytes of main memory. Using the list method there is an overhead of 8B per memory block. Using the bitmap method, the allocation granularity is of 128B. How many blocks are there when the space overhead of both methods is the same? **Explain** the average block size for this many blocks?	Apply	3

2	**Consider** a computer system supports 32-bit virtual addresses as well as 32-bit physical addresses. Since the virtual address space is of the same size as the physical address space, the operating system designers decide to get rid of the virtual memory entirely.	Apply	4
3	**Consider** a CPU generates 32-bit virtual addresses. The page size is 4 KB. The processor has a translation look-aside buffer (TLB) which can hold a total of 128 page table entries and is 4-way set associative. The minimum size of the TLB tag is:	Apply	2
4	**Consider** there are 3 page frames which are initially empty. If the page reference string is 1, 2, 3, 4, 2, 1, 5, 3, 2, 4, 6, the number of page faults using the optimal replacement policy is	Apply	1
5	**Consider** the following page reference string 7,0,2,0,3,0,4,2,3,0,3,2,1,2,0,1,7,0 Assuming three frames, how many page faults would occur in each of the following cases? a) LRU b) FIFO c) Optimal algorithms Note that initially all frames are empty.	Apply	1
6	**Analyze** that we have a paging system with page table stored in memory A. If a memory reference takes 200 nanoseconds how long does a paged B. If we add associative registers and 75% of all page table references are memory reference take found in the associative registers, what is the effective memory reference time? Assume that finding a page table entry in the associative registers takes zero time, if the entry is there.	Analyze	2
7	In two level nested loops, the outer index (i) runs from 1 to 5 and the inner index (j) runs from 1 to 10.The page faults seem to occur for every 7^{th} innermost iterations. If it takes 0.02 micro second to load a new page what is the extra time required because of occurrence of page faults?	Apply	2
8	Given memory partitions of 100K, 500K, 200K, 300K, and 600K (in order), how would each of the First-fit, Best-fit, and Worst-fit algorithms place processes of 212K, 417K, 112K, and 426K (in order)? **Explain** Which algorithm makes the most efficient use of memory?	Apply	2
9	Suppose we have a demand paged memory. The page table is held in registers. It takes 8 milliseconds to service a page fault if an empty frame is available or the replaced page is not modified and 20 milliseconds if the replaced page is modified. Memory access time is 100 nanoseconds. **Consider** that the page to be replaced is modified 70 percent of the time. What is the maximum acceptable page-fault rate for an effective access time of no more than 200 nanoseconds?	Apply	3
10	**Consider** a logical address space of eight pages of 1024 words each mapped onto a physical memory of 32 frames a) How many bits are in the logical address? b) How many bits are in the physical address?	Apply	3
	UNIT – IV		
	PART – A (Short Answer Questions)		
1	**Define** the terms – file, file path, directory?	Knowledge	2
2	**Explain** any four common file attributes?	Understand	2
3	**Explain** any four file operations?	Understand	2
4	**Distinguish** between shared and exclusive lock?	Understand	2
5	**List** any four common file types and their extensions?	Knowledge	2
6	**Explain** the information associated with an open file?	Understand	3
7	**List** the different file accessing methods?	Knowledge	3

8	**Explain** the operations that can be performed on a directory?	Understand	4
9	**Discuss** the most common schemes for defining the logical structure of a directory?	Understand	4
10	**Describe** UFD and MFD.?	Knowledge	4
11	**Describe** file system mounting?	Knowledge	2
12	**Write** the format of a typical file-control block?	Knowledge	3
13	**List** the different disk-space allocation methods?	Knowledge	2
14	**List** the various layers of a file system?	Knowledge	3
15	**Explain** the functions of virtual file system (VFS)?	Understand	3
16	**Describe** about different types of disk scheduling?	Knowledge	3
17	**Define** the terms with respect to disk I/O - seek time, latency time?	Knowledge	3
18	**Explain** the allocation methods of a disk space?	Understand	3
19	**State** the advantages of linked disk-space allocation strategy?	Knowledge	3
20	**State** the advantages of indexed disk-space allocation strategy?	Knowledge	2
21	**List** the different free disk-space management techniques?	Knowledge	2
22	**Explain** the bit vector method free space management on disk?	Understand	2
23	**Discuss** the advantages of contiguous memory allocation of disk space?	Understand	2
24	**Discuss** the drawbacks of contiguous allocation of disk space?	Understand	1
25	**List** any four secondary storage memory devices?	Knowledge	1
26	**Describe** about logical formatting of the disk?	Knowledge	1
27	**List** various disk-scheduling algorithms?	Knowledge	1
28	**State** the purpose of boot block?	Knowledge	2
PART-B (Long Answer Questions)			
1	a) **Discuss** the criteria for choosing a file organization? b) **Describe** indexed file and indexed sequential file organization?	Understand	3
2	**Describe** the file system of UNIX?	Understand	3
3	**List** the common file types along with their extensions and describe each file type?	Knowledge	3
4	**Differentiate** among the following disk scheduling algorithms? a) FCFS b) SSTF c) SCAN d) C-SCAN e) LOOK f) C-LOOK	Understand	2
5	a) **Explain** magnetic disk structure and its management? b) **Exemplify** swap space management?	Understand	1
6	**Explain** the following in detail with respect to disk? a) Seek time b) Latency c) Access time d) Transfer time	Understand	1
7	a) **Explain** in detail the interrupts and interrupt handling features? b) **Explain** with neat diagram the steps in DMA transfer?	Understand	1
8	a) **Discuss** the N-step SCAN policy for disk scheduling? b) **Explain** how double buffering improves the performance than a single buffer for I/O?	Understand	1

9	a) **Explain** the techniques used for performing I/O? b) Give an example of an application in which data in a file should be accessed in the following order: i. sequential ii. Random	Understand	2
10	**Discuss** in detail the performance issues of secondary storage management?	Understand	2
11	**Explain** how disk caching can improve disk performance?	Understand	2
12	**Explain** low-level formatting or physical formatting?	Understand	2
13	**Define** buffering, caching and spooling?	Knowledge	2
14	**Discuss** the following a) File system mounting b) Thrashing	Understand	2
15	**Explain** the following file concepts: a) File attributes b) File operations c) File types d) Internal file structure	Understand	3
16	**Explain** the concept of file sharing? What are the criteria to be followed in systems which implement file sharing?	Understand	3
17	**Describe** the following Directory Implementation methods? a) Linear List b) Hash Table	Knowledge	3
18	**Explain** the concept and techniques of free space management?	Understand	3
19	**Discuss** about a) Disk space management b) Swap -space management	Understand	3
1	Suppose we have files F1 to F4 in sizes of 7178, 572, 499 and 1195 bytes. Our disks have fixed physical block size of 512 bytes for allocation. **Explain h**ow many physical blocks would be needed to store these four files if we were to use a chained allocation strategy assuming that we need 5 bytes of information to determine the next block in the link? Which file results in the maximum internal fragmentation (measured as a percentage of the file size itself)?	Understand	1
2	**Using** a diagram, show how an indexed allocation of a file may be done for a disked based system with the following characteristics. The disc size is 30blocks each of 1024 bytes (may be modeled as 6 X 5 matrixes). File f1 is 11 logical records of 112 bytes, file f2 is 890 logical records of 13 bytes, file f3 is 510 bytes of binary data stream and file f4 is 4 logical blocks of 95 bytes.	Apply	2
3	A hard disk has 63 sectors per tracks, 10 platters each with 2 recording surfaces and 1000 cylinders. The address of a sector is given as a triple <c, h, and s> where c is the cylinder number, h is the surface number and s is the sector number. Thus 0th sector is addressed as <0, 0, and 0>, the 1st sector is Addressed as <0, 0, and 1> and so on. Calculate the address of 1050th sector.	Understand	2
4	**Explain** the maximum file size supported by a file system with 16 direct blocks, single, double, and triple indirection? The block size is 512 bytes. Disk block numbers can be stored in 4 bytes.	Understand	2
5	**Discuss** the reasons why the operating system might require accurate information on how blocks are stored on disk. how could operating system improves file system performance with this knowledge	Understand	2
6	**Discuss** how OS could maintain a free-space list for a tape-resident file system. Assume that the tape technology is append-only and that it uses EOT marks and locate, space and read position command	Understand	2
7	Is there any way to implement truly stable storage? **Explain** your answer	Understand	2

8	Could a RAID level 1 organization achieve better performance for read requests than RAID level 0 organization(with non redundant striping of data)? If so, how?	Understand	1
9	Compare the performance of write operations achieved by a RAID level 5 organization with that achieved by a RAID level 1 organization.	Understand	2
10	**Consider** that a disk drive has 5,000 cylinders, numbered 0 to 4,999. The drive is currently serving request at cylinder 143, and the previous request was at cylinder 125. The queue of pending requests, in FIFO order, is: 86, 1470, 913, 1774, 948, 1509, 1022, 1750, 130 Starting from the current head position, what is the total distance (in cylinders) that the disk arm moves to satisfy all pending requests for each of the following disk scheduling algorithms? A. FCFS B. SSTF C. SCAN D. C-SCAN E. LOOK F. C-LOOK	Apply	2
	UNIT – V		
	PART – A (Short Answer Questions)		
1	**Define** deadlock?	Knowledge	1
2	**Define** resource. List some resources that a process might need for its execution?	Knowledge	1
3	**Explain** the sequence in which a process may utilize the resources in normal mode of operation?	Understand	1
4	**Describe** the conditions under which a deadlock situation may arise?	Knowledge	1
5	**Explain** safe state and unsafe state?	Understand	2
6	**Describe** the representation of a resource-allocation graph?	Knowledge	2
7	**Distinguish** between deadlock avoidance and prevention strategies?	Understand	2
8	**Describe** the purpose of banker's algorithm?	Knowledge	2
9	**List** the four data structures (matrices) that must be maintained to implement banker's algorithm?	Knowledge	2
10	**Describe** the techniques for recovery from deadlock?	Knowledge	3
11	**List** the goals of protection?	Knowledge	3
12	**Define** the terms – object, domain, access right?	Knowledge	3
13	**Write** the format of an access matrix?	Knowledge	3
14	**List** the implementation techniques of access matrix?	Knowledge	3
15	**Describe** role-based access control?	Knowledge	3
16	**List** the schemes that implement revocation of capabilities?	Knowledge	4
17	**List** any two example systems that implement capability-based protection?	Knowledge	4
18	**Describe** any one language-based protection schemes.	Knowledge	1
19	**Write** the main differences between capability lists and access lists?	Knowledge	1
20	**State** the protection problems that may arise if a shared stack is used for parameter passing?	Knowledge	1
21	**State** principle of least privilege?	Knowledge	1
	PART-B (Long Answer Questions)		
1	**Define** deadlock? what are the four conditions necessary for a deadlock situation to arise? how it can be prevented?	Knowledge	2
2	**Explain** briefly resource allocation graph with examples?	Understand	2
3	**Differentiate** the deadlock handling methods?	Understand	2
4	**Discuss** in detail the technique of deadlock avoidance?	Understand	2

5	**Explain** Banker's algorithm for deadlock avoidance with an example?	Understand	3
6	**Discuss** deadlock detection method in detail?	Understand	3
7	**State** and explain the methods involved in recovery from deadlocks?	Knowledge	3
8	Describe resource-allocation graph? **Explain** how resource graph can be used for detecting deadlocks?	Understand	4
9	**Describe** the terms. a) Race condition b) Atomic transaction c) Critical section d) Mutual exclusion	Knowledge	4
10	**Describe** how the access matrix facility and role-based access control facility are similar? how do they differ?	Knowledge	4
11	**Explain** why a capability based system such as Hydra provides greater flexibility than the ring- protection scheme in enforcing protection policies?	Understand	4
12	**Explain** the following. a) Goals of protection b) Principles of protection	Understand	4
13	**Discuss** about domain of protection?	Understand	4
14	Why do you need to provide protection to the system? **Explain** how access matrix can be used for the purpose?	Understand	4
15	**Discuss** the access matrix implementation techniques?	Understand	3
16	**Compare** the various access matrix implementation techniques?	Understand	3
17	**Discuss** the various issues that need to be considered through the process of revocation of access rights?	Understand	2
18	**Explain** various schemes to implement revocation for capabilities?	Understand	2
19	**Explain** how language-based protection scheme can be used for providing system protection at kernel level?	Understand	1
20	**Explain** relative merits of compiler-based enforcement based solely on a kernel, as opposed to enforcement provided largely by a compiler?	Understand	1
	PART-C (Problem Solving and Critical Thinking)		
1	**Consider** the following snapshot of a system <table><tr><th></th><th colspan="4">Allocation</th><th colspan="4">Max</th><th colspan="4">Available</th></tr><tr><th></th><th>A</th><th>B</th><th>C</th><th>D</th><th>A</th><th>B</th><th>C</th><th>D</th><th>A</th><th>B</th><th>C</th><th>D</th></tr><tr><td>P1</td><td>0</td><td>0</td><td>1</td><td>3</td><td>0</td><td>0</td><td>1</td><td>2</td><td>1</td><td>5</td><td>2</td><td>0</td></tr><tr><td>P2</td><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td>7</td><td>5</td><td>0</td><td></td><td></td><td></td><td></td></tr><tr><td>P3</td><td>1</td><td>3</td><td>5</td><td>4</td><td>2</td><td>3</td><td>5</td><td>6</td><td></td><td></td><td></td><td></td></tr></table>Answer the following questions using the banker's algorithm: a) What is the content of matrix "Need"? b) Is the system in a safe state? c) If a request from process P1 arrives for (0, 4, 2, 0) can the request be granted immediately?	Apply	1
2	**Consider** the version of the dining-philosophers problem in which the chopsticks are placed at the center of the table and any two of them can be used by a philosopher. Assume that requests for chopsticks are made one at a time. Describe a simple rule for determining whether a particular request can be satisfied without causing deadlock given the current allocation of chopsticks to philosophers.	Analyze	1
3	**Consider** a system consisting of *m* resources of the same type being shared by *n* processes. A process can request or release only one resource at a time. Show that the system is deadlock free if the following two conditions hold: a) The maximum need of each process is between one resource and *m* resources. b) The sum of all maximum needs is less than *m* + *n*.	Analyze	1

4	**Explain** How does the principle of least privilege aid in the creation of protection systems?	Analyze	2
5	**Describe** how the Java protection model would be compromised if a Java program were allowed to directly alter the annotations of its stack frame.	Analyze	2
6	**List** the Coffman's conditions that lead to a deadlock**.**	Understand	2

7	A system has n resources $R_0,...,R_{n-1}$,and k processes $P_0,....P_{k-1}$.The implementation of the resource request logic of each process P_i is as follows:
	if (i % 2 == 0)
	{
	if (i < n) request Ri
	if (i+2 < n) request Ri+2
	}
		Analyze	2

8	A system contains three programs and each requires three tape units for its operation. **Explain** the minimum number of tape units which the system must have such that deadlocks never arise is?	Analyze	2
9	A system has 6 identical resources and N processes competing for them. Each process can request atmost 2 resources. **Explain** which one of the following values of N could lead to a deadlock?	Analyze	2
10	Two shared resources R_1 and R_2 are used by processes P_1 and P_2. Each process has a certain priority for accessing each resource. Let T_{ij} denote the priority of P_i for accessing R_j. A process $P_i$can snatch a resource R_h from process P_j if T_{ik} is greater than T_{jk}. Given the following : 1. $T_{11} > T_{21}$ 2. $T_{12} > T_{22}$ 3. $T_{11} < T_{21}$ 4. $T_{12} < T_{22}$ **Explain** which of the following conditions ensures that P_1 and P_2 can never deadlock?	Analyze	3

COMPUTER SCIENCE AND ENGINEERING

COURSE DESCRIPTION FORM

Course Title	**INTELLECTUAL PROPERTY RIGHTS**			
Course Code	**A50017**			
Regulation	**R13-JNTUH**			
Course Structure	**Lectures**	**Tutorials**	**Practical**	**Credits**
	5	-	-	4
Course Faculty	**B SRINIVAS GOUD Asst.Prof**			

I. COURSE OVERVIEW:

This course introduces the importance of intellectual property and the protection of creation or innovation or ideas which are to be used to make a product or service or design layout or process which is economical called patents, utilities etc. The course emphasizes on intellectual property protection and its importance of estimating the intelligence of an individual correlates with financial advantages. It also deals with fundamentals of laws to protect and encourage the inventions and creations. The main objective of this course is to examine the laws and the procedures to protect the intellectual property rights of an intellectual or expert and make it like another property which is non tangible. This course is presented to students by power point projections, lecture notes, course handouts, assignments, objective and subjective tests.

II. PREREQUISITE(S):

Level	Credits	Periods / Week	Prerequisites
UG	4	5	-

III. MARKS DISTRIBUTION:

Sessional Marks (25 Marks)	University End Exam Marks	Total Marks
Mid Semester Test There shall be 2 midterm examinations. Each midterm examination consists of subjective type and Objective type tests. The subjective test is for 10 marks, with duration of 1 hour. The objective type test is for 10 marks with duration of 20minutes. It consists of 10 Multiple choice and 10 fill in the blanks. The student has to answer all the questions and each carries half mark. First midterm examination shall be conducted for the first two and half units of syllabus and second midterm examination shall be conducted for the remaining portion. Five marks are earmarked for assignments. Marks shall be awarded considering the average of two midterm examinations in each course reason whatsoever, will get zero marks(s).	75	100

IV EVALUATION SCHEME:

Mid Semester Test	25 marks
End Semester Examination	75 arks

V COURSE OBJECTIVES:

At the end of the course, the student will be able to:

1. Be familiar with different types of Intellectual Property (IP)
2. Be familiar with the Rights of Ownership
3. Be familiar with procedures of evaluation, registration, protection and acquisition of trademarks
4. Be familiar with Law of Intellectual Property
5. Explore knowledge in Trademarks, Copyrights, Patents and Trade Secrets
6. Adequate knowledge in New Developments in IP
7. Be familiar with auditing and advantages

IV. COURSE OUTCOMES:

1. Understand different types of Intellectual Property
2. List the International organizations and its functions to protect Intellectual Property
3. Explain in detail about agencies and treaties related to Intellectual Property Rights.
4. Explain the importance of Intellectual Property Rights
5. Explain the purpose and function of Trademarks
6. Explain the acquisition of Trademark Rights
7. Explain the Trademark Evaluation, Registration Processes
8. Describe the fundamentals of Copyright Law
9. Explain the originality of material and Rights or reproduction
10. Illustrate international Copyright law with respect to ownership and registration of Copyrights
11. Explain the patent searching processes and transfer of ownership on patents
12. Explain Trade Secrets determination, misappropriation, protection for submission and litigation
13. Explain the New International Developments in Trademarks Law and Copyright Law and Patent Law
14. Explain the New International Developments in Copyright Law and Patent Law Explain Intellectual Property Audits

V. HOW COURSE OUTCOMES ARE ASSESSED:

Program Outcomes		Level	Proficiency assessed by
PO1	**Engineering Knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems	H	Assignments
PO2	**Problem Analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences	H	Assignments
PO3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the	S	--

Program Outcomes		Level	Proficiency assessed by
	public health and safety, and the cultural, societal, and environmental considerations		
PO4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions	H	Designing, Exercises
PO5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations	S	Designing .
PO6	**The Engineer and Society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice	N	--
PO7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development	N	--
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice	S	Prototype Models
PO9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings	N	--
PO10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions	S	Document Preparation, Presentation
PO11	**Project Management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments	S	Assignments
PO12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change	H	Assignments

N = None **S = Supportive** **H = Highly Related**

HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes		Level	Proficiency assessed
PSO1	**Applications of Computing**: Ability to use knowledge in various domains to provide solution to new ideas and innovations.	H	Lectures, Assignments
PSO2	**Programming Skills**: Identify required data structures, design suitable algorithms, develop and maintain software for real world problems.	H	Projects

SYLLABUS:

UNIT – I
INTRODUCTION TO INTELLECTUAL PROPERTY:
Introduction, Types of Intellectual Property (IP), International Organizations, Agencies and treaties, Importance of Intellectual Property Rights.

