

Illustrated Handbook of

Medical Biochemistry:

Theory, Practical & Viva – Voce

First Edition

Authors

Prof. (Dr.) Abhra Ghosh

Dr. Mrityunjoy Halder

Dr. Javed Ahmed Ansari

Dr. Dhiraj Kumar

Dr. Md. Khalid Ansari



Title of the Book: Illustrated Handbook of Medical Biochemistry: Theory, Practical & Viva – Voce

First Edition – 2026

Copyright 2026 ©Authors

Prof. (Dr.) Abhra Ghosh, Professor, Department of Biochemistry, Mata Gujri Memorial Medical College & LSK Hospital, Kishanganj, Bihar.

Dr. Mrityunjoy Halder, Associate Professor, Department of Biochemistry, AIIMS Patna, Bihar

Dr. Javed Ahmed Ansari, PGY-3, Department of Biochemistry, Mata Gujri Memorial Medical College & LSK Hospital, Kishanganj, Bihar.

Dr. Dhiraj Kumar, PGY-3, Department of Biochemistry, Mata Gujri Memorial Medical College & LSK Hospital, Kishanganj, Bihar.

Dr. Md. Khalid Ansari, Assistant Professor, Department of Biochemistry, Madhubani Medical College, Bihar.

No part of this book may be reproduced or transmitted in any form by any means, electronic or mechanical, including photocopy, recording, or any information storage and retrieval system, without permission in writing from the copyright owners.

Disclaimer

The authors are solely responsible for the contents published in this book. The publishers don't take any responsibility for the same in any manner. Errors, if any, are purely unintentional, and readers are requested to communicate such errors to the author or publishers to avoid discrepancies in the future.

E-ISBN: 978-81-69931-63-2

MRP Rs. 180/-

Publisher, Printer & Distributor:

Selfypage Developers Pvt Ltd.,
Pushpagiri Complex,
Beside SBI Housing Board,
K.M. Road Chikkamagaluru, Karnataka.
Tel.: +91-8861518868
E-mail: info@iipbooks.com

IMPRINT: IIP Iterative International Publishers

For Sales Enquiries:

Contact: +91- 8861511583
E-mail: sales@iipbooks.com

PREFACE

Biochemistry is not merely a subject to be studied — it is the language in which life speaks. Every enzymatic cascade, every metabolic pathway, every molecule whose behavior we analyze in the laboratory is, at its heart, a page from the story of human health and disease. It is with this conviction that we place this laboratory manual in the hands of first-year MBBS students, who stand at the threshold of one of the most rewarding professions the world has to offer.

The idea for this manual was born from years of teaching at the bedside of the laboratory bench — from the questions asked by curious students, from the gaps we noticed between theoretical knowledge and practical understanding, and from the deep belief that a medical student who truly understands what happens inside a test tube will one day be a physician who truly understands what happens inside a patient. The laboratory is not a room one visits to complete a requirement; it is a training ground for the scientific temperament that every good clinician must possess.

“The laboratory teaches the student not merely to measure — but to observe, to question, to reason, and to doubt wisely. These are the very qualities that separate a competent practitioner from a truly excellent one.”

This manual has been carefully structured to accompany the first year MBBS curriculum in biochemistry as prescribed by the National Medical Commission. It covers the full breadth of practical biochemistry — from the qualitative color reactions of carbohydrates and proteins, to the quantitative estimation of clinically vital analytes such as blood glucose, serum urea, creatinine, cholesterol, bilirubin, and the liver enzymes. The sections on urinalysis, arterial blood gas interpretation, quality control, chromatography, electrophoresis, and DNA isolation have been written with the same care, ensuring that no corner of the syllabus is left unaddressed.

What distinguishes this edition from others of its kind is our commitment to visual learning. Each experiment and concept is accompanied by pictorial illustrations — flowcharts, procedural diagrams, interpretive decision trees, and clinical correlation figures — designed to make abstract biochemical processes tangible and memorable. We know from experience that a well-drawn diagram often accomplishes in seconds what paragraphs of text cannot. Our hope is that students will return to these illustrations long after the examination is over, finding in them a reliable companion during clinical postings and beyond.

KEY FEATURES OF THIS MANUAL

- **Illustrated procedures**

Step-by-step diagrams for every practical experiment

- **Clinical correlations**

Connecting lab findings to bedside medicine

- **Q&A sections**

Examination-focused questions with detailed model answers

- **Decision flowcharts**

Visual guides for qualitative analysis and interpretation

- **Normal reference ranges**

Clinically relevant values highlighted throughout

- **Principle-first approach**

Every method explained from foundational biochemical principles

Each chapter opens with the aim and principle of the experiment, followed by the procedure in a clear tabular format, sample calculations, clinical significance, and a question-and-answer section that mirrors the pattern of university examinations. We have been especially careful to highlight the clinical relevance of every estimation — because a student who understands why a test matters will always perform it with greater care and interpret it with greater wisdom than one who merely knows how.