UNIT - II
TRADE MARKS:
Purpose and Function of Trademarks, Acquisition of Trademarks Rights, Protectable Matter, Selecting and Evaluating Trademark, Trademark Registration Processes

UNIT - III
LAW OF COPYRIGHTS:
Fundamentals of Copyrights Law, Originality of Material, Rights to Reproduction, Rights to Perform the Work Publicly, Copyright Ownership issues, Copyright Registration, Notice of Copyright, International Copyright Law.

LAW OF PATENTS:
Foundation of Patent Law, Patent searching Process, Ownership Rights and transfer

UNIT - IV
TRADE SECRETS:
Trade Secrets Law, Determination of trade Secrets Status, Liability for misappropriations of Trade Secrets, Protection for submission, Trade Secrets Litigation

UNFAIR COMPETITION: Misappropriation of Right of Publicly, False Advertising

UNIT – V
NEW DEVELOPMENTS OF INTELLECTUAL PROPERTY:
New Developments in Trade Law, Copyright Law, Patent Law, Intellectual Propety Audits
International overview of Intellectual Property, International-Trademark Law, Copyright Law, International Patent Law, International Development in Trade Secrets Law

TEXT BOOKS:

1. Deborah.E.Bouchoux, "Intellectual Property Right", Cengage Learning
2. Prabuddha Ganguli, "Intellectual Property Right", Unleashing the knowledge economy", Tata Mc.Graw Hill Publishing Company Ltd.

COURSE PLAN:

At the end of the course, the students are able to achieve the following course learning outcomes:

Lecture No.	CLO	Unit	Course Learning Outcomes	Topics to be covered	Reference
1-5	1	I	**Describe** different types of Intellectual Property	Introduction of Intellectual Property (IP), Types of IP	T1:1.1, T1:1.2
6-8	2		**Describe** the organizations	International Organizations	T1:1.4
9-11	3		**List** Agencies and treaties related to Intellectual Property	Agencies and Treaties	T1:1.4
12-13	4		**Understand** the different Laws in IP	Importance of Intellectual Property Rights	T1:1.5
14-16	5	II	**Understand** the purpose and function of trademarks	Purpose and function of Trademarks	T1:2.2
17-20	6		**Describe** acquisition of trademark rights and protectable matter	Acquisition of Trademarks Rights and Protectable Matter	T1:2.4, 2.9
21-23	7		**Describe** the evaluation of trademark and its selection	Selecting and Evaluating Trade Mark	T1:3.1

Lecture No.	CLO	Unit	Course Learning Outcomes	Topics to be covered	Reference
24-26	8		**Elevate** trademark Registration Processes	Trademark Registration Processes	T1:4.5
27-30	9	III	**Understand** fundamentals of Copyright Law	Fundamentals of Copyright Law	T1:10.2
31-32	10		**Understand** Originality of material and rights of reproduction	Originality of material and rights of Reproduction	T1:11.2
33-36	11		**Explain** the rights to perform the work publicly, copyright ownership and copyright registration	The Rights to perform the work publicly, Copyright ownership issues and Copyright registration	T1:11.5, T1:12.1, T1:13.4
37-40	12		**Know** International Copyright law and notice of copyright	Notice of copyright, International Copyright Law	T1:16
41-43	13		**Explain** the foundation of patent law	Foundation of patent Law	T1:17
44-46	14		**Explain** the patent searching process	Patent Searching Process	T1:18.1
47-48	15		**Learn** patent ownership rights and transfer	Ownership Rights and Transfer	T1:19
49-50	16	IV	**Describe** Trade Secret Law and determine trade secret status	Trade Secrets Law, Determination of Trade Secrets status	T1:2.1, T1:2.3, T1:22.2
51-53	17		**Identify** liability for misappropriation of trade secrets	Liability for misappropriations of Trade Secrets	T1:22.2
54-56	18		**Identify** trade secrets litigation	Protection for submission, trade secrets Litigation	T1:22.5, T1:22.8
57-59	19		**Describe** misappropriation right of publicity	Unfair Competition: Misappropriation of right of publicly	T1:23
60-63	20		Identify False advertising	False advertising	T1:23.3
64-65	21	V	**Describe** new developments in Trade Law	New developments in Trade Law	T1:7
66-67	22		**Describe** new developments in Copyright law	New developments in Copyright Law	T1:8
68-69	23		**Describe** new developments in patent law	New developments in Patent Law	T1:15.7
70-71	24		**Understand** IP audits	Intellectual Property Audits	T1:16
72-73	25		**Understand** International Overview of IP	International Overview of IP	T1:21.1,2
74-75	26		**Understand** International Trademark Law	International Trademark Law	T1:21.1, 2
76-77	27		**Understand** International Copyright law	International Copy right Law	T1:24.2
78-79	28		**Understand** International Patent Law	International patent Law	T1:24.2
80-83	29		**Understand** International Trade Secrets Law	International Development in Trade Secrets Law	T1:24.2

MAPPING COURSE OBJECTIVES LEADING TO THE ACHIEVEMENT OF PROGRAMME OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Objectives	Program Outcomes												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
I	H	H	S	S	S	H		H		S		S	H	S
II	H	H	S										H	S
III	H	H	S	S				S				S	S	H
IV	H	H						S				S	H	S
V	H	H						S					H	

S = Supportive **H = Highly Related**

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	H	S	S	S	S	H		S		S		S	H	S
2	S	H	S	S	S	S		H		S		S	S	H
3	S	S	S	S	S	H		S		S		S	H	S
4	S	S	S	S	S	S		S		S		S	S	H
5	H	S											S	H
6	H			S								S	H	S
7	S			H									S	H
8	S	H											H	S
9			H	H	S							S	S	H
10	H			S									S	H
11	H			S	S								H	S
12	H		H									S	S	H
13	H		S							S		S	S	
14	H		S							S		S	S	

COMPUTER SCIENCE AND ENGINEERING

ASSIGNMENT

Course Name	**INTELLECTUAL PROPERTY RIGHTS**
Course Code	**A50017**
Class	III B. Tech I Semester
Branch	Computer Science and Engineering
Year	2016 – 2017
Course Faculty	**B SRINIVAS GOUD Asst.Prof**

OBJECTIVES

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education. The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited.

In line with this, Faculty of Institute of Aeronautical Engineering, Hyderabad has taken a lead in incorporating philosophy of outcome based education in the process of problem solving and career development. So, all students of the institute should understand the depth and approach of course to be taught through this question bank, which will enhance learner's learning process.

ASSIGNMENT-I

S. No	Question	Blooms Taxonomy Level	Course Outcome
	UNIT-I		
1	**Explain** different types of intellectual property in detail?	Understand	1
2	**Explain** the functions of international intellectual property organizations?	Understand	1
3	**Explain** the agencies and treaties of intellectual property?	Understand	8
4	**Describe** the importance of intellectual property rights?	Knowledge	4
5	**Describe** about IPR? Do you think this is useful rights for us? Explain	Knowledge	4
6	**Explain** about International Organizations, Agencies, and Treaties?	Understand	4
7	**Discuss** whether the following items would be protectable as trademarks, copyrights, patents, or trade secrets: 'Freeze You' as the name of a new type of ice cream a company's plans for its future business operations and possible mergers a new type of rose a new slogan to be used by Burger King a new novel by Toni Morrison	Understand	4
8	**Distinguish** between Trademark and Trade secrets.	Understand	4
9	**Explain** why agencies responsible for Intellectual Property Registration with any two examples?	Understand	1
10	**Describe** the importance of International organisation? When it was established?	Knowledge	1
S. No	**Question**	**Blooms Taxonomy Level**	**Course Outcome**
	UNIT – II		
1	**Explain** acquisition of trademark rights?	Understand	4
2	**Write** the procedure for Selecting and evaluating of trademark?	Apply	4
3	**Discuss** the functions of trademark?	Understand	1
4	**Describe** Protectable matter?	Knowledge	1
5	**Explain** trademark registration processes?	Understand	3
6	**Discuss** the method of protecting the prior-used trademarks in the system of acquisition-through-registration?	Understand	3
7	**Explain** the reasons for protecting trademarks in the system of acquisition?	Understand	5
8	**Discuss** new developments in Trademark Law? How do you avoid cyberspace trademark issues?	Understand	2
9	**Explain** how do you select and evaluate Trademark?	Understand	1
10	**Explain** about the process of Trademark?	Understand	1
	UNIT – III		
1	**Explain** about copyright Law and when it was founded?	Apply	6
2	**Discuss** about the Rights under the 1976 copyright act?	Understand	5
3	**Explain** the subject matter of copyright?	Understand	9
4	**Explain** the fundamental of Copyright Law?	Understand	8
5	**Define** the originality of material and how it is identified?	Knowledge	5
6	**Explain** the rights afforded by copyright law?	Understand	9
7	**Discuss** the rights of reproduction?	Understand	9
8	**Discuss** about "the rights to perform the work publicly" and explain it.	Understand	5

9	**Explain** copyright ownership issues?	Understand	9
10	**Explain** when the terminations of transfers of copyrights take place?	Understand	8

ASSIGNMENT-II

S. No	Question	Blooms Taxonomy Level	Course Outcome
	UNIT – III		
1	**Explain** how the ownership rights and transfers are taken place?	Understand	5
2	**Write** about the notice of copy right.	Apply	8
3	**Describe** about copy rights.	Knowledge	5
4	**Explain** how the patent searching process is taken place?	Understand	9
5	**Discuss** about copy rights.	Understand	9
6	**What** did you understand about Law of patents?	Understand	8
7	**Write** about the procedure for 'the notice of the copy right' is prepared.	Apply	7
8	**Define** the rights of ownership issues.	Knowledge	9
9	**Write** surplusage in Copyright Notice.	Apply	9
10	**Describe** the procedure restoration of Copyright is done.	Knowledge	8
	UNIT – IV		
1	**Define** Trade Secrets Law? Explain about Trade Secrets Law.	Knowledge	13
2	**Explain** the liability for misappropriation of trade secrets?	Understand	11
3	**Illustrate** Trade Secret Litigation.	Understand	10
4	**Discuss** about trade secret protection programs. Explain?	Understand	10
5	**Write** about new development in International trade secrets law. What are they?	Apply	9
6	**Explain** about unfair competition? Write its types?	Understand	9
7	**Discuss** right of publicity. Explain?	Understand	9
8	**Discuss** Misappropriation in Trade Secrets and how the Right of Publicity help in misappropriation?	Understand	9
9	**Discuss** whether the New Developments in the Right of Publicity is necessary, if so in what way.	Understand	9
10	**Explain** false advertising with examples?	Understand	8
	UNIT – V		
1	**Explain** about the new developments in Trademark law?	Understand	12
2	**Discuss** how you protect a domain name. Explain the precautionary steps to be taken for protecting domain name in trademark?	Understand	12
3	**Explain** how the cyber crime can control in trademark? How you hyperlink?	Understand	12
4	**Explain** cybersquatters and the Anticybersquatting consumer Protection Act?	Understand	12
5	**Discuss** new development in protecting copyright law. What are they? Explain?	Understand	12
6	**Explain** how a copyright protection is overcoming the cyber crime?	Understand	12
7	Describe about copyright protection act? How the copyright protection for automated database is processed?	Knowledge	13
8	**Explain** copyright in the electronic age?	Understand	11
9	**Describe** the digital millennium copyright act?	Knowledge	13
10	**Explain** the new developments in copyright and recent developments in copyright law?	Understand	13

TUTORIAL QUESTION BANK

Course Name	**INTELLECTUAL PROPERTY RIGHTS**
Course Code	**A50017**
Class	III B.Tech I Semester
Branch	Computer Science and Engineering
Year	2016 – 2017
Course Faculty	**B SRINIVAS GOUD Asst.Prof**

OBJECTIVES

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S.No	Questions	Blooms Taxonomy Level	Course Outcome
	UNIT – I		
	PART - A (SHORT ANSWER QUESTIONS)		
1	**Define** intellectual property?	Knowledge	1
2	**Discuss** intellectual property rights?	Understand	1
3	**Discuss** condition of purchase a book and make photocopies of it and sell, Is it violation?	Understand	8
4	**Explain** with an example of why intellectual properties need to be protected?	Understand	4
5	**Describe** how monopoly nature of owner is controlled by Patent Trademark Organization?	Knowledge	4
6	**Describe** how long will patent protections for the invention for which application was filed on August 10 and patent was issued on January 28, 2003 last?	Knowledge	4
7	**Explain** how long will the copy right last if a novel written by Moby Dick in 1851 and died in 1891?	Understand	4
8	**Explain** how long will protections for the song composed by bala in1982 last?	Understand	4
9	**Define** trademark?	Knowledge	1
10	**Define** service mark?	Knowledge	1
11	**Explain** united states trademark law from which time trademark is considered?	Understand	3
12	**Explain** the time validity for registered trademark?	Understand	3
13	**Explain** the additional period of protection with trademark renewal?	Understand	5
14	**Discuss** the protection time period for utility and plant patents?	Understand	2
15	**Explain** the protection time period for design patents?	Understand	11
16	**Define** Trade Secrets?	Knowledge	13
17	**Explain** which type of IPR is preferable for a Jewellery design item; design patent or copyright?	Understand	11
18	**Explain** significant changes to US intellectual property law from General	Apply	3

S.No	Questions	Blooms Taxonomy Level	Course Outcome
	Agreement on Tariffs and Trade (GATT)?		
19	**Explain** the functions of united nations agency for promoting Intellectual property?	Understand	12
20	**Explain** Paris Convention?	Understand	4
21	**Write** a short note on Berne Convention?	Apply	4
22	**Explain** Madrid Protocol?	Understand	12
23	**Write** the duties of NAFTA?	Apply	4
24	**Define** Trademark?	Understand	12
25	**Write** the importance of IP?	Knowledge	11
PART - B (LONG ANSWER QUESTIONS)			
1	**Explain** different types of intellectual property in detail?	Understand	1
2	**Explain** the functions of international intellectual property organizations?	Understand	1
3	**Explain** the agencies and treaties of intellectual property?	Understand	8
4	**Describe** the importance of intellectual property rights?	Knowledge	4
5	**Describe** about IPR? Do you think this is useful rights for us? Explain	Knowledge	4
6	**Explain** about International Organizations, Agencies, and Treaties?	Understand	4
7	**Discuss** whether the following items would be protectable as trademarks, copyrights, patents, or trade secrets: a) 'Freeze You' as the name of a new type of ice cream b) a company's plans for its future business operations and possible mergers c) a new type of rose d) a new slogan to be used by Burger King e) a new novel by Toni Morrison	Understand	4
8	**Distinguish** between Trademark and Trade secrets?	Understand	4
9	**Explain** why agencies responsible for Intellectual Property Registration with any two examples?	Understand	1
10	**Describe** the importance of International organisation? When it was established?	Knowledge	1
11	**Explain** why the International Organization, Agencies and Treaties were established? Give any Five International agreements and treaties that affect Intellectual property?	Understand	3
12	**Explain** the reasons for increasing importance for Intellectual Property Rights?	Understand	3
13	**Explain** the International organizations, Agencies and treaties?	Understand	5
14	**Explain** Federal Registration of Trademarks?	Understand	2
15	**Describe** why Trade Secrets are necessary? how do they function?	Knowledge	5
16	**Explain** the functions of INTA, WIPO?	Knowledge	1
17	**Express** your views about the Intellectual Property Rights necessity for the countries?	Understand	1
18	**Explain** about patent?	Understand	8
19	**Explain** about different types of Intellectual property??	Understand	4
20	**Write** about the following terms: a) Trademark and Service marks b) Copyrights c) Patent d) Trade Secrets	Apply	4
21	**Explain** the scope of searching in Trademark?	Understand	5

S.No	Questions	Blooms Taxonomy Level	Course Outcome
22	**Write** the procedure for "use of mark" owned by Third parties?	Understand	2
23	**Write** the New Development in Assignment of Domain Names under Trademark	Knowledge	5
24	**Explain** cybersquatters and the dilution doctrine under protecting a Domain name in Trademark?	Knowledge	1
25	**Explain** Cybersquatters and the Anticybersquatting consumer Protection Act?	Understand	1
	Part – C (Problem Solving and Critical Thinking)		
1	**Categories** whether the following items would be protectable as trademark, Copyrights, Patents or Trade Secrets: a) a vacuum cleaner (the name of a new type of ice cream) b) a company's plans for its future business operations and possible mergers c) a new type of rose d) a new slogan to be used by Burger King e) a new novel by Toni Morrison	Apply	1
2	**Analyze** Mc Donald's Corporation has filed a trademark application for MCMAGIC MIXERS for new condiment blends, will the mark is protectable if so explain?	Analyze	1
3	**Discriminate** types of copyrights in cinema autography in India?	Understand	8
4	**Estimate** the time period for the protection of son "Allentown" was composed Billy Joel in 1982?	Analyze	4
5	**Calculate** the loss occurred to the US for infringement in IP and counterfeiting of goods and piracy	Analyze	4
	UNIT – II		
	PART - A (SHORT ANSWER QUESTIONS)		
1	**Explain** the purpose of Trademark?	Understand	3
2	**Define** goodwill?	Knowledge	2
3	**Explain** the origin function of trademark?	Understand	2
4	**Explain** the trademark rights arise in law of United states?	Understand	3
5	**Explain** the Quality guarantee in function of trademark?	Understand	5
6	**Explain** the Advertising function of trademark?	Understand	4
7	**Write** about the procedure for recognizing trademark in France?	Apply	4
8	**Define** the uses of acquisition of Trademark rights?	Knowledge	3
9	**Give** examples for acquisition of Trademark rights taken place?	Understand	4
10	**Explain** how protectable matter did rises and on what basis it is adopted?	Understand	4
11	**Define** evaluating trademark?	Knowledge	4
12	**Evaluate** the trademark?	Analyze	3
13	**Explain** how the trademarks and service marks properly identified and used?	Understand	7
14	**Classify** the types of marks?	Understand	6
15	**Give** examples for trade mark selection?	Understand	7
16	**Write** about Indian Trade mark law?	Apply	7
17	**Write** the scope for searching the state trademark?	Apply	6
18	**Discuss** the conflicts of trademarks?	Understand	8
19	**Explain** the procedure for evaluating Trademark?	Understand	6
20	**Write** the classes in Service mark?	Understand	1
21	**Write** the types of Marks?	Knowledge	6
22	**Write** the procedure of Trademark search?	Understand	7

S.No	Questions	Blooms Taxonomy Level	Course Outcome
23	**Explain** duty to search for Trademark?	Understand	6
24	**Discuss** types of searching process?	Understand	7
25	**Write** the duty of an applicant in selecting a Trademark?	Knowledge	9
	PART - B (LONG ANSWER QUESTIONS)		
1	**Explain** acquisition of trademark rights?	Understand	4
2	**Write** the procedure for Selecting and evaluating of trademark?	Apply	4
3	**Discuss** the functions of trademark?	Understand	1
4	**Describe** Protectable matter?	Knowledge	1
5	**Explain** trademark registration processes?	Understand	3
6	**Discuss** the method of protecting the prior used trademarks in the system of acquisition-through-registration?	Understand	3
7	**Explain** the reasons for protecting trademarks in the system of acquisition?	Understand	5
8	**Discuss** new developments in Trademark Law? how do you avoid cyberspace trademark issues?	Understand	2
9	**Explain** how do you select and evaluate Trademark?	Understand	1
10	**Explain** about the process of Trademark?	Understand	1
11	**Explain** how the investigation is taken place in resolving conflicts?	Understand	8
12	**Explain** the methods used in preparing the application in Trademark registration?	Understand	4
13	**Explain** the Principal and Supplemental Registers?	Understand	4
14	**Write** the procedure of the trademark registration?	Apply	4
15	**Explain** the Post registration procedures?	Understand	4
16	**Discuss** about the advantages of Trademark use and compliance policies?	Knowledge	4
17	**Describe** the Procedure for transfer of ownership in Trademarks?	Understand	1
18	**Explain** about Inter partes and inter partes proceedings? What is the role of Inter partes?	Understand	1
19	**Explain** Infringement of Trademarks?	Understand	3
20	**Discuss** about the methods of preparing the Trademark application?	Understand	3
21	**Write** the Rights afforded by Copyright Law?	Knowledge	1
22	**Discuss** the Rights to display the work publically?	Understand	3
23	**Explain** the effects of works made for hire?	Understand	3
24	**Write** the different types of Application Forms in Copyright?	Knowledge	1
25	**Explain** the searching process in copyright office records?	Understand	3
	Part – C (Problem Solving and Critical Thinking)		
1	**Devise** an application for registration of different types of marks in PTO and an Indian IPR organization?	Understand	3
2	**Distinguish** the register mark AVALON BAY PERFUME and AVALAR BAY PERFUME? Discuss whether the marks are confusingly similar and will they accepted by the PTO, explain?	Knowledge	2
3	**Illustrate** the basis for filling application and methods of use with appropriate acts	Analyze	2
4	**Describe** the type of specimen that would support use of the following marks: PLAYROOM (for child care center services) AQUARIUM (for restaurant services)	Understand	3
5	**Explain** if an application for INTEGRA COMPUTER SERVICES (for computer consulting services) is refused registration on the basis that the mark is merely descriptive, how the applicant should respond?	Understand	5

S.No	Questions	Blooms Taxonomy Level	Course Outcome
	UNIT – III		
	PART A (SHORT ANSWER QUESTIONS)		
1	**Define** the law of copyrights?	Knowledge	6
2	**Write** the Fundamental of Copyrights laws was formulated	Apply	5
3	**Discuss** the originality of material in copyrights?	Understand	9
4	**Explain** the rights of reproduction in copy rights?	Understand	8
5	**Write** the procedure of 'rights to perform the work publicly' in copy rights?	Apply	5
6	**Explain** how the copy right ownership issues are solved?	Understand	9
7	**Explain** how the copy rights are registered?	Understand	9
8	**Discuss** the Foundation of patent law?	Understand	5
9	**Describe** the advantages of Law of patent?	Knowledge	9
10	**Illustrate** patent searching process?	Analyze	8
11	**Explain** how the ownership rights and transfers are taken place?	Understand	5
12	**Write** about the notice of copy right?	Apply	8
13	**Describe** about copy rights?	Knowledge	5
14	**Explain** how the patent searching process is taken place?	Understand	9
15	**Discuss** about copy rights?	Understand	9
16	**What** did you understand about Law of patents?	Understand	8
17	**Write** about the procedure for 'the notice of the copy right' is prepared?	Apply	7
18	**Define** the rights of ownership issues?	Knowledge	9
19	**Write** surplusage in Copyright Notice?	Apply	9
20	**Describe** the procedure restoration of Copyright is done?	Knowledge	8
21	**List** out the copyright excluded from protection?	Knowledge	8
22	**Explain** "Works made for Hire"?	Apply	7
23	**Write** the types of Application?	Knowledge	7
24	**Write** the procedure of filing the application?	Understand	8
25	**Write** the importance of Copyright Notice?	Apply	7
	PART - B (LONG ANSWER QUESTIONS)		
1	**Explain** about copyright Law and when it was founded?	Apply	6
2	**Discuss** about the Rights under the 1976 copyright act?	Understand	5
3	**Explain** the subject matter of copyright?	Understand	9
4	**Explain** the fundamental of Copyright Law?	Understand	8
5	**Define** the originality of material and how it is identified?	Knowledge	5
6	**Explain** the rights afforded by copyright law?	Understand	9
7	**Discuss** the rights of reproduction?	Understand	9
8	**Discuss** about "the rights to perform the work publicly" and explain it?	Understand	5
9	**Explain** copyright ownership issues?	Understand	9
10	**Explain** when the terminations of transfers of copyrights take place?	Understand	8
11	**Explain** when the duration of copyright act come into force?	Understand	5
12	**Explain** the procedure for fill the application and registration of copyright?	Understand	8
13	**Explain** the copyright notice and when it is issued?	Understand	5
14	**Discuss** about copyright infringement? Explain?	Understand	9
15	**Differentiate** Contributory Infringement and Vicarious Infringement?	Understand	9
16	**Discuss** about new developments in copyright law? What are they?	Understand	8
17	**Explain** the international copy right law?	Understand	7

S.No	Questions	Blooms Taxonomy Level	Course Outcome
18	**Define** Patentability? Explain the utility of patents?	Knowledge	9
19	**Write** about the need of patent searching? Explain?	Apply	9
20	**Explain** the process of the Patent Application?	Understand	8
21	**Explain** the Digital Millennium Copyright Act?	Understand	8
22	**Discuss** New development in Copyright?	Understand	7
23	**Discuss** New development in Patent?	Knowledge	9
24	**Explain** Vessel Hull Protection in Copyright?	Understand	
25	**Write** the Gray Market Goods?	Knowledge	9
Part – C (Problem Solving and Critical Thinking)			
1	**Classify** the following as likely copyrightable or not copyrightable: a) a live broadcast of a radio program; b) a speech written for the secretary of defence; c) the artwork for the cover of a CD; d) a new method of calculating the value of business;	Analyze	6
2	**Analyze** a highly stylized electric mixer be copyrightable? Discuss?	Understand	5
3	**Analyze** if two artists each paint an oil painting of Niagara Falls, which painting receives copyrights protection? Discuss?	Understand	9
4	**Describe** the principles governing while a purchased book is later sold to others?	Knowledge	8
5	**Explain** the violation of copyrights in dramatic performances on television channels and cinema autography?	Knowledge	5
UNIT – IV			
PART - A (SHORT ANSWER QUESTIONS)			
1	**Write** about Trade secrets?	Apply	9
2	**Explain** the determination of trade secrete status?	Understand	9
3	**Determine** the affect for misappropriations of trade secrets?	Apply	12
4	**Write** the procedure to be followed for protection for submission?	Apply	11
5	**Discuss** about trade secrets?	Understand	11
6	**Explain** liability for misappropriation of trade secrets?	Understand	12
7	**Discuss** about the protection for submission?	Understand	11
8	**Explain** defences to Trade Secret Misappropriation? Give to remedies for Misappropriation?	Understand	12
9	**Define** trade secret protection programs?	Knowledge	12
10	**Describe** trade secret protection program	Understand	12
11	**Explain** about the new developments in International Trade secrets law?	Understand	12
12	**Write** five physical protections in trade secret protection program?	Apply	12
13	**Write** four written agreements? Briefly explain them?	Apply	12
14	**Discuss** unfair competition?	Understand	12
15	**Discuss** about unfair competition act? When it came into existence?	Understand	12
16	**Describe** the unfair competition act is useful in the trademarks?	Understand	8
17	**Write** about two unfair competitions?	Apply	11
18	**Write** about misappropriation under unfair competition?	Apply	12
19	**What** is Right of Publicity?	Understand	12
20	**Discuss** about false advertising?	Understand	12
21	**Discuss** whether written agreement is compulsory or not in Trade secret?	Understand	12
22	**Write** the relationship between Employer and Employee in a Trade Secret?	Understand	8

S.No	Questions	Blooms Taxonomy Level	Course Outcome
23	**List** out the defences to trade secret misappropriation?	Apply	11
24	**Write** four examples for False advertising?	Apply	12
25	**Explain** five New International Development in Trade secrets?	Understand	12
	PART - B (LONG ANSWER QUESTIONS)		
1	**Define** Trade Secrets Law? Explain about Trade Secrets Law?	Knowledge	13
2	**Explain** the liability for misappropriation of trade secrets?	Understand	11
3	**Illustrate** Trade Secret Litigation?	Understand	10
4	**Discuss** about trade secret protection programs? Explain?	Understand	10
5	**Write** about new development in International trade secrets law? What are they?	Apply	9
6	**Explain** about unfair competition? Write its types?	Understand	9
7	**Discuss** right of publicity? Explain?	Understand	9
8	**Discuss** Misappropriation in Trade Secrets and how the Right of Publicity help in misappropriation?	Understand	9
9	**Discuss** whether the New Developments in the Right of Publicity is necessary, if so in what way?	Understand	9
10	**Explain** false advertising with examples?	Understand	8
11	**Discuss** about the regulations taken by the Federal Trade Commission?	Understand	8
12	**Define** product disparagement? Explain them	Knowledge	8
13	**Explain** how the infringement of trade dress is involved in trade mark?	Understand	8
14	**Describe** defences to secret misappropriation?	Knowledge	8
15	**Explain** about the remedies for misappropriation in Trade Secrets?	Understand	8
16	**Discuss** about trade secret litigation?	Understand	9
17	**List** out the new developments in International Trade Secrets?	Knowledge	9
18	**Explain** the liability for misappropriation of trade secrets taken place?	Understand	9
19	**Describe** the determination of trade secret status?	Knowledge	9
20	**Explain** the product disparagement in unfair competition?	Understand	9
21	**Explain** with suitable examples about patentable subject matter?	Understand	10
22	**Write** the methods of Patent searching process?	Apply	9
23	**Explain** about patent infringement Litigation?	Understand	9
24	**Write** five new developments in International Patent?	Understand	9
25	**Write** the remedies in patents infringement?	Understand	9
	Part – C (Problem Solving and Critical Thinking)		
1	**Explain** the action taken by PepsiCo? On a competitor selling another type of cola beverage in Pepsi bottles?	Knowledge	11
2	**Discuss** what type of trademark dilution is involved for each of the following: a) Nestle pens; b) Lexus photocopiers c) Mattel's Head Shop (for a shop selling drug paraphernalia)	Knowledge	13
3	**Classify** the liability for misappropriation of trade secrets?	Analyze	10
4	**Explain** different types of remedies for misappropriation from a court?	Knowledge	10
5	**Discuss** the remedies for Mr Woods for using his photograph in the following: a) an advertisements for golf clubs b) a new story about young golfers; and c) an advertisement for pizza	Understand	9
	UNIT – V		

S.No	Questions	Blooms Taxonomy Level	Course Outcome
PART - A (SHORT ANSWER QUESTIONS)			
1	**Discuss** New Developments in Patent Law?	Understand	13
2	**Write** about International patent protection?	Apply	11
3	**Explain** how the International patent protection act is used?	Understand	10
4	**Discuss** about International Patent protection?	Understand	10
5	**Explain** about the Paris convention?	Understand	9
6	**When** did Paris convention established and for what?	Understand	9
7	**Explain** why the Paris convention is introduced?	Understand	9
8	**Explain** copy write law?	Understand	9
9	**Define** the copy write law is useful?	Knowledge	9
10	**Describe** the reasons for introducing copyright law?	Knowledge	8
11	**Explain** about intellectual property audit?	Understand	8
12	**Write** the duties of IP audit?	Apply	8
13	**Discuss** about the International trade mark Law?	Understand	8
14	**Discuss** about the International patent law?	Understand	8
15	**Describe** the advantages of International Patent law?	Knowledge	8
16	**Explain** trade secrets Law?	Understand	9
17	**Write** the advantages about trade secrets law?	Apply	9
18	**Discuss** why the trade secrets law is developed internationally?	Understand	9
19	**Explain** the patent law treaty?	Understand	9
20	**Discuss** about patent cooperation treaty?	Understand	9
21	**Discuss** about Dilution?	Understand	12
22	**Write** about Trade dress?	Understand	12
23	**Explain** about Post audit activity?	Understand	8
24	**List** out the liabilities for misapplication of Trade Secrets?	Apply	11
25	**Write** the determination of trade secret statues?	Apply	12
PART - B (LONG ANSWER QUESTIONS)			
1	**Explain** about the new developments in Trademark law?	Understand	12
2	**Discuss** how do you protect a domain name? Explain the precautionary steps to be taken for protecting domain name in trademark?	Understand	12
3	**Explain** how the cyber crime can control in trademark? how you hyperlink?	Understand	12
4	**Explain** cybersquatters and the Anticybersquatting consumer Protection Act?	Understand	12
5	**Discuss** new development in protecting copyright law? what are they? Explain?	Understand	12
6	**Explain** how a copyright protection is overcoming the cyber crime?	Understand	12
7	Describe about copyright protection act? how the copyright protection for automated database is processed?	Knowledge	13
8	**Explain** copyright in the electronic age?	Understand	11
9	**Describe** the digital millennium copyright act?	Knowledge	13
10	**Explain** the new developments in copyright and recent developments in copyright law?	Understand	13
11	**Define** Vessel Hull protection? How it is useful in copyrights act?	Knowledge	13
12	**Explain** semiconductor chip protection?	Understand	
13	**Discuss** new developments in international patent law? How can you analyze them?	Understand	13
14	**Explain** the International patent protection?	Understand	13

S.No	Questions	Blooms Taxonomy Level	Course Outcome
15	**Discuss** about patent cooperation treaty?	Understand	13
16	**Discuss** about European patent organization and what are its duties?	Understand	13
17	**Explain** about patent law treaty with suitable examples?	Understand	13
18	**Discuss** new developments in trade secrets law?	Understand	13
19	**Discuss** about international developments in trade secrets law?	Understand	13
20	**Discuss** about intellectual property audits?	Understand	13
	Discuss what type of Trademark Dilution is involved for each of the following and why it is in Trademark Dilution? a. Lexuz photocopiers b. Nestle pens c. Barbie's Toys d. Mattle's Head shop	Knowledge	13
22	**Write** the advantages and disadvantages of TRIPs**?**	Understand	12
23	**Explain** EPO**?**	Knowledge	13
24	**Write** the Digital Millennium Copyright Act?	Understand	12
25	**Write** recent Developments in Copyright law?	Knowledge	13
	Part – C (Problem Solving and Critical Thinking)		
1	**Explain** new developments in the copyright protection for following: a) Computer programs b) Video games c) Piracy of software	Analyze	12
2	**Describe** the new development in patent law relating for the: a) Business method b) Software patents c) Biotechnology patents	Understand	12
3	**Illustrate** the importance of IP audit in different business organisation?	Knowledge	12
4	**Explain** the practical aspects of IP audits and process of conducting audit?	Knowledge	12
5	**Distinguish** International trademark law and copy right law?	Understand	12

COMPUTER SCIENCE AND ENGINEERING

COURSE DESCRIPTION FORM

Course Title	**COMPUTER NETWORKS**			
Course Code	**A50515**			
Regulation	**R13 - JNTUH**			
Course Structure	Lectures	Tutorials	Practical	Credits
	4	-	-	4
Course Faculty	**K SIVA RAMA PRASAD Asst.Prof**			

I. COURSE OVERVIEW:

The growing importance of Internetworking in recent years and their use in every field has made Computer Networks a central issue for modern systems. The main objective of the course is to know the functions of various layers of a network model. Topics to be covered include: data communication concepts and techniques in a layered network architecture, communications switching and routing, types of communication, network congestion, network topologies, network configuration and management, network model components, layered network models (OSI reference model, TCP/IP networking architecture) and their protocols, various types of networks (LAN, MAN, WAN and Wireless networks) and their protocols.

PREREQUISITE(S):

Level	Credits	Periods/ Week	Prerequisites
UG	4	4	Data Structures, Data Communications, Computer Organization, Linux Operating Systems

II. MARKS DISTRIBUTION:

Sessional Marks	University End Exam marks	Total marks
Midterm Test There shall be two midterm examinations. Each midterm examination consists of essay paper, objective paper and assignment. The essay paper is for 10 marks of 60 minutes duration and shall contain 4 questions. The student has to answer 2 questions, each carrying 5 marks. The objective paper is for 10 marks of 20 minutes duration. It consists of 10 multiple choice and 10 fill-in-the blank questions, the student has to answer all the questions and each carries half mark. First midterm examination shall be conducted for the first two and half units of syllabus and second midterm examination shall be conducted for the remaining portion. Five marks are earmarked for assignments. There shall be two assignments in	75	100

VALUATION SCHEME:

S. No	Component	Duration	Marks
1.	I Mid Examination	80 minutes	20
2.	I Assignment	-	5
3.	II Mid Examination	80 minutes	20
4.	II Assignment	-	5
5.	External Examination	3 hours	75

III. COURSE OBJECTIVES:

At the end of the course, the students will be able to:

I. Build an understanding of the fundamental concepts of computer networking.

II. Familiarize with the basic taxonomy and terminology of the computer networking area.

III. Introduced to advanced networking concepts, preparing for entry to advanced courses in computer networking.

IV. Allow to gain expertise in some specific areas of networking such as the design and maintenance of individual networks.

IV. COURSE OUTCOMES:

1. Students should be understand and explore the basics of Computer Networks and Various Protocols. He/She will be in a position to understand the World Wide Web concepts.
2. Students will be in a position to administrate a network and flow of information further he/she can understand easily the concepts of network security, Mobile, and ad hoc networks.

HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes		Level	Proficiency assessed
PSO1	**Applications of Computing**: Ability to use knowledge in various domains to provide solution to new ideas and innovations.	H	Lectures, Assignments
PSO2	**Programming Skills**: Identify required data structures, design suitable algorithms, develop and maintain software for real world problems.	H	Projects

V. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes		Level	Proficiency assessed by
PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	H	Lectures
PO2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	H	Lectures, Assignments, Exams
PO3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	H	Problem Solving Seminars, Exercises
PO4	**Conduct investigations of complex problems**: Use research- based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	H	Lectures, Assignments, Exams
PO5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	H	Lectures, Assignments, Workshops
PO6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.	S	--
PO7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	N	--
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	S	--
PO9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	H	Assessments Discussions,
PO10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	N	--
PO11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	S	--

PO12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	S	--

SYLLABUS:

UNIT-I

Overview of the Internet: Protocol, Layering Scenario, TCP/IP Protocol Suite: The OSI Model, Internet history standards and administration. Comparison of the OSI and TCP/IP reference model.
Physical Layer: Guided transmission media, wireless transmission media.

Data Link Layer-design issues, CRC Codes, Elementary Data link Layer protocols, sliding window protocol.

UNIT-II

Multiple Access Protocols- ALOHA, CSMA, Collision free protocols, Ethernet-Physical Layer, Ethernet Mac Sub layer, data link layer switching & use of bridges, learning bridges, spanning tree bridges, repeaters, hubs, bridges, switches, routers and gateways.

UNIT-III

Network Layer: Network Layer Design issues, store and forward packet switching connection less and connection oriented networks-routing algorithms-optimality principle, shortest path, flooding, Distance Vector Routing, Count to Infinity Problem, Hierarchical Routing, Congestion control algorithms, admission control.

UNIT-IV

Internetworking: Tunneling, Internetwork Routing, Packet fragmentation, IPv4, IPv6 Protocol, IP addresses CIDR, IMCP, ARP, RARP, DHCP.
Transport Layer: Services provided to the upper layers elements of transport protocol-addressing connection establishment, connection release, Crash Recovery.