No textbook is perfect at its first printing, and we are acutely aware of the limitations of any first edition. We invite readers — students, teachers, and practitioners alike — to share their observations, corrections, and suggestions. Every such contribution will be carefully considered in future editions, for a textbook, like medicine itself, must always be open to revision in the light of new evidence.

To the student opening this manual for the first time: the laboratory may seem, at first, a place of unfamiliar smells and daunting glassware. Do not be discouraged. Every pipette you learn to hold steadily, every absorbance you learn to read correctly, every result you learn to interpret meaningfully — each of these small victories is a step toward becoming the physician your future patients will need. Work with curiosity, with honesty, and with care. The molecules do not lie; they will reward your attention.

We dedicate this first edition to every student who has ever looked down a test tube and wondered what it all means for the patient waiting outside.

Kishanganj, Bihar | 2026

Contributions:

Infographics and Chapter 1 to 23: Dr. Abhra Ghosh & Dr. Mrityunjoy Halder.

Chapter 24 to 28: Dr. Javed Ahmed Ansari, Dr. Dhiraj Kumar and Dr Md. Khalid Ansari

ACKNOWLEDGEMENTS

Joint Acknowledgement

We begin by expressing our deepest gratitude to **Dr. Veena Singh Ghalaut**, Former Head of the Department of Biochemistry, Pt. B.D. Sharma PGIMS, Rohtak — the teacher we share, and the one who first taught us to see Biochemistry not as an examination subject but as a living, clinical science. Her passion for the discipline shaped both of our careers in ways we are still discovering, and this manual is, in no small part, a reflection of the love for the subject she instilled in us.

We are grateful to the **1st Professional MBBS students** of our respective institutions — past and present — whose curiosity, earnest questions, and early mornings in the laboratory inspired us to write a guide that speaks to them directly. This book is for the student who walks into the biochemistry laboratory for the first time, uncertain and perhaps a little overwhelmed, and finds in these pages a steady and reassuring companion.

From Prof. (Dr.) Abhra Ghosh

I owe more than I can express to **Dr. Pitbaran Chakraborty**, Former Principal, NRS Medical College & Hospital, Kolkata — my mentor and constant guide through every phase of my life as a doctor and teacher. His wisdom has accompanied me at every crossroad, and his belief in me has been a quiet, sustaining force.

To **Dr. Navjot Kaur Bajwa**, Former Head of Department, Biochemistry, Dayanand Medical College, Ludhiana — my first workplace and my first true home in this profession. She welcomed me with extraordinary warmth, nurtured my growth as both a consultant and a faculty member, and gave me the kind of unconditional love and guidance one is fortunate to find even once in a lifetime. I carry her lessons with me every single day.

To **Dr. Tapan Mukhopadhyay**, my present Head of Department, Biochemistry, MGM Medical College, Kishanganj — for his unwavering support, his faith in my work, and the collegial atmosphere that makes meaningful academic endeavor possible.

To **Dr. Vikram Kumar Gupta**, Professor, Community Medicine, DMCH, Ludhiana — who planted the seed from which this book has grown. It was his encouragement and gentle conviction that made me believe a practical manual was not just possible but necessary. That conversation changed the course of things.

To **Dr. Priyanka Dutta** — who has been, in every true sense, the elder sister I could always turn to. Her guidance has never wavered, and her presence has always been a source of strength.

To **Dr. Ekta Bansal** and **Dr. Nandita**, my former seniors at DMCH, and to **Dr. Rina Kumari**, **Dr. S.S. Bharti**, **Dr. Abrita**, and **Dr. Soutrik**, my present colleagues — thank you for your warmth, your collaboration, and the daily encouragement that quietly kept this project moving forward.

To **Kajal Dutta** and **Amit Kumar Bhatt**, my laboratory colleagues — whose hands-on knowledge, practical wisdom, and quiet dedication remind me every day of the true backbone of any laboratory. This book would not have taken its present form without their inspiration and generous help in compilation.