UNIT-V

The Internet Transport Protocols UDP-RPC, Real Time Transport Protocols,

The Internet Transport Protocols-Introduction to TCP, The TCP Service Model, The TCP Segment Header, The Connection Establishment, The TCP Connection Release, The Connection Management Modeling, The TCP Sliding Window, The TCP Congestion Control, The future of TCP.
Application Layer-Introduction, providing services, Application layer paradigms, Client server model, Standard client-server application-HTTP, FTP, electronic mail, TELNET, DNS,SSH.

Text Books:

1. Behrouz A. Forouzan, "Data Communications and Networking", 5e TMH, 2013.
2. Andrew S Tanenbaum, "Computer Networks", 4e, Pearson Education.

Reference Books:

1. S. Keshav, "An Engineering Approach to Computer Networks", 2e, Pearson Education.

2. W. A. Shay, "Understanding communications and Networks", 3e, Cengage Learning.
3. Chwan-Hwa(John)Wu, J.David Irwin, "Introduction to Computer Networks and Cyber Security", CRC Press.
4. L. L. Peterson and B. S. Davie, "Computer Networks", 4e, Elsevier.
5. James F. Kurose, K. W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", 3e, Pearson Education.

VI. COURSE PLAN:

Lecture No.	Topics to be covered	Course Learning Outcomes	Reference
1	Protocols and layering scenario	**Understand** and explore the basics of computer networks and various network protocols.	T1:2.1
2	OSI model	**Demonstrate** guidelines for the development of universally compatible networking protocols using OSI model.	T1:2.3
3	Internet history standards and administration and comparison of the OSI and TCP/IP reference model	**Recognize** knowledge on previous versions of internet and demonstrates that TCP/IP protocol is not replacement for OSI model.	T1:2.3.1
4-8	Guided and wireless transmission media	**Illustrate** guided and unguided medium.	T1:7.2,7.3
9	Design issues of CRC codes	**Illustrate** the purpose of error detection and correction techniques.	T1:10.3.1
10-19	Elementary data link layer protocol: sliding window protocol ALOHA, CSMA and collision free protocols	**Design** and implement data link layer protocol with in a simulated networking environment.	T1:11.2, 12.1.1,12.1.2,
20-21	Ethernet-physical layer and MAC sub layer	**Describe** how networked devices can format data for transmission to other network devices on the same network segment using Ethernet.	T1:13.3.2,13.4.1
22-24	Data link layer switching & use of bridges, learning bridges, spanning tree bridges, repeaters, hubs, switches, routers and gateways	**Understand** the working concepts of the switching devices.	T1:17.1.1,17.1.3
25 - 27	Network layer design issues, store and forward packet switching, connection-less and connection-oriented networks	**Identify** global addressing system and routing procedures	T1:18.1, 18.2.1
28-30	Routing algorithms	**Understand** various routing algorithms and analyze the shortest path between any two stations.	T1:20.2
31-34	Congestion control algorithms and admission control	**Understand** the mechanisms to handle congestion scenarios on networks.	T1:18.3.4,18.3.4.1
35-36	Tunneling, internetworking and packet fragmentation	**Illustrate** the pros and cons of tunneling.	T1:22.12,19.1.2

Lecture No.	Topics to be covered	Course Learning Outcomes	Reference
37-40	IPv4, IPv6 Protocol and IP addresses CIDR	**Compare** popular internet protocols IPV4 and IPV6.	T1:18.4,18.4.3
41-43	ICMP, ARP, RARP and DHCP	**Understand** various address related protocols.	T1:19.2,18.4.4
44-46	Services provided to the upper layers elements of transport protocol and addressing connection establishment, connection release, crash recovery	**Describe** how transport Layer protocol provides process-process delivery and evaluate the recovery of crashed data packets.	T1:23.1.1,23.1.3
47-49	UDP-RPC and Real Time Transport Protocols(RTP)	**Describe** the practical use of UDP and RTP protocols.	T1:24.2,28.4
50-54	Introduction to TCP, TCP service model, segment header, connection establishment, release and management modeling	**Explain** three way handshaking procedure of TCP.	T1:24.3.1, 24.3.3,24.3.4
55-58	The TCP sliding window, congestion control and future of TCP	**Understand** the packet transmission mechanism of TCP.	T1:24.3.6, 24.3.9
59-60	Introduction, providing services, application layer paradigms and client server model, standard client-server application	**Apply** latest client –server technologies to configure and manage web servers.	T1:25.1,25.1.2
61-64	HTTP, FTP, electronic mail TELNET and SSH	**Explain** purpose of FTP for file transfer and access remote system through remote login.	T1:26.1.2,26.2, 26.3, 26.4,26.5
65-67	DNS	**Define** name space, Domain Name Space and explain how to assign the domain for different organization.	T1:26.6

VII. MAPPING COURSE OBJECTIVES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Objectives	Program Outcomes												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
I	H								S		S			
II	H			S	H									
III	H			S	H									
IV	S	S			H									

VIII. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	H			S	S								H	
2	S	H		S	S									

S – Supportive **H - Highly Related**

ASSIGNMENT

Course Name	**COMPUTER NETWORK**
Course Code	A50515
Class	III B. Tech I Semester
Branch	Computer Science and Engineering
Year	2016– 17
Course Faculty	**K SIVA RAMA PRASAD** **Asst.Prof**

OBJECTIVES:

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education. The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited.

In line with this, Faculty of Institute of Aeronautical Engineering, Hyderabad has taken a lead in incorporating philosophy of outcome based education in the process of problem solving and career development. So, all students of the institute should understand the depth and approach of course to be taught through this question bank, which will enhance learner's learning process.

ASSIGNMENT – I & II

S. No	Questions	Blooms Taxonomy Level	Course Outcome
	UNIT – I		
1.	**List** two advantages of layering principle in computer networks?	Knowledge	2
2.	**Explain** the role of ARPANET in computer networks?	Knowledge	2
3.	**Distinguish** between baseband transmission and broadband transmission?	Understand	
4.	**Suggest** two points to improve the performance of network?	Understand	1
5.	**Write** the responsibilities of the data link layer in the Internet model?	Understand	2
6.	**Distinguish** between baseband transmission and broadband transmission?	Understand	2
7.	**Define** topology and explain the topologies of the network?	Understand	2
8.	Consider a 1 km 10Mbps channel. What would be the utilization of this channel when 100 nodes are connected in an Ethernet configuration? If the channel is converted to a ring, running token ring, what would be the utilization of the channel? Assume fixed frame size of 1024 bits in both cases?	Understand	2
9.	**Explain** in detail the different transmission media and compare and contrast them of cost, speed, security, attenuation and other in terms of relevant characteristics?	Understand	1
10.	**Explain** why sliding window flow control is considered to be more efficient than stop and wait flow control?	Understand	2

Sl No	Questions	Blooms Taxonomy Level	Course Outcome
	UNIT- II		
1.	**Define** vulnerable period? How it affects the performance in MAC protocols?	Understand	1
2.	**Define** parameter 'a'? How does it affect the performance of the CSMA protocol?	Understand	1
3.	**Explain** how throughput is improved in slotted ALOHA over pure ALOHA?	Understand	1
4.	**Distinguish** between FDMA and TDMA?	Understand	1
5.	**Explain** how a Token Ring LAN operates? Discuss that can be used to set up wireless LAN's?	Understand	1
6.	**Name** the four basic network topologies and explain them giving all the Relevant features?	Understand	1
7.	**Explain** the frame format, operation and ring maintenance feature of IEEE 802.5 MAC protocol?	Understand	1
8.	**Assume** that a portion y of every transmitted packet is overhead (e.g., address, sync bits, etc.). 1. What will be the throughput delay characteristic of an FDMA channel? 2. What will be the throughput delay characteristic of a TDMA channel?	Apply	1
9.	**Compare** the first two moments of the distribution of the queuing time of FDMA with that of TDMA (Note: the queuing time does not include the actual transmission time)?	Understand	1
10.	**Derive** the steady-state distribution and the first two moments of the number of messages in a TDMA system where L (z) is the generating function of the number of packets in a message?	Understand	2
	UNIT – III		
1.	**List** out network support layers and user support layers?	Knowledge	2
2.	**Explain** internet protocol with the neat block diagram of IP header?	Understand	2
3.	**Describe** two groups of multicast routing protocol?	Understand	2
4.	**Describe** the routing information protocol and distance vector routing protocol?	Understand	2
5.	**Explain** Link State Routing algorithm with an example?	Understand	2
6.	**Define** BGP protocol. Describe its routing functionality in detail?	Knowledge	1
7.	**Explain** Distance Vector algorithm. Mention the limitation of Distance Vector routing algorithm?	Understand	1
8.	**Compare** circuit switched, datagram and virtual circuit network	Understand	1
9.	**Write** short notes on a) X.25 b) ARP	Understand	1
10.	Show a routing table for a host that is connected to a LAN without being connected to internet? **Explain**?	Understand	1
	UNIT - IV		
1.	**Explain** the TCP Connection establishment and termination using Time-line diagram?	Understand	2
2.	**Illustrate** data units at different layers of the TCP / IP protocol suite?	Apply	2
3.	**Explain** how an application process running in one host is addressed by another process through TCP?	Understand	2
4.	**Differentiate** between network layer delivery and the transport layer delivery?	Understand	2
5.	**Describe** the three way handshake protocol to establish the transport level connection?	Understand	2
6.	**Discuss** about the TCP sliding window algorithm for flow control?	Understand	

S. No	Questions	Blooms Taxonomy Level	Course Outcome
7.	**Find** the class of the following IP addresses? a) 237.14.2.1 b) 208..35.54.12 c) 129.14.6.8 d) 114.34.2.8	Apply	2
8.	An IPV4 datagram arrives with fragmentation offset of 0 and an M bit (more fragment bit) of 0.Is this a first fragment middle fragment or last fragment **Explain?**	Understand	2
9.	A router with IPV4 address 123.45.21.12 and Ethernet physical address 23:45: BA: 00:67: CD has received a packet for a host destination with IP address 124.10.78.10.Show the entries in the ARP request packet sent by the router. **Assume** no subnetting?	Apply	2
10.	**Write** the following MASKS in slash notation (/n)? a) 255.0.0.0 b) 255.255.224.0 c) 255.255.255.0 d) 255.255.240.0	Understand	2
	UNIT – V		
1.	**Describe** the role of the local name server and the aut2horitative name server in DNS?	Understand	1
2.	**Discuss** how the Simple Mail Transfer Protocol (SMTP) is useful in electronic mail?	Understand	1
3.	**Explain the** specific purposes of the DNS, HTTP, SMB, and SMTP/POP application layer protocols?	Understand	1
4.	**Define** Domain Name Service (DNS) and explain in detail about the domain hierarchy and name servers?	Knowledge	1
5.	**Compare** and contrast client/server with peer-to-peer data transfer over networks?	understand	1
6.	**Describe** in detail about the World Wide Web (WWW)?	Understand	1
7.	**Interpret** the following sequences of characters (In hexa decimals) received by a TELNET client or server? a) FFFB01 b) FFFE01 c) FFF4 d) FFF9	Apply	2
8.	A client uses UDP to send data to a server. The data are 15 bytes. **Calculate** the efficiency of this transmission at the UDP level (ratio of useful bytes to total bytes)?	Understand	2
9.	**Determine** the sequence of bits sent from a client TELNET for the binary transmission of 11110011 00111100 11111111	Understand	2
10.	**Determine** which of the following an FQDN is and which is a PQDN? a) mil b) edu c) xxx.yyy.net d) zzz.yyy.xxx.edu	Understand	2

TUTORIAL QUESTION BANK

Course Name	**COMPUTER NETWORKS**
Course Code	**A50515**
Class	III B. Tech I Semester
Branch	Computer Science and Engineering
Year	2016 – 17
Course Faculty	**K SIVA RAMA PRASAD Asst.Prof**

OBJECTIVES:

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education. The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited.

In line with this, Faculty of Institute of Aeronautical Engineering, Hyderabad has taken a lead in incorporating philosophy of outcome-based education in the process of problem solving and career development. So, all students of the institute should understand the depth and approach of course to be taught through this question bank, which will enhance learner's learning process.

UNIT – I

PART - A (SHORT ANSWER QUESTIONS)

S. No.	Question	Blooms Taxonomy Level	Course Outcome
1.	**Define** Network?	Knowledge	1
2.	**Explain** different types of networks?	Understand	2
3.	**Describe** Why are protocols needed?	Understand	2
4.	**Describe** Access point?	Understand	1
5.	**State** the goals of networks?	Knowledge	2
6.	**Describe** the importance of networking?	Understand	1
7.	**List** two advantages of layering principle in computer networks?	Knowledge	2
8.	**Classify** different types of Layers?	Understand	2
9.	**Define** the responsibilities of data link layer?	Knowledge	1
10.	**Enumerate** the types of errors?	Knowledge	1
11.	**Explain** the role of ARPANET in computer networks?	Understand	2
12.	**Discuss** two points to improve the performance of network?	Understand	1
13.	**Define** redundancy?	Knowledge	2
14.	**List** different types of Transmission Media?	Knowledge	2
15.	**Describe** Why are standards needed?	Understand	1
16.	**Explain** briefly about MAN?	Understand	1
17.	**Explain** about Sliding Window Protocol?	Understand	2
18.	**Explain** briefly about WAN?	Understand	2
19.	**Define** peer-to-peer process?	Knowledge	1
20.	**Describe** an internet?	Understand	2
21.	**Define** Intranet?	Knowledge	3
22.	**Define** Extranet?	Knowledge	1
23.	**Explain** briefly about LAN?	Understand	1
24.	**Describe** the advantages of a multipoint connection over a Point-to-point connection?	Understand	2

25.	**List** out the available detection methods?	Knowledge	2
26.	**Discuss** the responsibilities of the data link layer in the Internet model?	Understand	1
27.	**Differentiate** four basic topologies?	Understand	1
28.	**List** the advantages of CN?	Knowledge	1
29.	**List** the networks Applications?	Knowledge	1
30.	**Define** checksum?	Knowledge	2
PART – B (LONG ANSWER QUESTIONS)			
1.	**Explain** how are OSI and ISO related to each other?	Understand	1
2.	**Illustrate** some of the factors that determine	Apply	2
3.	**List** the responsibilities of the data link layer in the Internet	Knowledge	2
4.	**Calculate** the hamming distance for each of the following code words? a) d(10000, 01000) b) d(10101, 10010) c) d(1111, 1111) d) d(0000, 00,00)	Understand	1
5.	**List** three types of transmission impairment?	Knowledge	1
6.	**Distinguish** between baseband transmission and	Understand	2
7.	**Explain** the categories of networks?	Understand	2
8.	**Explain** ISO/OSI Reference model with neat diagram?	Understand	1
9.	**Define topology** and explain the topologies of the network?	Knowledge	2
10.	**Explain** error detection and error correction techniques?	Understand	1
11.	**Explain** the flow control mechanism?	Understand	2
12.	**Explain** about HDLC?	Understand	1
13.	**Explain** the timers and time registers in FDDI?	Understand	1
14.	**Explain** error control mechanism?	Understand	2
15.	**Explain** about SONET and Bridges?	Understand	1
16.	**Describe** the advantages of a multipoint connection	Understand	1
17.	**Define** VRC, LRC, and CRC?	Understand	1
18.	**Discuss** how do the layers of the Internet model	Understand	1
19.	**Explain** about Guided media?	Understand	1
20.	**Describe** the Unguided Media?	Understand	1
PART – C (CRITICAL THINKING QUESTIONS)			
1.	**Calculate** the following consider an 1 km 10Mbps channel. What would be the utilization of this channel when 100 nodes are connected in an Ethernet configuration? If the channel is converted to a ring, running token ring, what would be the utilization of the channel? **Assume** fixed frame size of 1024 bits in both cases.	Understand	1
2.	**Describe** in detail about the concept of data transmission and its terminology with necessary example?	Understand	2
3.	For P = 110011 and M = 1100011, **find CRC**?	Understand	2
4.	**Discuss** For each of the following four networks, the consequences if a connection fails? a) Six devices arranged in a bus topology b) Four devices arranged in a ring topology c) five devices arranged in a mesh topology d) Seven devices arranged in a star topology	Understand	1

5.	**Explain** the following for Suppose a computer sends a frame to another computer on a bus topology LAN. The physical destination address of the frame is corrupted during the transmission. What happens to the frame? how can the sender be informed about the situation?	Understand	1
6.	**Design** the autonomous system with the following specifications : a. There are 8 networks (N1 to N8) b. There are 8 routers (R1 to R8) c. N1,N2,N3,N4,N5 and N6 are Ethernet LANs d. N7 and N8 are point to point WANs	Apply	1
7.	**Design** an organization with one primary and four secondary stations uses polling. The size of a data frame is 1000 bytes. The size of the poll, ACK, and NACK frames are 20 bytes each. Each station has 5 frames to send. How many total bytes are exchanged if there is no limitation on the number of frames a station can send in response to a poll?	Apply	1

UNIT – II

PART - A (SHORT ANSWER QUESTIONS)

S. No.	Question	Blooms Taxonomy Level	Course Outcome
1.	**Define** ALOHA?	Knowledge	1
2.	**List** out advantage of token passing protocol over CSMA/CD Protocol?	Knowledge	1
3.	**Define MAC**?	Knowledge	1
4.	**List** the drawbacks of token ring topology?	Knowledge	1
5.	**Define Ethernet**?	Knowledge	1
6.	**Illustrate** in what way the MAC protocol of FDDI differs from that of token ring?	Apply	1
7.	**Explain** how FDDI offers higher reliability than token ring Protocol?	Understand	2
8.	**Explain** the two techniques for implementing Ethernet switches?	Understand	2
9.	**Define** Bridge?	Knowledge	2
10.	**Define** Hub?	Knowledge	2
11.	**Define** Router?	Knowledge	2
12.	**Explain** in what situations contention based MAC protocols are suitable?	Understand	2
13.	**Illustrate** what is vulnerable period? how it affects the performance in MAC protocols?	Apply	2
14.	**List** three categories of multiple access protocols?	Knowledge	1
15.	**Define** CSMA and CDMA?	Knowledge	1
16.	**Define** parameter 'a'? how does it affect the performance of the CSMA protocol?	Knowledge	1
17.	**Explain** how performance is improved in CSMA/CD protocol compared to CSMA protocol?	Understand	1
18.	**Explain** Vulnerable Time?	Understand	2
19.	**Distinguish** between FDMA and TDMA?	Understand	2
20.	**Define** Bandwidth?	Knowledge	1

PART – B (LONG ANSWER QUESTIONS)

1.	**State** the functions of MAC?	Knowledge	1

2.	**Explain** how performance is improved in CSMA/CD protocol compared to CSMA protocol?	Understand	1
3.	**Explain** in brief? how CSMA/CA differs from CSMA/CD.	Understand	1
4.	**Explain** in details about the access method and frame format used in Ethernet and token ring?	Understand	1
5.	**Explain** the working of carrier sense multiple access protocol?	Understand	1
6.	**Discuss** the MAC layer functions of IEEE 802.11?	Understand	1
7.	**Explain** in details the types of bridges?	Understand	1
8.	**Discuss** that can be used to set up wireless LAN's? How a Token Ring LAN does operate?	Understand	1
9.	**List** and briefly discuss the two different basic transmission technologies?	knowledge	1
10.	**List** the four basic network topologies and explain them giving all the Relevant features?	knowledge	1
11.	**Explain** the frame format, operation and ring maintenance feature of IEEE 802.5 MAC protocol?	Understand	2
12.	**Define** key requirements and functioning of wireless LANs?	Knowledge	2
13.	**Explain** why collision is an issue in a random access protocol controlled access or channelizing protocols ?	Understand	2
14.	**Compare** and contrast a controlled access protocol with a channelizing protocol?	Understand	2
15.	**Explain** do we need a multiple access protocol when we use the local loop of the telephone company to access the internet?	Understand	1
16.	**List** out advantage of token passing protocol over CSMA/CD protocol?	Understand	1
17.	**Explain** how performance is improved in CSMA/CD protocol compared to CSMA protocol?	Understand	2
18.	**Explain** how throughput is improved in slotted ALOHA over pure ALOHA protocol?	Understand	2
19.	**Define** key requirements and functioning of wireless LANs?	Knowledge	2
20.	**Explain** why collision is an issue in a random access protocol bu controlled access or channelizing protocols ?	Understand	1
PART -C (CRITICAL THINKING QUESTIONS)			
1.	**Derive** the Laplace transform of the message delay in FDMA in which every message contains a random number of packets. Compare the expected message delay with that of TDMA?	Understand	1
2.	**Assume** a network with one primary and four secondary stations uses polling. The size of a data frame is 1000 bytes. The size of the poll, ACK, and NAK frames are 32 bytes each. Each station has 5 frames to send. **How** many total bytes are exchanged if there is no limitation on the number of frames a station can send in response to a poll?	Understand	1
3.	**Derive** the steady-state distribution and the first two moments of the number of messages in a TDMA system where L (z) is the generating function of the number of packets in a message?	Understand	1
4.	**Find** the throughput if each station is sending 10 frames/sec? One hundred stations on a pure ALOHA network share a 1-Mbps channel. if frames are 1000 bits long,	Understand	1

5.	**Assume** that a portion y of every transmitted packet is overhead (e.g., address, sync bits, etc.). 1. What will be the throughput delay characteristic of an FDMA channel? 2. What will be the throughput delay characteristic of a TDMA channel?	Understand	2
6.	**Find** the class of the following IP addresses? a) 237.14.2.1 b) 208..35.54.12 c) 129.14.6.8 d) 114.34.2.8	Understand	2
7.	**Assume** A router with IPV4 address 123.45.21.12 and Ethernet physical address 23:45: BA: 00:67: CD has received a packet for a host destination with IP address 124.10.78.10.Show the entries in the ARP request packet sent by the router. Assume no sub netting?	Understand	2

UNIT – III			
PART - A (SHORT ANSWER QUESTIONS)			
S. No.	**Question**	**Blooms Taxonomy Level**	**Course Outcome**
1.	**Explain** Design Issues Of Network layer?	Understand	1
2.	**List** network support layers and the user support layers?	Knowledge	1
3.	**Define** the functions of LLC?	Knowledge	1
4.	**Illustrate** shortest path?	Apply	1
5.	**Define** Flooding?	Knowledge	1
6.	**Explain** Optimality principle?	Understand	1
7.	**Define** the functions of MAC?	Knowledge	1
8.	**Define** protocol data unit?	Knowledge	1
9.	**Explain** Congestion Control?	Understand	2
10.	**Define** virtual circuit?	Knowledge	2
11.	**List** out responsibilities of network layer?	Knowledge	2
12.	**Define** datagram's?	Knowledge	2
13.	**Explain** how broadcast and multicast address is represente addressing scheme?	Understand	2
14.	**List** some of the uni-cast routing protocols?	Knowledge	2
15.	**Differentiate** between Datagram and datagram networks?	Understand	1
16.	**Define** routers?	Knowledge	1
17.	**Differentiate** between virtual circuit and virtual circuit networks?	Understand	1
18.	**List** out functions of IP?	Knowledge	1
19.	**Explain** what is meant by routing algorithm?	Understand	2
20.	**Define** session routing?	Understand	2
21.	**Define** Flooding?	Knowledge	2
22.	**Define** Link state Routing?	Knowledge	1
23.	**State** Leaky bucket?	Knowledge	1
24.	**Explain** Choke packet?	Understand	1
25.	**Define** packet switching?	Knowledge	1
26.	**State** circuit switching?	Knowledge	1
PART – B (LONG ANSWER QUESTIONS)			
1.	**Define** switching? Explain Virtual circuit switching techniques?	Knowledge	1

2.	**Explain** Packet switching technique in detail?	Understand	1
3.	**Explain** Internet Protocol with the neat block diagram of IP header format?	Understand	1
4.	**Discuss** about Address Resolution Protocol?	Understand	1
5.	**Explain** about Internet Control Message Protocol?	Understand	1
6.	**Define** BGP Protocol. Describe its routing functionality	Knowledge	2
7.	**Write** short notes on a) X.25 b) ARP?	Knowledge	2
8.	**Explain** the various congestion control mechanism in detail?	Understand	2
9.	**Explain** the Link State routing algorithm with an example?	Understand	2
10.	**Describe** the Routing Information protocol and Distance vector routing protocol?	Understand	2
11.	**Explain** the Datagram delivery and Forwarding in Internet Protocol?	Understand	2
12.	**Explain** the two approaches of packet switching techniques?	Understand	1
13.	**Define** Routers and explain the type of routers?	Knowledge	1
14.	**Explain** IP addressing method?	Understand	1
15.	**Describe** two groups of multicast routing protocols?	Understand	1
16.	**Illustrate** the routing strategies?	Understand	1
17.	**Explain** how check sum is calculated in TCP?	Knowledge	1
18.	**Explain** CODE BITS in TCP header?	Understand	1
19.	**Explain** how connection Establishment is acquiring?	Understand	2
20.	**Explain** how to release a connection from the network?	Understand	2

PART -C (CRITICAL THINKING QUESTIONS)

1.	**Find** out the contents of the table if the router received the following RIP message from router C? Net 1 2 Net 2 2 Net 3 4 Net 4 3 A router has the following RIP routing table: Net 1 5 B Net 2 1 C Net 3 2 F Net 4 4 G	Understand	1
2.	**Design** a router using DVMRP receives a packet with source address 10.14.17.2 From interface 2.If the router forwards the packet, what are the contents of the entry related to this address in the uni-cast routing table?	Understand	1
3.	**Explain** a frame goes from A to B. There is congestion in both directions. Is the FECN bit set? Is the BECN bit set?	Understand	1
4.	**Explain** a routing table for a host that is connected to a LAN without being connected to a internet?	Understand	1
5.	**Design** the autonomous system with the following specifications : There are 8 networks (N1 to N8) There are 8 routers(R1 to R8) a. N1,N2,N3,N4,N5 and N6 are Ethernet LANs b. N7 and N8 are point to point WANs c. R1 connects N1 and N2 d. R2 connects N1 and N7 e. R3 connects N2 and N8	Understand	1
6.	**Explain** in what situations contention based MAC protocols are suitable?	Apply	1
7.	**Explain** in what way the MAC protocol of FDDI differs from that of token ring?	Apply	1

UNIT – IV			
PART - A (SHORT ANSWER QUESTIONS)			
S. No.	**Question**	**Blooms Taxonomy Level**	**Course Outcome**
1.	**List** out functions of transport layer?	Knowledge	1
2.	**Define** Multi-protocol router?	Knowledge	1
3.	**List** out duties of the transport layer?	Knowledge	1
4.	**Define** BGP?	Knowledge	1
5.	**Differentiate** between network layer delivery and the transport layer delivery?	Understand	1
6.	**Define** IP Address?	Knowledge	1
7.	**Define** quality of service?	Knowledge	1
8.	**Explain** Subnet Mask?	Understand	1
9.	**Define** Payload?	Knowledge	1
10.	**Explain** how an application process running in one host is addressed by another process through TCP?	Understand	2
11.	**Describe** Datagram Format of UDP?	Understand	1
12.	**Define** IMCP?	Knowledge	1
13.	**State** two protocols available at transport layer?	Knowledge	1
14.	**List** out various congestion avoidance techniques?	Knowledge	1
15.	**Distinguish** between Contention and Congestion?	Understand	1
16.	**Define** Tunneling?	Knowledge	1
17.	**State** the four major aspects of reliable delivery at the transport layer?	Knowledge	1
18.	**State** the use of SYN and FIN bits in TCP?	Knowledge	1
19.	**Define** RARP?	Knowledge	1
20.	**Explain** DHCP?	Understand	2
21.	**Explain** about Transport Layer Services?	Understand	2
PART -B (LONG ANSWER QUESTIONS)			
1.	**Explain** the real transport protocol of UDP and how will you calculate checksum in UDP?	Understand	1
2.	**Explain** the TCP segment format?	Knowledge	1
3.	**Write** short notes on Wrap around time (8)?	Knowledge	1
4.	**Describe** the Adaptive retransmission policy in	Understand	1
5.	**Explain** the TCP Connection establishment and termination using Timeline diagram?	Understand	1
6.	**Describe** the three way handshake protocol to establish the transport level connection?	Understand	1
7.	**Explain** TCP state Transition diagram?	Understand	1
8.	**Explain** the connection establishment?	Understand	1
9.	**Discuss** about the TCP sliding window algorithm for flow control?	Understand	1
10.	**Explain** congestion control algorithms in detail?	Understand	1
11.	**Explain** leaky bucket and token bucket algorithm?	Understand	1
12.	**Explain** UDP &TCP?	Understand	1
13.	**Explain** congestion avoidance techniques in detail?	Understand	1
14.	**List** major types of networks and explain?	Knowledge	1
15.	**Illustrate** data units at different layers of the TCP / IP protocol	Apply	2
16	**Discuss** Types of Payload?	Understand	2
17	**Define** Multiplexing?	Understand	2
18	**Explain** how connection Establishment is acquiring?	Understand	2
19	**Explain** how to release a connection from the network?	Understand	2
20.	**Explain** congestion avoidance techniques in detail?	Understand	1

PART -C (CRITICAL THINKING QUESTIONS)1			
1.	**Write** the following MASKS in slash notation (/n)? a) 255.0.0.0 b) 255.255.224.0 c) 255.255.255.0 d) 255.255.240.0	Understand	1
2.	**Find** the class of the following IP addresses? a) 237.14.2.1 b) 208..35.54.12 c) 129.14.6.8 d) 114.34.2.8	Understand	1
3.	**Design** a router with IPV4 address 123.45.21.12 and Ethernet physical address 23:45: BA: 00:67: CD has received a packet for a host destination with IP address 124.10.78.10.Show the entries in the ARP request packet sent by the router. Assume no sub netting?	Understand	1
4.	**Explain** an IPV4 datagram arrives with fragmentation offset of 0 and an M bit (more fragment bit) of 0.Is this a first fragment middle Fragment or last fragment**?**	Understand	1
5.	**Describe** an IPV4 fragment has arrived with an offset value of 100.How many bytes of the data were originally sent by the source before the data in this fragment**?**	Understand	1
6.	**Explain** the basic difference between IEEE 802.3 and switched Ethernet, as far as implementation is concerned.	Apply	1
7.	**Explain** the two techniques for implementing Ethernet switches.	Apply	1

UNIT - V			
PART - A (SHORT ANSWER QUESTIONS)			
S. No.	**Question**	**Blooms Taxonomy Level**	**Course Outcome**
1.	**Explain** Internet Transport Protocols?	Understand	1
2.	**Define** UDP?	Knowledge	1
3.	**State** advantages of stateless server of HTTP?	Knowledge	1
4.	**Define** message Formatting?	Knowledge	1
5.	**Define** TCP?	Knowledge	1
6.	**Differentiate** between FTP & HTTP?	Understand	1
7.	**Explain** TCP segment Header?	Understand	1
8.	**Explain** Sliding Window Protocol?	Understand	1
9.	**List** two applications of Application Layer?	Knowledge	1
10.	**Explain** DNS Name Space?	Understand	1
11.	**List** the advantages of Email?	Knowledge	2
12.	**Define** SMTP?	Knowledge	2
13.	**Explain** the concept of Telnet?	Understand	2
14.	**Define** FTP?	Knowledge	2
15.	**Explain** MIME?	Understand	1
16.	**Illustrate** the use of MIME Extension?	Apply	1
17.	**Explain** WWW?	Understand	2
18.	**Define** Lossy Compression and Lossless Compression?	Knowledge	1
19.	**List** two applications of Application Layer?	Remember	2
20.	**Define** SNMP?	Understand	1
PART -B (LONG ANSWER QUESTIONS)			
1.	**List** different Data types used for Presentation formatting?	knowledge	1
2.	**Define** two methods of HTTP?	knowledge	1
3.	**Define** Big-endian format and little-endian format?	knowledge	1
4.	**Describe** the role of the local name server and the authoritative name server in DNS?	Understand	1
5.	**Define** Domain Name Service (DNS) and explain in detail about the domain hierarchy and name servers?	knowledge	1
6.	**Explain** in detail about the working principles of Simple Network Management Protocol (SNMP) ?	Understand	1
7.	**Discuss** how the Simple Mail Transfer Protocol (SMTP)	Understand	1
8.	**Describe** in detail about the World Wide Web (WWW)?	Understand	1
9.	**Explain** the working principle of FTP in detail with neat diagram?	Understand	1
10.	**Explain** the WWW in detail?	Understand	1
11.	**Differentiate** between ARP and RARP?	Understand	1
12.	**Explain** the specific purposes of the DNS, HTTP, SMB, and SMTP/POP application layer protocols?	Understand	1
13.	**Compare** and contrast client/server with peer-to-peer data transfer over networks?	Understand	1
14.	**Explain** three domains of the Domain Name Space?	Understand	1
15.	**Differentiate** between primary server and secondary server?	Understand	1
16.	**Differentiate** between FTP & HTTP?	Understand	1
17.	**Differentiate** between FTP & HTTP?	Understand	1
18.	**Define** Lossy Compression and Lossless Compression?	Understand	1
19.	**Explain** the specific purposes of the SMTP/POP application layer protocols?	Understand	1

20.	**Define** Domain Name Service (DNS) and explain in detail about the domain hierarchy and name servers?	Understand	1

PART -C (CRITICAL THINKING QUESTIONS)			
1.	**Calculate** the efficiency of this transmission at the UDP level (ratio of useful bytes to total bytes)?A client uses UDP to send data to a server. The data are 15 bytes.	Understand	2
2.	**Design** a diagram to show the situation of the window before and after?A TCP connection is using a window size of 12000 bytes and the previous acknowledgement number was 22001.It receives assignment with acknowledgment number 24001 and window size advertisement of 12000.	Understand	2
3.	**Determine** which of the following an FQDN is and which is a PQDN? a) mil b) edu c) xxx.yyy.net d) zzz.yyy.xxx.edu	Understand	2
4.	**Interpret** the following sequences of characters (In hexa decimals) received by a TELNET client or server? a) FFFB01 b) FFFE01 c) FFF4 d) FFF9	Understand	2
5.	**Show** the sequence of bits sent from a client TELNET for the binary transmission of 11110011 00111100 11111111	Understand	2
6.	**State** the main rules that should be used when installing a cable. Show that maximum cabling area for LAN for horizontal cabling runs is approximately 200m.What do you understand by [illegible]?	Understand	2
7.	**Calculate** the maximum number of class A, B and C network ids.What is the various classes of IP addressing?	Understand	2

COMPUTER SCIENCE AND ENGINEERING

COURSE DESCRIPTION FORM

Course Title	**SOFTWARE ENGINEERING**			
Course Code	A50518			
Regulation	**R13 - JNTUH**			
Course Structure	Lectures	Tutorials	Practicals	Credits
	5	-	-	4
Course Faculty	**K NIKHIL Asst.Prof**			

COURSE OVERVIEW:

Software Engineering comprises the core principles consistent in software construction and maintenance: fundamental software processes and life-cycles, mathematical foundations of software engineering, requirements analysis, software engineering methodologies and standard notations, principles of software architecture and re-use, software quality frameworks and validation, software development, and maintenance environments and tools. An introduction to object-oriented software development process and design.

PREREQUISITE(S):

Level	Credits	Periods/ Week	Prerequisites
UG	4	5	OOAD

MARKS DISTRIBUTION:

Sessional Marks	University End Exam marks	Total marks
Midterm Test There shall be two midterm examinations. Each midterm examination consists of essay paper, objective paper and assignment. The essay paper is for 10 marks of 60 minutes duration and shall contain 4 questions. The student has to answer 2 questions, each carrying 5 marks. The objective paper is for 10 marks of 20 minutes duration. It consists of 10 multiple choice and 10 fill-in-the blank questions, the student has to answer all the questions and each carries half mark. First midterm examination shall be conducted for the first two and half units of syllabus and second midterm examination shall be conducted for the remaining portion. Five marks are earmarked for assignments. There shall be two assignments in every theory course. Assignments are usually issued at the time of commencement of the semester. These are of problem solving in nature with	75	100

Sessional Marks	University End Exam marks	Total marks
critical thinking. Marks shall be awarded considering the average of two midterm tests in each course.		

EVALUATION SCHEME:

S. No	Component	Duration	Marks
1.	I Mid Examination	80 minutes	20
2.	I Assignment	-	5
3.	II Mid Examination	80 minutes	20
4.	II Assignment	-	5
5.	External Examination	3 hours	75

COURSE OBJECTIVES:

I Be familiar with basic Software engineering methods and practices, and its applications.

II Master the implementation of software engineering layered technology and Process frame work.

III Be familiar with software measurement and software risks.

IV Be familiar with software requirements and the SRS documents.

V Be familiar with role of project management including planning, scheduling, risk management.

VI Master the implementation of different software architectural styles.

COURSE OUTCOMES:

At the end of the course the students are able to:

1. Ability to identify the minimum requirements for the development of applications.
2. Ability to develop, maintain, efficient, reliable and cost effective software solutions.
3. Ability to critical thinking and evaluate assumptions and arguments.

HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes		Level	Proficiency assessed
PSO1	**Applications of Computing**: Ability to use knowledge in various domains to provide solution to new ideas and innovations.	H	Lectures, Assignments
PSO2	**Programming Skills**: Identify required data structures, design suitable algorithms, develop and maintain software for real world problems.	H	Projects

4. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes		Level	Proficiency assessed by
PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	H	Assignments, Tutorials
PO2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	H	Assignments
PO3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	S	Mini Projects
PO4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	S	Projects
PO5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	S	Mini Projects
PO6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.	N	--
PO7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	N	--
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	N	--
PO9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	S	Mini Projects
PO10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	N	--
PO11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	H	Mini Projects
PO12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	S	Projects

N - None S - Supportive H - Highly Related

VIII. SYLLABUS:

UNIT-I

Introduction to Software Engineering: The evolving role of software, Changing Nature of Software, legacy software, Software Myths.

A Generic View of Process: Software engineering-A layered technology, a process framework, The Capability Maturity Model Integration (CMMI), Process Patterns, Process Assessment, personal and team process models.

Process Models: The Waterfall model, Incremental process models, Evolutionary Process Models, Specialized Process Models, The Unified Process.

UNIT-II

Software Requirements: Functional and non-Functional Requirements, User Requirements, System Requirements, Interface Specification, the software requirement document.

Requirement engineering process: Feasibility studies, Requirements elicitation and analysis, requirements validation, Requirements management.

System models: Context Models, behavioral models, Data models, object models, structured method.

UNIT-III

Design Engineering: Design process and design quality, Design concepts, the design model, pattern based software design.

Creating an Architectural Design: Software architecture, Data design, Architectural Styles and patterns, Architectural design, assessing alternative architectural designs, mapping data flow into software architecture.

Modeling Component-level design: designing class –based components, conducting component-level design, object constraint language, designing conventional components.

Performing User interface design: Golden rules, User interface analysis and design, interface analysis, interface design steps, Design evaluation.

UNIT-IV

Testing Strategies: A strategic approach to software testing, test strategies for conventional software, Black-Box and White-Box testing, Validation testing, system testing, the art of debugging.

Product metrics: Software Quality, Frame work for product metrics, Metrics for Analysis Model, Metrics for Design Model, metrics for source code, metrics for testing, metrics for maintenance.

Metrics for process and products: Software Measurement, Metrics for software quality.

UNIT-V

Risk management: Reactive vs. Proactive Risk strategies, software risks, Risk identification, Risk projection, Risk refinement, RMMM, RMMM plan.

Quality Management: Quality concepts, software quality assurance, Software Reviews, Formal technical Reviews, Statistical Software quality Assurance, Software reliability, The ISO 9000 quality standards.

Text books:

1. Software engineering a practitioner's approach, Roger S Pressman, sixth edition Mc Graw Hill International Edition.
2. Software Engineering, Ian Sommerville, seventh edition, Pearson education.

References:

1. Software Engineering, a Precise Approach, PankajJalote, Wiley India, 2010.
2. Software Engineering: A primer, Waman S Jawadekar, Tata McGraw-Hill, 2008.
3. Fundamentals of Software Engineering, Rajib Mall, PHI, 2005.

IX. COURSE PLAN:

At the end of the course, the students are able to achieve the following course learning outcomes.

Lecture No.	Topics to be covered	Course Learning Outcomes	Reference
1-4	The evolving role of software, Changing Nature of Software. Legacy software, Software Myths.	**Explain** the evolution of software	T1:1.1 T1:1.4
5	Software engineering-A layered technology, a process framework.	**Explain** process frame work	T1:2.1
6	The Capability Maturity Model Integration (CMMI).	**Illustrate** CMMI	T1:2.3
7-9	Process Patterns, Process Assessment, personal and team process models.	**Explain** process patterns	T1:2.4
10-15	The Waterfall model, Incremental process models, Evolutionary Process Models, Specialized Process Models, The Unified Process.	**Demonstrate** waterfall model, incremental evolutionary, specialized models	T1:3.2
16-18	Functional and non-Functional Requirements	**Distinguish** between Functional and non-Functional Requirements	T2:6.1
19-22	User Requirements, System Requirements. Interface Specification, the software requirement document	**Discuss** user and system requirements, **Explain** software requirement document	T2:6.2
23-25	Requirements elicitation and analysis, requirements validation, Requirements management	**Demonstrate** requirement management	T2:7.2
26-32	Context Models, behavioral models, Data models, object models, structured method	**Demonstrate** Design Engineering	T2:8.1
33-35	Design process and design quality, Design concepts	**Explain** design concepts	T1:9.2
36-37	The design model, pattern based software design	**Explain** software design	T1:9.4
38-41	Software architecture, Data design, Architectural Styles and patterns, Architectural design	**Demonstrate** Architectural Styles and patterns	T1:10.1
42-44	Assessing alternative architectural designs, mapping data flow into software architecture.	**Illustrate** data flow in software architecture	T1:10.5
45-46	Designing class –based components, conducting component-level design, object constraint language, designing conventional components	**Explain** component level design	T1:9.3
47	Golden rules, User interface analysis and design, interface analysis	**Summarize** golden rules	T1:12.1
48	Interface design steps, Design evaluation.	**Explain** interface design	T1:12.3.4
49-50	A strategic approach to software testing, test strategies for conventional software, Black-Box and White-Box testing, Validation testing, system testing, the art of debugging.	**Demonstrate** testing techniques	T1:13.1
51-52	Software Quality, Frame work for product metrics, Metrics for Analysis Model, Metrics for Design Model	**Explain** software quality	T1:15.1

53	Metrics for source code, metrics for testing, metrics for maintenance	**Demonstrate** metrics for testing	T1:15.5
54	Metrics for process and products: Software Measurement, Metrics for software quality	**Explain** metrics of software quality	T1:22.1
55	Reactive vs. Proactive Risk strategies, software risks, Risk identification, Risk projection, Risk refinement, RMMM, RMMM plan.	**Demonstrate** RMMM	T1:25.1
56-58	Quality concepts, software quality assurance, Software Reviews, Formal technical Reviews	**Explain** quality concepts	T1:26.1
59-60	Statistical Software quality Assurance, Software reliability, The ISO 9000 quality standards	**Demonstrate** quality standards	T1:26.6

IX. MAPPING COURSE OBJECTIVES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Objectives	Program Outcomes												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
I	H	H	S	S					S		H	S	H	S
II	S		H						S			H	S	H
III			S						H		S	H	S	H
IV	H	S		H					S		S		H	
V	S	S		S					H		H		H	S
VI	H	S		H					S		S		S	H

S - Supportive **H - Highly Related**

X. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
I	H	H	S	S					S		H	S	S	H
II	S		H						S			H		
III			H						H		S	H		

S - Supportive **H - Highly Related**

COMPUTER SCIENCE AND ENGINEERING

ASSIGNMENT

Course Name	:	**SOFTWARE ENGINEERING**
Course Code	:	A50518
Class	:	III B. Tech II Semester
Branch	:	Computer Science and Engineering
Year	:	2016 – 2017
Course Faculty	:	**K NIKHIL Asst.Prof**

OBJECTIVES

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education. The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited.

In line with this, Faculty of Institute of Aeronautical Engineering, Hyderabad has taken a lead in incorporating philosophy of outcome based education in the process of problem solving and career development. So, all students of the institute should understand the depth and approach of course to be taught through this question bank, which will enhance learner's learning process.

S. No	Question	Blooms Taxonomy Level	Course Outcome
	UNIT – I		
1	**Describe** "Software myth"? Discuss on various types of software myths and the true aspects of these myths?	Remember	1
2	**Explain** software Engineering? Explain the software engineering layers?	Understand	1
3	**Explain** in detail the capability Maturity Model Integration (CMMI)?	Understand	1
4	**Describe** with the help of the diagram discuss in detail waterfall model. Give certain reasons for its failure?	Understand	1
5	**Explain** briefly on (a) the incremental model (b) The RAD Model?	Understand	1
6	**Explain** the Spiral model in detail?	Understand	1
7	**Explain** unified process? Elaborate on the unified process work products?	Remember	1
8	**Explain** product and process are related?	Understand	1
9	**Explain** changing nature of software in detail?	Understand	1
10	**Explain** and contrast perspective process models and iterative process models?	Remember	1
11	**Explain** about the evolutionary process models ?	Remember	1
	UNIT – II		
1	**Compare** functional requirements with nonfunctional requirements?	Remember	1
2	**Explain** requirement engineering process?	Remember	1
3	**Discuss** briefly how requirement validation is done?	Remember	1
4	**Discuss** your knowledge of how an ATM is used, develop a set of usecases that could serve as a basis for understanding the requirements for an ATM system?	Understand	2
5	**Describe** four types of non-functional requirements that may be placed on a system. Give examples of each of these types of requirement?	Understand	2

6	**Explain** SRS document and explain along with its contents?	Understand	2
7	**Explain** interface specification in detail?	Understand	2
8	**Discuss** how requirements are felicitated and validated in software project?	Remember	2
9	**Discuss** how feasibility studies are important in requirement engineering process?	Remember	2
10	**Demonstrate** class hierarchy for library by using interface specification?	Remember	2
	UNIT – III		
1	**Explain** a two level process? Why should system design be finished before the detailed design, rather starting the detailed design after the requirements specification? Explain with the help of a suitable example	Understand	2
2	**Discuss** briefly the following fundamental concepts of software design: i) Abstraction, ii) Modularity, iii) Information hiding	Understand	2
3	**Explain** briefly the following: i) Coupling between the modules, ii) The internal Cohesion of a module	Understand	2
4	**Explain** software design? Explain data flow oriented design?	Understand	2
5	**Explain** the goals of the user interface design?	Remember	2
6	**Discuss** briefly about the golden rules for the user interface design?	Remember	2
7	**Discuss** architectural styles and patterns?	Remember	2
8	**Explain** with a neat diagram of architectural design?	Understand	2
9	**Explain** the guide lines of component level design?	Understand	2
10	**Describe** the way of conducting a component level design?	Understand	2
	UNIT – IV		
1	**Explain** about the importance of test strategies for conventional software?	Remember	3
2	**Discuss** black box testing in a detailed view?	Remember	3
3	**Compare** black box testing with white box testing?	Understand	3
4	**Compare** validation testing and system testing?	Remember	3
5	**Discuss** software quality factors? Discuss their relative importance?	Understand	3
6	**Explain** about Product metrics?	Understand	3
7	**Explain** in detail about Software Measurement?	Remember	3
8	**Explain** strategic approach to software testing	Understand	4
9	**Describe** test strategies for conventional software	Remember	3
10	**Discuss** a framework for product metrics	Understand	3
	UNIT – V		
1	**Explain** about software risks?	Remember	3
2	**Elaborate** the concepts of Risk management Reactive Vs Proactive Risk strategies?	Understand	3
3	**Explain** about RMMM Plan?	Remember	3
4	**Explain** about Quality concepts?	Understand	3
5	**Explain** software quality assurance?	Understand	3
6	**Explain** about formal technical reviews?	Understand	3
7	**Explain** in detail ISO 9000 quality standards?	Understand	3
8	**Explain** six sigma for software engineering?	Remember	2
9	**Explain** quality management with their terms?	Understand	3
10	**Demonstrate** risk identification?	Remember	3

COMPUTER SCIENCE AND ENGINEERING

TUTORIAL QUESTION BANK

Course Name	:	**SOFTWARE ENGINEERING**
Course Code	:	A50518
Class	:	III B. Tech I Semester
Branch	:	Computer Science and Engineering
Year	:	2016 – 2017
Course Faculty	:	**K NIKHIL Asst.Prof**

OBJECTIVES

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education. The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited.

In line with this, Faculty of Institute of Aeronautical Engineering, Hyderabad has taken a lead in incorporating philosophy of outcome based education in the process of problem solving and career development. So, all students of the institute should understand the depth and approach of course to be taught through this question bank, which will enhance learner‟s learning process.

S No	QUESTION	Blooms taxonomy level	Course Outcomes
	UNIT - I **INTRODUCTION TO SOFTWARE ENGINEERING**		
	Part - A (Short Answer Questions)		
1	**Explain** is legacy software?	Knowledge	1
2	**Demonstrate** all the applications of software	Knowledge	1
3	**List** the types of software myths?	Knowledge	1
4	**Discuss** the architecture of layered technology	Understand	1
5	**List** all the umbrella activities in process framework	Understand	1
6	**Explain** process pattern?	Knowledge	1
7	**List** the types of software models	Understand	1

8	**Explain** the types other software process models	Understand	1
9	**Explain** software component? explain its uses	Understand	1
10	**Explain** process assessment?	Knowledge	1
11	**Explain** the models in CMMI	Knowledge	1
12	**Explain** the levels in continuous model in CMMI	Understand	1
13	**Explain** the differences between perspective and iterative process models	Understand	1
14	**Explain** staged model in CMMI	Knowledge	1
15	**Explain** waterfall model and who invented waterfall model	Understand	1
16	**Explain** boehm model?	Understand	1
17	**List** the phases in unified process model	Understand	1
18	**List** the types of patterns	Knowledge	1
19	**Explain** PSP and TSP	Knowledge	1
20	**Explain** high speed adaptation model	Understand	1
	Part - B (Long Answer Questions)		
1	**Explain** the evolving role of software	Knowledge	1
2	**Define** software and explain the various characteristics of software	Knowledge	2
3	**Explain** "Software myth"? Discuss on various types of software myths and the true aspects of these myths	Knowledge	2
4	**Discuss** about software Engineering? Explain the software engineering layers?	Understand	2
5	**Explain** in detail the capability Maturity Model Integration (CMMI)	Understand	2
6	**Describe** with the help of the diagram discuss in detail waterfall model. Give certain reasons for its failure	Knowledge	2
7	**Explain** briefly on (a) the incremental model (b) The RAD Model	Understand	2
8	**Explain** the Spiral model in detail?	Understand	2
9	**Describe** With the help of the diagram explain the concurrent development model	Understand	2
10	**Explain** unified process? Elaborate on the unified process work products	Knowledge	3
11	**Explain** specialized process models	Knowledge	3
12	**Explain** different software applications?	Knowledge	3
13	**Explain** the paradigms do you think would be most effective? Why?	Understand	3
14	**Explain** product and process are related?	Understand	3
15	**Explain** personal and team process models	Understand	3
16	**Explain** process frame work activities	Knowledge	3

17	**Explain** the purpose of process assessment	Knowledge	3
18	**Explain** changing nature of software in detail	Knowledge	3
19	**Explain** and contrast perspective process models and iterative process models	Understand	3
20	**Explain** about the evolutionary process models	Understand	3
Part - C (Problem Solving and Critical Thinking Questions)			
1	**Describe** the law of conservation of familiarity in your own words	Knowledge	1
2	**Suggest** a few ways to build software to stop deterioration due to change	Knowledge	1
3	**Try** to develop a task set for the communication activity	Apply	2
4	**Explain** the purpose of process assessment? Why has SPICE been developed as a standard for process assessment?	Knowledge	2
5	**Discuss** the meaning of "cross-cutting concerns" in your words	Knowledge	2

UNIT - II **SOFTWARE REQUIREMENTS**			
Part – A (Short Answer Questions)			
1	**Explain** the kinds of system requirements	Knowledge	3
2	**Explain** functional requirement	Knowledge	3
3	**Explain** non-functional requirement	Understand	3
4	**Explain** domain requirements	Understand	3
5	**What** are kinds of non-functional requirements	Knowledge	3
6	**Explain** example of functional requirement	Understand	3
7	**Explain** user requirements in detail.	Understand	3
8	**Explain** system requirement in detail	Understand	3
9	**Explain** interface and list out how many types of there and what are they	Knowledge	3
10	**Explain** the term stake holder	Knowledge	3
11	**Explain** use case	Knowledge	3
12	**Explain** requirement validation	Understand	3
13	**Explain** requirement review	Understand	2
14	**Explain** data dictionary?	Understand	2
15	**Discuss** data flow model	Knowledge	2
16	**Explain** state machine model of a microwave oven	Knowledge	2
17	**List** kinds of behavioural and object models	Knowledge	2
18	**Design** class hierarchy for library by using in inheritance model	Knowledge	2
19	**Describe** ethnography	Understand	2
20	**Explain** viewpoints and types of view points	Understand	2
Part - B (Long Answer Questions)			
1	**Write** short notes on user requirements. What is requirements	Knowledge	3
2	**Compare** functional requirements with non-functional requirements	Knowledge	3
3	**Discuss** system requirements in a detail manner	Understand	3
4	**Explain** requirement engineering process.	Understand	3
5	**Discuss** briefly how requirement validation is done?	Knowledge	3
6	**Discuss** your knowledge of how an ATM is used , develop a set of use-cases that could serve as a basis for understanding the requirements for an ATM system.	Understand	3
7	**Describe** four types of non-functional requirements that may be placed on a system. Give examples of each of these types of requirement.	Understand	3

8	**Explain** how requirements are managed in software project management	Understand	3
9	**Explain** context models	Knowledge	3
10	**Explain** Behavioural models.	Knowledge	3
11	**Explain** Data models.	Knowledge	3
12	**Explain** Object models	Understand	2
13	**Explain** in which circumstances would you recommend using structured methods for system development?	Understand	2
14	**Explain** SRS document and explain along with its contents	Understand	2
15	**Explain** interface specification in detail	Knowledge	2
16	**Discuss** how requirements are elicitated and validated in software project	Knowledge	2
17	**Discuss** how feasibility studies are important in requirement engineering process.	Knowledge	3
18	**Demonstrate** class hierarchy for library by using interface specification	Understand	3
19	**Explain** inheritance model	Understand	3
20	**Explain** state machine model with a suitable example	Understand	3
	Part – C (Problem Solving and Critical Thinking)		
1	**Identify** and briefly describe four types of requirements that may be defined for computer based system	Knowledge	3
2	**List** out plausible user requirements for the following functions a)cash dispensing function in a bank ATM b)spelling check and correcting function in a word processor	Knowledge	3
3	**Suggest** how an engineer responsible for drawing up a system requirements specification might keep track of the relationship between functional and non- functional requirements.	Knowledge	3
4	**Suggest** who might be stakeholders in a university student record system. Explain why it is almost inevitable that the requirements of different stakeholders will conflict in some way.	Knowledge	3
5	**Explain** who should be involved in requirements review? draw a process model showing how a requirements review might be organized.	Apply	3
	UNIT-III **DESIGN ENGEERING**		
	Part - A (Short Answer Questions)		
1	**Explain** why design is important in design engineering	Knowledge	3
2	**Discuss** analysis and design model	Understand	3
3	**Describe** quality attributes and its guidelines	Understand	3

4	**List** the design concepts	Knowledge	3
5	**Justify** the importance of refactoring	Understand	3
6	**Give** a short notes on low coupling	Understand	3
7	**Define** software architecture with its importance	Understand	3
8	**Explain** taxonomy of architectural styles	Knowledge	3
9	**Write** a short notes on architecture patterns	Knowledge	3
10	**Define** archetypes	Understand	3
11	**Define** component	Knowledge	2
12	**Write** a short notes on coupling	Knowledge	2
13	**List** out the steps for conducting component level design	Knowledge	2
14	**Write** a short notes on cohesion	Knowledge	2
15	**Design** the class based components	Understand	2
16	**List** out the golden rules for interface design	Understand	1
17	**Write** a short notes on interface design steps	Knowledge	1
18	**Describe** design evaluation	Knowledge	1
19	**List** out all the design issues	Understand	1
20	**Explain** process in user interface design	Understand	2
	Part – B (Long Answer Questions)		
1	**Explain** a two level process? Why should system design be finished before the detailed design, rather starting the detailed design after the requirements specification? Explain with the help of a suitable example.	Knowledge	3
2	**Discuss** briefly the following fundamental concepts of software design: i) Abstraction ii) Modularity iii) Information hiding.	Understand	3
3	**Explain** briefly the following: a. Coupling between the modules b. The internal Cohesion of a module.	Understand	3
4	**Discuss** the fundamental principles of structured design. Write notes on transform analysis.	Knowledge	2
5	**Explain** software architecture in a detail manner	Understand	2
6	**Explain** software design? Explain data flow oriented design	Understand	2
7	**What** are the goals of the user interface design	Understand	2
8	**Discuss** briefly about the golden rules for the user interface design	Knowledge	1
9	**Discuss** interface design steps in a brief manner	Knowledge	1
10	**Explain** how the design is evaluated	Understand	1
11	**Explain** design processing along with its quality	Knowledge	2
12	**What** are the design concepts in software engineering	Understand	2

13	**Explain** pattern based software design in a detail manner	Understand	2
14	**Elaborate** model for the design	Understand	1
15	**Discuss** architectural styles and patterns	Knowledge	1
16	**Explain** with a neat diagram of architectural design	Knowledge	1
17	**Elaborate** modeling component level design	Knowledge	1
18	**Describe** mapping data flow into a software architecture	Understand	2
19	**Explain** the guide lines of component level design	Understand	1
20	**Describe** the way of conducting a component level design	Understand	1
Part – C (Problem Solving and Critical Thinking)			
1	**State** how do we assess quality of a software design?	Knowledge	2
2	**Suggest** a design pattern that you encounter in a category of everyday things.	Apply	2
3	**Provide** examples of three data abstractions and the procedural abstractions that can be used to manipulate them	Apply	2
4	**Explain** the difference between a data base that services one or more conventional business applications and data warehouse	Knowledge	2
5	**Demonstrate** the architecture of a house or building as a metaphor, draw comparison with software architecture. How are the disciplines of classical architecture and software architecture similar? How do they differ?	Apply	2
UNIT-IV **TESTING STRATEGIES**			
Part – A (Short Answer Questions)			
1	**Compare** verification and validation	Knowledge	1
2	**Write** a short notes on unit testing	Knowledge	2
3	**Describe** smoke testing	Knowledge	2
4	**List** out the steps for bottom-up integration	Knowledge	2
5	**List** out the steps for top-down integration	Understand	2
6	**Write** short note on integration testing	Understand	2
7	**Define** alpha testing	Knowledge	2
8	**Define** beta testing	Knowledge	3
9	**Write** a short notes on validation testing	Knowledge	3
10	**Explain** art of debugging	Understand	2
11	**Describe** regression testing	Knowledge	2
12	**List** out the steps for integration step documentation	Knowledge	2

13	Describe performance testing	Knowledge	2
14	Write a short notes on glass box testing	Knowledge	2
15	Explain behavioral testing	Understand	2
16	List the quality factors of McCall's	Understand	2
17	List the quality factors of ISO 9126	Knowledge	2
18	Define the following terms measures, metrics, indicators	Understand	2
19	Give a short notes on product metric land scape	Understand	2
20	List out the metrics for analysis model	Understand	2
Part – B (Long Answer Questions)			
1	**Explain** about the importance of test strategies for conventional software	Knowledge	1
2	**Discuss** black box testing in a detailed view	Apply	1
3	**Compare** black box testing with white box testing	Apply	1
4	**Compare** validation testing and system testing	Knowledge	1
5	**Discuss** software quality factors? Discuss their relative importance	Understand	1
6	**Discuss** an overview of quality metrics	Understand	1
7	**Explain** should we perform the Validation test – the software developer or the software user? Justify your answer	Apply	1
8	**Explain** about Product metrics	Knowledge	1
9	**Explain** about Metrics for maintenance	Knowledge	1
10	**Explain** in detail about Software Measurement?	Understand	1
11	**Explain** about Metrics for software quality?	Knowledge	2
12	**Explain** strategic approach to software testing	Understand	2
13	**Describe** test strategies for conventional software	Understand	2
14	**Describe** validation testing	Understand	2
15	**Write** a long notes on system testing	Knowledge	2
16	**Demonstrate** art of debugging	Knowledge	2
17	**Discuss** a framework for product metrics	Knowledge	2
18	**Demonstrate** metrics for analysis model	Understand	2
19	**Briefly** list the metrics for the design model	Understand	2
20	**Describe** metrics for source code and for testing	Understand	1
Part – C (Problem Solving and Critical Thinking)			
1	**Provide** a few examples that illustrate why response time variability can be an issue.	Knowledge	2

2	**Develop** two additional design principles "place the user in control"	Apply	2
3	**Develop** two additional design principles "make the interface consistent"	Apply	2
4	**Develop** a complete test strategy for the safe home system. Document it in a test specification.	Apply	2
5	**Provide** examples for unit testing.	Apply	2
UNIT-V **RISK MANAGEMENT**			
Part - A (Short Answer Questions)			
1	**Define** reactive and proactive risk strategies	Knowledge	3
2	**List** out the generic subcategories of predictable risks	Understand	3
3	**Define** risk components	Understand	3
4	**List** out the conditions for risk refinement	Knowledge	3
5	**Demonstrate** quality concepts	Understand	3
6	**Give** a short notes on formal technical reviews	Understand	3
7	**List** out review guidelines	Understand	3
8	**Describe** six sigma for software	Knowledge	3
9	**Define** SQA plan	Knowledge	3
10	**Write** a short notes on ISO 9000 quality standards	Understand	2
11	**Give** the formulae for measures of reliability and availability	Knowledge	2
12	**Define** software safety	Knowledge	2
13	**Define** risk projection	Knowledge	2
14	**Define** software risks and what are the types of software risks	Knowledge	2
15	**Describe** risk components and drivers	Understand	2
16	**Define** risk refinement	Understand	2
17	**What** does RMMM stands in RMMM plan	Knowledge	2
18	**Define** software reliability	Understand	2
19	**Define** quality and quality control in quality management	Understand	2
20	**Give** a short notes on risk identification	Understand	3
Part - B (Long Answer Questions)			
1	**Explain** about software risks?	Knowledge	2
2	**Elaborate** the concepts of Risk management Reactive vs Proactive Risk strategies	Understand	2
3	**Explain** about RMMM Plan?	Understand	2

4	**Explain** about Quality concepts?	Knowledge	2
5	**Explain** software quality assurance	Understand	2
6	**Explain** about formal technical reviews	Understand	2
7	**Explain** in detail ISO 9000 quality standards	Understand	2
8	**Discuss** risk refinement?	Knowledge	2
9	**Compare** reactive with proactive risk strategies	Knowledge	2
10	**Discuss** software reliability?	Understand	2
11	**Briefly** explain about formal approaches to SQA	Knowledge	3
12	**Demonstrate** statistical SQA	Understand	3
13	**Define** software reliability along with its terms	Understand	3
14	**Explain** risk projection in detail	Understand	3
15	**Explain** seven principals of risk management	Knowledge	3
16	**Explain** software reviews in brief	Knowledge	2
17	**Explain** six sigma for software engineering	Knowledge	2
18	**Explain** quality management with their terms	Understand	2
19	**Demonstrate** risk identification	Understand	2
20	**Describe** developing a risk table	Understand	1
Part – C (Problem Solving and Critical Thinking)			
1	Quality and reliability are related concepts but are fundamentally different in number of ways**. Discuss** them	Apply	2
2	**Expalain** you have been given the responsibility for improving quality of software across your organization. What is the first thing that you should do? what's next	Apply	2
3	Some people argue that an FTR should assess programming style as well as correctness is this a good idea? **Discuss** why?	Apply	2
4	**Demonstrate is** it possible to assess the quality of software if the customer keeps changing what it is supposed to do?	Apply	2
5	**Create** a risk table for the project that if you are the project manager for a major software company. you have been asked to lead a team that's developing "next generation "word- processing software.	Apply	1

COMPUTER SCIENCE AND ENGINEERING

COURSE DESCRIPTION FORM

Course Title	**PRINCIPLES OF PROGRAMMING LANGUAGES**			
Course Code	**A50511**			
Regulation	**R13 - JNTUH**			
Course Structure	**Lectures**	**Tutorials**	**Practicals**	**Credits**
	4	-	-	4
Course Coordinator	**K ABDUL BASITH Prof**			

I. COURSE OVERVIEW:

The course addresses growing importance of Programming languages, their uses, and importance of using different programming tools. Course addresses various influences of language design and language implementation techniques like, compilers, interpreters. This course also explains about different expressions and statements used in different programming languages. Comparison of functional programming with logic programming, structure of imperative programming. Exceptions and exception handling procedures of different programming languages like, C#, C++, Java, Ada95. It also introduces the importance of scripting languages features and data types of Python language.

II. PREREQUISITE(S):

Level	Credits	Periods/ Week	Prerequisites
UG	4	4	Computer Programming, Formal Languages and Automata Theory

III. MARKS DISTRIBUTION:

Sessional Marks	University End Exam marks	Total marks
Midterm Test There shall be two midterm examinations. Each midterm examination consists of essay paper, objective paper and assignment. The essay paper is for 10 marks of 60 minutes duration and shall contain 4 questions. The student has to answer 2 questions, each carrying 5 marks. The objective paper is for 10 marks of 20 minutes duration. It consists of 10 multiple choice and 10 fill-in-the blank questions, the student has to answer all the questions and each carries half mark. First midterm examination shall be conducted for the first two and half units of syllabus and second midterm examination shall be conducted for the remaining portion. Five marks are earmarked for assignments. There shall be two assignments in every theory course. Assignments are usually issued at the time of commencement of the semester. These are of problem solving in nature with critical thinking.	75	100

Sessional Marks	University End Exam marks	Total marks
Marks shall be awarded considering the average of two midterm tests in each course.		

IV. EVALUATION SCHEME:

S. No	Component	Duration	Marks
1.	I Mid Examination	80 minutes	20
2.	I Assignment	-	5
3.	II Mid Examination	80 minutes	20
4.	II Assignment	-	5
5.	External Examination	3 hours	75

V. COURSE OBJECTIVES:

At the end of the course, the students will be able to:

I. Be familiar with the structure and design principles of programming languages.
II. Master the skills in analyzing and using the features of programming languages.
III. Be familiar with the preliminary concepts like context-free grammar, Backus-Naur form, Parse trees.
IV. Be familiar with the data types of different programming languages.
V. Be familiar with logic programming and functional programming languages features.
VI. Be familiar with variable declarations in programming languages, in particular to binding, scope, and substitution of variables.
VII. Be familiar with Python scripting language.

VI. COURSE OUTCOMES:

After completing this course the student must demonstrate the knowledge and ability to:

1. Ability to express syntax and semantics in formal notation.
2. Ability to apply suitable programming paradigm for the application.
3. Gain knowledge and comparison of the features of programming languages.

HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes		Level	Proficiency assessed
PSO1	**Applications of Computing**: Ability to use knowledge in various domains to provide solution to new ideas and innovations.	H	Lectures, Assignments
PSO2	**Programming Skills**: Identify required data structures, design suitable algorithms, develop and maintain software for real world problems.	H	Projects

II. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes		Level	Proficiency assessed by
PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	H	Assignments, Tutorials
PO2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	H	Assignments
PO3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	S	Mini Projects
PO4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	S	Mini Projects
PO5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	S	Projects
PO6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.	N	--
PO7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	N	--
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	N	--
PO9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	N	--
PO10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	N	--
PO11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	N	--
PO12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	S	Projects, Discussions

N – None **S - Supportive** **H - Highly Related**

IX. SYLLABUS:

UNIT- I:

Preliminary Concepts: Reasons for studying, concepts of programming languages, Programming domains, Language Evaluation Criteria, influences on Language design, Language categories, Programming Paradigms– Imperative, Object Oriented, functional Programming , Logic Programming. Programming Language Implementation – Compilation and Virtual Machines, programming environments.

Syntax and Semantics: general Problem of describing Syntax and Semantics, formal methods of describing syntax - BNF, EBNF for common programming languages features, parse trees, ambiguous grammars, attribute grammars, denotational semantics and axiomatic semantics for common programming language features.

UNIT – II

Data types: Introduction, primitive, character, user defined, array, associative, record, union, pointer and reference types, design and implementation uses related to these types. Names, Variable, concept of binding, type checking, strong typing, type compatibility, named constants, variable initialization.

Expressions and Statements: Arithmetic relational and Boolean expressions, Short circuit evaluation mixed mode assignment, Assignment Statements, Control Structures – Statement Level, Compound Statements, Selection, Iteration, Unconditional Statements, and guarded commands.

UNIT – III

Subprograms and Blocks: Fundamentals of sub-programs, Scope and lifetime of variable, static and dynamic scope, Design issues of subprograms and operations, local referencing environments, parameter passing methods, overloaded sub-programs, generic sub-programs, parameters that are sub-program names, design issues for functions user defined overloaded operators, co routines

UNIT – IV

Abstract Data types: Abstractions and encapsulation, introductions to data abstraction, design issues, language examples, C++ parameterized ADT, object oriented programming in small talk, C++, Java, C#, Ada 95.

Concurrency: Subprogram level concurrency, semaphores, monitors, massage passing, Java threads, C# threads.

Exception handling: Exceptions, exception Propagation, Exception handler in Ada, C++ and Java.

Logic Programming Language: Introduction and overview of logic programming, basic elements of prolog, application of logic programming

UNIT – V

Functional Programming Languages: Introduction, fundamentals of FPL, LISP, ML, Haskell, application of Functional Programming Languages and comparison of functional and imperative Languages.

Scripting Language: Pragmatics, key concepts, case study: Python- values and types, variables, storage and control, bindings and scope, procedural abstraction, data abstraction, separate compilation, module library.

Text books:

1. Robert .W. Sebesta, “Concepts of Programming Languages”, 9/e, Pearson Education.

References:

1. A. B. Tucker, R. E. Noonan, “Programming languages”, 2e, TMH.
2. K. C. Louden, ”Programming Languages”, 2e, 2003.
3. Patric Henry Winston and Paul Horn,” LISP”, Pearson Education.
4.
5. W. F. Clocksin, C. S. Melish, “Programming in Prolog”, 5e, Springer.

X. COURSE PLAN:

At the end of the course, the students are able to achieve the following course learning outcomes:

Lecture No.	Topics to be covered	Course Learning Outcomes	Reference
1	Reasons for studying concepts of programming languages.	**Identify the** importance of programming languages.	T1: 1.2
2	Programming domains.	**Understand** different programming domains.	T1: 1.5
3 – 4	Language evaluation criteria, influences on language design	**Evaluate language** criteria that influence on language design.	T1: 1.7
5	Language categories.	**Categorize** the languages	T1: 1.22
6 – 7	Programming Paradigms – imperative, object oriented, functional programming, and logic programming.	**Compare and Contrast** different programming paradigms	T1: 1.25
8 – 9	Programming language implementation – compilation and virtual machines	**Reproduce** programming language Implementation	T1: 2.2
10	Programming environments.	**Distinguish** programming environments	T1: 1.32
11	General Problem of describing syntax and semantics	**Understand** Syntax and Semantics	T1: 3.3
12 – 15	Formal methods of describing syntax - BNF, EBNF for common programming languages features	**Contrast** BNF, EBNF.	T1: 3.5
16	Parse trees	**Construct** parse trees for given grammar	T1: 3.6
17 – 18	Ambiguous grammar, attribute grammar.	**Distinguish** ambiguous grammars and define attribute grammar	T1: 3.7
19 – 21	Denotational semantics and axiomatic semantics for common programming language features.	**Understand** semantics of common programming language features	T1: 3.27
22 – 26	Introduction, primitive, character. user defined, array, associative, record, union, pointer and reference types, design and implementation uses related to these types.	**Use** different data types	T1: 6.4
27 – 30	Names, variable, concept of binding, type checking, strong typing, type compatibility, named constants, variable initialization.	**Review** the concept of binding conversion and compatibility of data types	T1: 5.2,6.5
31 - 33	Arithmetic relational and Boolean expressions.	**Illustrate** different type of expressions	T1: 7.3
34 – 38	Short circuit evaluation mixed mode assignment, assignment statements. Control Structures – Statement Level, compound statements. selection, iteration, unconditional statements, guarded commands.	**Understand** different types of Statements.	T1: 7.1,8.3
39– 40	Fundamentals of sub-programs, scope and lifetime of variable, static and dynamic scope, design issues of subprograms and operations	**Able** to write subprograms	T1: 9.2
41	Local referencing environments.	**Understand** local referencing environments	T1: 9.1
42 – 43	Parameter passing methods. overloaded sub-programs, generic sub-programs, parameters that are sub-program	**Distinguish** different types of parameter passing methods	T1: 9.4

	names		
44 – 46	Design issues for functions , user defined overloaded operators, co routines.	**Illustrate** design issues for functions and co routines	T1: 9.5
47	Abstractions and encapsulation, introductions to data abstraction.	**Understand** data abstraction.	T1:10.3
48 – 49	Design issues, language examples. C++ parameterized ADT.	**Illustrate** design issues with examples	T1:10.7
50 – 51	Object oriented programming in small talk, C++, Java, C#, Ada 95.	**Compare and contrast** oops concepts of different languages	T1:11.1
52 – 53	Subprogram level concurrency, semaphores, monitors, Massage passing, Java and C# threads.	**Understand** concurrency concepts	T1:12.6
54 – 56	Exceptions, exception Propagation, Exception handler in Ada, C++ and Java.	**Illustrate** exceptional handling concepts of different languages	T1: 13.2
57 – 58	Introduction and overview of logic programming, basic elements of prolog, application of logic programming	**Understand** the basic concepts of logic programming and its applications	T1: 14.3
59 – 60	Introduction, fundamentals of FPL, LISP, ML, Haskell. Application of functional programming languages , comparison of functional and imperative languages	**Understand** the basic concepts and applications of different functional programming languages	T1:14.7
61 – 62	Pragmatics, key concepts, case study: Python- values and types, variables, storage and control, bindings and scope, procedural abstraction, data abstraction, separate compilation, module library	**Understand** about scripting languages	T1:16.5

XI. MAPPING COURSE OBJECTIVES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Objectives	Program Outcomes												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
I	H	H			H							S		
II	S	H			S							S		
III	H	S	S	S	S							S		
IV	H	S			H							H		
V	S		S											
VI			S		S							S		
VII			S	S	S							S		

S – Supportive **H - Highly Related**

XII. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	S	S												S
2	S													
3					S							S		

S – Supportive **H - Highly Related**

COMPUTER SCIENCE AND ENGINEERING

ASSIGNMENT

Course Name	**PRINCIPLES OF PROGRAMMING LANGUAGES**
Course Code	A50511
Class	III B. Tech I Semester
Branch	Computer science and engineering
Year	2016 –17
Course Faculty	**K ABDUL BASITH Prof**

OBJECTIVES

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education. The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited.

In line with this, Faculty of Institute of Aeronautical Engineering, Hyderabad has taken a lead in incorporating philosophy of outcome based education in the process of problem solving and career development. So, all students of the institute should understand the depth and approach of course to be taught through this question bank, which will enhance learner's learning process.

ASSIGNMENT – I & II

S. No.	Question	Blooms Taxonomy Level	Course Outcome
	UNIT - I		
1	**Compute** the weakest precondition for each of the following simple assignment statements and post conditions. i. a=2*(b-1)-1{a>0} ii. b=(c+10)/3 {b>6} iii. a=a+2*b-1 {a>1} d) X=2*y+x-1 {x>11}	Apply	1
2	**Illustrate** some reasons why computer scientist and professional software developers should study general concepts of language design and evaluation.	Apply	1
3	**Write** reasons for the statement: "Exception handling is very important, but often neglected by programming languages".	Apply	1
4	**Apply** reasons for the statement: "A programming language can be compiled or interpreted". Give relative advantages and disadvantages of compilation and interpretation. Give examples of compiled and interpreted	Apply	1
5	**Show** that **the** given grammar is ambiguous. <assign> -><id>=<expr> <id>->A|B|C <expr>-><expr>+<expr> |<expr>*<expr>|(<expr>).	Apply	1

S. No.	Question	Blooms Taxonomy Level	Course Outcome
6	**Write** BNF notation for following: a) For loop b) If-else condition c) Structure definition	Apply	1
7	**Explain** in detail about denotational semantic?	Understand	1
8	**Sketch** the parse tree for following grammar? A = B * (A+C)	Apply	1
9	**Explain** in detail about operational semantics?	Understand	1
10	**Explain** about EBNF?	Understand	1
	UNIT - II		
1	**List** what advantages does java's break statement have over C's and C++'s break statement?	Knowledge	1
2	**State** whether static binding is more reliable or dynamic binding?	Knowledge	1
3	**Illustrate** with an example the language used for structural type equivalence and name type equivalence approach?	Apply	1
4	**Illustrate** suitable examples of Ada programming language for arithmetic Expressions?	Apply	1
5	**Write** an Ada Code to swap two variable values?	Apply	1
6	**Write** code for employee record details in COBOL language?	Apply	1
7	**Discuss** about user defined ordinal types?	Understand	2
8	**Evaluate** record types and union types?	Evaluate	2
9	**Discuss** the design issues of pointer type?	Understand	2
10	**Discuss** about short circuit evaluation?	Understand	2
	UNIT - III		
1	**Discuss** generic subprograms in C++ and Java?	Understand	2
2	**Illustrate** with example Lua code which shows the importance of "Quasi Concurrency"?	Apply	2
3	**Compare** the parameter passing mechanisms of ALGOL and ADA?	Apply	2
4	**Illustrate** with suitable examples to differentiate subprograms and	Apply	2
5	**Define** shallow and deep binding for referencing environment of sub-programs that have been passed as parameters.	Knowledge	2
6	"The design considerations of parameter passing plays a major role in a sub program block", **Comment** on the statement.	Apply	3
7	**Discuss** design issues of functions?	Understand	3
8	**State** three general characteristics of subprograms?	Knowledge	3
9	**Show** the implementation of different parameter passing methods?	Apply	2
10	**List** design issues of subprograms?	Knowledge	2
	UNIT - IV		
1	**Discuss** how dining philosopher's problem and producer consumer problem are solved using concurrency in Ada?	Understand	1
2	**Describe** the cooperation synchronization and competition synchronization in message passing?	Knowledge	1
3	**Compare** the parameter passing mechanisms of ALGOL and ADA.	Apply	2
4	**Explain** how Smalltalk messages are bound to methods. When does this take place?	Understand	2
5	**Write** a C# code to find the factorial of a number?	Apply	2
6	**Discuss** the different prepositions of PROLOG language.	Understand	2
7	**Discuss** the design issues of Abstract Data Types?	Understand	

8	**Compare** Java threads with C# threads?	Apply	2
9	**List** the applications of Logic programming?	Knowledge	2
10	**Discuss** about semaphores?	Understand	1
	UNIT - V		
1	**Explain** the procedural abstraction in PYTHON language?	Understand	3
2	**Discuss** Python data types with suitable examples?	Understand	3
3	**Write** features of Haskell that makes very different from Scheme?	Apply	3
4	**List** the ways in which ML is significantly different from Scheme?	Knowledge	2
5	**Compare** functional and imperative Languages?	Apply	3
6	**Discuss** application of Functional Programming Languages?	Understand	2
7	**Explain** the data abstraction in Python language?	Understand	3
8	**Describe** the separate compilation and module library of Python language?	Knowledge	3
9	**Discuss** fundamentals of Functional programming languages?	Understand	2
10	**Write** the features of LISP language?	Apply	2

TUTORIAL QUESTION BANK

Course Name	**PRINCIPLES OF PROGRAMMING LANGUAGES**
Course Code	**A50511**
Class	III B. Tech I Semester
Branch	CSE
Year	2016 – 2017
Course Faculty	**K ABDUL BASITH Prof**

OBJECTIVES

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education. The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited.

In line with this, Faculty of Institute of Aeronautical Engineering, Hyderabad has taken a lead in incorporating philosophy of outcome based education in the process of problem solving and career development. So, all students of the institute should understand the depth and approach of course to be taught through this question bank, which will enhance learner's learning process.

S No	QUESTION	Blooms taxonomy level	Course Outcomes
	UNIT-I		
	Part - A (Short Answer Questions)		
1	**Define** programming language?	Knowledge	1
2	**Differentiate** between sentence and sentential form?	Understand	1
3	**Define** Syntax and Semantics?	Knowledge	1
4	**Differentiate** between Syntax and Semantics?	Understand	1
5	**Write** BNF notation for i) For loop ii) if-else condition	Understand	1
6	**Describe** grammars for simple assignment statements?	Understand	1
7	**Describe** unambiguous grammar for if-then-else?	Understand	1
8	**Define** Parse trees?	Knowledge	1
9	**Define** De-notational semantics?	Knowledge	1
10	**Define** Operational semantics?	Knowledge	1
11	**Define** Axiomatic semantics?	Knowledge	1
12	**Differentiate** compiler and interpreter?	Understand	11
13	**Describe** language recognizers?	Knowledge	1
14	**Describe** generators?	Knowledge	1
15	**Distinguish** simplicity and orthogonality?	Understand	1

16	**Discuss** object oriented programming?	Understand	1
17	**List** out the programming environments?	Knowledge	1
18	**Define** programming domains?	Knowledge	1
19	**List** language categories?	Knowledge	2
20	**Write** reasons for studying concepts of programming languages?	Understand	2
21	**Which** part of an inference rule is the antecedent?	Knowledge	1
22	**When** a grammar rule said to be left recursive?	Knowledge	1
23	**List** out the example of an ambiguous grammar?	knowledge	1
24	**Define** BNF notation**?**	Knowledge	2
25	**Define** syntax Graphs?	Knowledge	1
	Part - B (Long Answer Questions)		
1	**Discuss** language evaluation criteria and the characteristics that affect them?	Understand	1
2	**List** the potential benefits of studying programming language concept?	Knowledge	1
3	**Explain** syntax of a "for" statement in PASCAL using BNF Notation ar syntax graphs?	Understand	1
4	**Explain** syntax of declaration statement in PASCAL using BNF notation and syntax graphs?	Understand	2
5	**Calculate** the weakest precondition for each of the following simple assignment statements and post conditions? i. a=2*(b-1)- 1{a>0} ii. b=(c+10)/3{b>6} iii. a=a+2*b-1 {a>1} iv. X=2*y+x-1{x>11}	Apply	1
6	**Write** the syntax and semantics of each term an draw BNF notation for the following: a)For loop b)If-else condition c)Structure definition	Understand	1
7	**Define** left most derivation? Prove that the following grammar is ambiguous? <program>--><stmt_list>end <stmt_list>--><stmt> |<stmt>;<stmt_list> <stmt>--><var>=<expression> <var>--> A|B|C <expression>-><var>+<var> |<var>-<var> |<var>	Knowledge	1
8	**State** the given grammar is ambiguous? <assign> –><id>=<expr> <id>-->A|B|C <expr>-><expr>+<expr> |<expr>*<expr> |(<expr>) |<id>	Knowledge	2
9	**List** the three general methods of implementing a programming language?	Knowledge	2
10	**Explain** different aspects of the costs of a programming language?	Understand	2
11	**Discuss** about the various programming domains and their associative languages?	Understand	1
12	**Demonstrate** the readability and write ability contradict with each other? Explain with an example?	Knowledge	1
13	**Compare** Procedure oriented and object oriented programming. Explain	Understand	2

	the object oriented features supported by C++?		
14	a. **Explain** Parse trees with an example? b. **Design** parse trees for the following expressions i) A:=B+C+A ii) A:=B*(A+C)	Understand	1
15	**Define** ambiguous and unambiguous grammar and list out their differences?	Knowledge	2
16	**Define** program language features?	Knowledge	2
17	**Explain** any 4 application languages?	Understand	1
	Part – C (Problem Solving and Critical Thinking)		
1	**Illustrate** some reasons why computer scientist and professional software developers should study general concepts of language design and evaluation?	Apply	2
2	**Write** reasons for the statement: "Exception handling is veryimportant, but often neglected by programming languages"?	Understand	2
3	**Analyze** the reasons for the statement: "A programming language can be compiled or interpreted". Give relative advantages and disadvantages of compilation and interpretation. Give examples of compiled and interpreted languages?	Analyze	1
4	**Write** EBNF descriptions for the following i. A Java class definition header statement ii. A Java method call statement iii. A 'C' switch statement iv. A 'C' Union definition **v.** A 'C' float literals	Understand	1
5	**Explain** recursive Descent Processing?	Understand	3
	UNIT-II		
	Part - A (Short Answer Questions)		
1	**Define** named constants?	Knowledge	2
2	**Define** associative arrays?	Knowledge	2
3	**Explain** numeric types?	Understand	2
4	**Distinguish** named type and structure type compatibility?	Understand	2
5	**List** the merits of sub range types?	Knowledge	2
6	**Differentiate** union and enumeration?	Understand	2
7	**Define** data type?	Knowledge	2
8	**List** the merits of type checking?	Knowledge	2
9	**Define** user defined data type?	Knowledge	2
10	**Define** widening and narrowing conversions?	Knowledge	2
11	**Define** a pointer?	Knowledge	2
12	**Write** the design issues of character string type?	Understand	2
13	**Explain** about strings and their operations?	Understand	2
14	**Evaluate** strings?	Evaluate	2
15	**List** the design issues of array types?	Knowledge	2
16	**Define** rectangular and jagged arrays?	Knowledge	2
17	**Evaluate** the arrays?	Evaluate	2
18	**List** the design issues of pointers?	Knowledge	2
19	**Explain** about dangling pointers?	Understand	2
20	**Write** the common problems with pointers?	Understand	2
21	**Define t**he primitive data types supported by C language**?**	Knowledge	2
22	**Define** Heap-dynamic Array?	Knowledge	2
23	**Illustrate** Slice of an array?	Knowledge	2

24	**Define** Keyword and list out few?	Knowledge	2
25	**Define** type checking?	knowledge	2
	Part - B (Long Answer Questions)		
1	**Define** heterogeneous array? Discuss the design issues of arrays?	Knowledge	3
2	**Explain** in detail the design issues of arithmetic expressions?	Understand	3
3	**Discuss** structural and name equivalence for types? Give an example of a language used for each approach?	Understand	3
4	**Define** a variable and what the attributes of a variable are? Elaborate on address of a variable?	Knowledge	3
5	**Write** a note on Boolean and relational expressions?	Understand	3
6	**Explain** the different types of relational operators used in C, Ada and Fortran 95?	Understand	3
7	**Discuss** the advantages and disadvantages of mixed mode arithmetic expressions?	Understand	1
8	**Define** array and record? Classify arrays based on storage allocation? What are the advantages and disadvantages of allocation memory during compilation time and run time?	Knowledge	1
9	**Define** static, fixed stack dynamic, stack dynamic, fixed heap dynamic and dynamic arrays? What are the advantages of each?	Knowledge	2
10	**List** and explain the design issues of pointers?	Knowledge	1
11	**Define** data type. Why every programming language supports different data types?	Knowledge	2
12	**Explain** in details various design issues of character string types?	Understand	1
13	**Define** slice of an array? Explain with the help of an example?	Knowledge	3
14	**Discuss** precedence and associatively rules of different programming languages?	Understand	1
15	**Discuss** various control statements in programming languages?	Understand	1
	Part – C (Problem Solving and Critical Thinking)		
1	**List** what advantages does java's break statement have over C's and C++'s break statement?	Knowledge	2
2	**State** whether static binding is more reliable or dynamic binding. Explain why?	Knowledge	2
3	**Differentiate** union and array types?	Understand	2
4	**Explain** the concept of binding in detail?	Understand	2
5	**Explain** in detail primitive data types**?**	Understand	2
6	**Explain** in detail Record, types, references to record fields, operations on records?	Understand	1
	UNIT-III		
	Part - A (Short Answer Questions)		
1	**Define** scope and lifetime of a variable?	Knowledge	2
2	**Differentiate** shallow and deep binding?	Understand	2
3	**Define** subprogram?	Knowledge	2
4	**Define** procedures?	Knowledge	2
5	**Define** local referencing environment?	Knowledge	2
6	**Differentiate** static and dynamic binding?	Understand	2
7	**Define** static scope?	Knowledge	2
8	**Define** dynamic scope?	Knowledge	2
9	**Evaluate** static scoping?	Evaluate	2
10	**Evaluate** dynamic scoping?	Evaluate	2
11	**List** the subprogram characteristics?	Knowledge	2
12	**Distinguish** different types of parameters?	Understand	2
13	**Differentiate** procedures and functions?	Understand	2

14	**Define** pass by value?	Knowledge	2
15	**Discuss** overloaded subprograms?	Understand	2
16	**Define** pass by result**?**	Knowledge	2
17	**Differentiate** ad hoc and parametric polymorphism?	Understand	2
18	**Define** pass by reference?	Knowledge	2
19	**List** the design issues of functions?	Knowledge	2
20	**Define** quasi concurrency?	Knowledge	2
21	**Define** functions?	Knowledge	2
22	**List** out the Local variable types?	Knowledge	2
23	**Differentiate** static variable and static dynamic local variable?	Understand	2
24	**Define** type checking?	Knowledge	2
25	**Define** overloaded operator?	Knowledge	1
	Part - B (Long Answer Questions)		
1	**Define** subprograms? What are the advantages of subprograms? Explain different methods of parameter passing mechanisms to subprograms?	Knowledge	2
2	**Explain** the design issues of subprograms?	Understand	2
3	**Discuss** about procedures and functions in subprograms?	Understand	2
4	**Define** shallow and deep binding for referencing environment of sub programs that have been passed as parameters?	Knowledge	2
5	**Discuss** with suitable examples static and dynamic scope?	Knowledge	2
6	**Discuss** generic subprograms in C++?	Understand	2
7	**Explain** about Co routines?	Understand	2
8	**Discuss** generic subprograms in java?	Understand	2
9	**Discuss** the importance of Co-routines of Lua language?	Understand	1
10	**Discuss** the importance of generic subprograms?	Understand	1
11	**Explain** general problem with static scoping?	Understand	1
12	**Define** block? How scope of a variable is dependent on block?	Knowledge	1
13	**Explain** how c language deals with scope of the variables?	Understand	1
14	**Demonstrate** advantages and disadvantage of dynamic local variables?	Understand	1
15	**Explain** how multi-dimensional arrays are passed as parameters?	Knowledge	1
	Part – C (Problem Solving and Critical Thinking)		
1	**Compare** the parameter passing mechanisms of ALGOL and ADA?	Apply	2
2	**State** the importance of Local Referencing Environments with suitable examples?	Knowledge	2
3	**Discuss** about different parameter passing methods of Ada language?	Understand	2
4	**Demonstrate** implementation of parameter passing methods in detail?	Knowledge	2
5	**Explain** side effect related to evaluation of expression and conditional expression of c language?	Apply	2
	UNIT-IV		
	Part - A (Short Answer Questions)		
1	**Define** an exception?	Knowledge	2
2	**Define** a thread?	Knowledge	2
3	**Define** concurrency?	Knowledge	2
4	**Define** binary semaphore?	Knowledge	2
5	**Define** monitors?	Knowledge	2
6	**Define** mutual exclusion?	Knowledge	3
7	**Define** deadlock?	Knowledge	3
8	**Define** an abstract data type?	Knowledge	2
9	**Define** logic programming language?	Knowledge	2
10	**Define** data abstraction?	Knowledge	2

11	**Write** about message passing?	Understand	2
12	**List** the design issues for abstract data types?	Knowledge	2
13	**Write** about object oriented programming in small talk?	Understand	2
14	**Evaluate** java threads?	Evaluate	2
15	**List** the design issues for object oriented languages?	Knowledge	2
16	**Define** rule and goal statements of prolog?	Knowledge	2
17	**Evaluate** C# threads?	Evaluate	2
18	**Compare** exception handling in java with C++?	Understand	2
19	**Write** the applications of logic programming?	Understand	2
20	**Define** terms and fact statements of prolog?	Knowledge	2
21	**Differentiate** java packages and c++ namespaces?	Understand	2
22	**List** out the features of abstract Data types?	Knowledge	2
23	**Define** polymorphism?	Knowledge	2
24	**Define** passing parameters?	Knowledge	2
25	**Define** semaphore?	Knowledge	3
Part - B (Long Answer Questions)			
1	**Describe** how exception is handled in ADA with an example?	Knowledge	2
2	**Describe** briefly about Semaphores?	Knowledge	3
3	**Describe** briefly about Monitors?	Knowledge	3
4	**Discuss** Object Oriented Programming in SMALLTALK?	Understand	3
5	**Write** about goal statements and simple arithmetic in PROLOG?	Understand	3
6	**Define** binary semaphore. What is counting semaphore? What are the primary problems with using semaphores to provide synchronization?	Knowledge	3
7	**Explain** the following terms: i. process synchronization ii. race condition iii. binary semaphores iv. MIMD	Understand	3
8	**Explain** different types of propositions present in logic programming?	Understand	3
9	**Describe** the cooperation synchronization and competition synchronization in message passing?	Knowledge,	1
10	**Discuss** how dining philosopher's problem and producer consumer problem are solved using concurrency in Ada?	Understand	3
11	**Discuss** analysis of the similarities and differences between java packages and c++ namespaces?	Understand	2
12	**Explain** the object-oriented programming support in java?	Understand	2
13	**Discuss** what way c++ 'throw 'specification differs from throw clause in java?	Understand	1
14	**Demonstrate** between checked and unchecked exceptions in java?	Knowledge	3
15	**Explain** about the applications of logic programming?	Understand	3
Part – C (Problem Solving and Critical Thinking)			
1	**Discuss** the reasons for using exception handlers in a programming language. What if there exist programming languages with no exception handlers?	Understand	2
2	**Write** the sample code to factorial of a number in PROLOG language?	Understand	2
3	**Analyze** the importance of logic programming languages over functional programming languages?	Analyze	2
4	**Discuss** how parameter passing techniques are implemented and explain type checking techniques?	Understand	2
5	**Explain** binary semaphore? Define cooperation synchronization and competition synchronization in semaphore?	Understand	2

UNIT-V			
Part - A (Short Answer Questions)			
1	**Explain** lazy evaluation?	Understand	1
2	**Define** procedural abstraction?	Knowledge	1
3	**List** few characteristics of Python language?	Knowledge	1
4	**Define** functional language?	Knowledge	1
5	**Define** imperative language?	Knowledge	1
6	**Explain** scripting language?	Understand	1
7	**List** few examples of scripting languages?	Knowledge	1
8	**List** keywords of Python language?	Knowledge	1
9	**List** data types of Python language?	Knowledge	2
10	**Define** the term separate compilation in Python?	Knowledge	2
11	**Define** referential transparency**?**	Knowledge	2
12	**List** the draw backs of using an imperative language to do functional programming	Knowledge	2
13	**Write** about first list interpreter?	Understand	2
14	**Write** the general form of function declaration in ML?	Understand	2
15	**Define** list comprehensions in Haskell?	Knowledge	1
16	**Write** about python variables?	Understand	1
17	**Define** data abstraction?	Knowledge	1
18	**Explain** about storage and control of python?	Understand	2
19	**Define scope** in python?	Knowledge	2
20	**Write** the syntax of selection control flow construct in ML?	Understand	1
21	**Define** functional programming?	Knowledge	3
22	**Compare** imperative languages and functional languages?	Understand	3
23	**Define** control?	Knowledge	3
24	**Define** separate compilation?	Knowledge	3
25	**Define** module library?	Knowledge	3
Part - B (Long Answer Questions)			
1	**Write** about control constraints in Python?	Understand	2
2	**Write** about data abstraction in Python?	Understand	3
3	**Write** about data types and structures of LISP and LISP interpreter?	Understand	3
4	**List** the ways in which ML is significantly different from scheme?	Knowledge	3
5	**Describe** the scoping rule in common LISP, ML and HASKELL?	Knowledge	3
6	**Explain** the characteristics of scripting languages?	Understand	3
7	**Discuss** in detail about the python primitive types?	Understand	3
8	**Explain** about LISP functional programming language?	Understand	3
9	**Discuss** and trace the Python code to find the factorial of a number?	Understand	3
10	**Discuss** and trace the Python code to print the Fibonacci series between the given ranges of numbers?	Understand	3
11	**Explain** about simple functions in mathematical functions?	Understand	3
12	**Draw** the internal representation for the following LISP statements. i. (A B C D) ii. (A(B C)D(E(F G)))	Knowledge	3
13	**Explain** structures and arrays in ML .give examples?	Understand	3
14	**Define** scripting languages list out the characteristics of scripting languages?	Understand	3
15	**Discuss** about procedural and data abstraction? Give an example?	Understand	3
Part – C (Problem Solving and Critical Thinking)			

1	**Write** features of Haskell that makes very different from schema?	Understand	2
2	**List** the ways in which ML is significantly different from schema?	Knowledge	3
3	**Compare** the advantages of Python scripting language over other scripting languages?	Apply	3
4	**Illustrate** Python code with example to find the roots of quadratic equation?	Apply	3
5	**Explain** a prolog description of your family tree (based only on facts),going back to your grandparents and including all descendants . be sure to include all relationship?	Apply	3

Prepared by:

HOD, COMPUTER SCIENCE AND ENGINEERING