And finally — to my family, whose love is the very foundation beneath everything I do. I begin with the memory of my father, **Late Sri Amar Kumar Ghosh** — whose quiet sacrifices,

steadfast values, and unwavering belief in education made the person I am today. He is no longer with us, but his presence is felt in every page of this work. To my mother, **Smt. Bharati Ghosh** — who has carried on with extraordinary grace, believed in me unconditionally, and whose blessings have seen me through every difficulty this life has placed before me. Words are far too small a tribute for all that she has given. To my father-in-law, **Sri Chanchal Paul**, whose warmth, generosity, and quiet encouragement have meant more to me than I have ever adequately expressed — I am deeply grateful. To my wife, **Madhura Ghosh Paul** — my partner, my anchor, and my greatest source of strength and calm. She has stood steadfastly beside me through late nights and uncertain mornings, offering not just support but a love that makes every endeavor feel meaningful and every effort feel worthwhile. This book belongs as much to this family as it does to me.

From Dr. Mrityunjoy Halder

It is with profound reverence that I begin by honoring the memory of **Late Prof. Subir Kumar Das** — the guiding light of my earliest professional years, whose example of intellectual integrity and clinical wisdom I have carried with me ever since.

To **Prof. Dr. Samar Deb**, first Principal of the College of Medicine & JNM Hospital, Kalyani, and a distinguished professor of anatomy — my teacher since undergraduate days, my mentor in the truest sense. His vision and warmth shaped not just my academic foundation but the kind of teacher I have aspired to become.

To **Prof. Dr. Kalyan Goswami**, Professor and Head, AIIMS Kalyani — for his guidance, scholarly rigor, and the confidence he has placed in my work.

To my present colleagues — **Prof. Dr. Sadhana Sharma**, Professor and Head of Biochemistry, **Prof. Dr. Ayan Banerjee**, **Prof. Dr. Mala Mahto**, **Dr. Sushil Kumar**, **Dr. Bandana Kumari**, and **Dr. Anurag Kumar** — for creating a department that feels like a second home, and for the daily collegiality that makes demanding work feel worthwhile.

To the colleagues of my previous workplace COMJNMH — the **late Prof. Dr. Hasi Dasgupta**, **Prof. Dr. Keshab Mukhopadhyay**, **Prof. Dr. Utpal Kumar Biswas**, **Prof. Dr. Arun Kumar**, **Prof. Dr. Amitabha Das**, **Prof. Dr. Chanchal Kumar Dalai**, **Prof. Dr. Soubhagya Ranjan Nayak**, **Prof. Dr. Shouvanik Adhya**, **Prof. Dr. Banashree Bhadra**, **Prof. Dr. Dhrubajyoti Sarkar**, **Dr. Deblina Sarkar**, **Dr. Tanmay Saha**, **Dr. Probir Roy**, **Dr. Bhaskar Saha**, **Dr. Sk Sabir Ali**, and **Dr. Abu Raihan Jakir** — each of you left an impression on my career that I carry forward with gratitude.

A special word for **Dr. Gaurav**, my first postgraduate student at AIIMS Patna — who reminded me early on that teaching is itself a form of learning. And to **Suman Sashmal**, my favorite paramedical student, whose enthusiasm for the subject was a quiet source of joy. To all my present and past Junior and Senior Residents, and to every MBBS, DMLT, B.Sc MLT, and B.Sc Nursing student who has passed through my classroom and laboratory — you are the reason this manual exists.

To my family — the bedrock beneath everything. To my father, **Muktipada Halder**, who gave me the values I live by. To my mother, the **late Tapati Halder**, whose memory is a constant blessing, and to **Jharna Halder**, whose warmth has filled that place with grace. To my sister, **Lopamudra Halder**, for her steadfast love and support. To my father-in-law, the **late Bivash Ch. Mandal**, whom I remember with deep respect, and to my mother-in-law, **Nayantara Mandal**, for her affection and encouragement. To my wife, **Dr Mita Mandal Halder** — my partner in every sense — whose patience, strength, and quiet devotion have made all of this possible. And to my daughter **Mandrita** and my son **Mohit** — my greatest joy, my truest motivation, and the two people for whom I hope this work will one day mean something.

Foreword

I have no hesitation in appreciating the work of Dr. Abhra Ghosh and his co-authors for their hard work and innovative approach to preparing a book on practical laboratory techniques for undergraduate students of the MBBS course.

I am awfully struck by their approach to frame every area relating to the technical aspects as well as the related clinical significances of the NMC practical curriculum for the subject, covering all competencies. The illustrations are helpful to the approach to each topic, with detailed projections on the background text, which will prove to be an all-in-one handbook for the students. I hope it will be accepted well by the students. My sincere congratulations to Dr. Ghosh and his co-authors for their great work.



Prof. (Dr.) Tapan Mukhopadhyay

Professor & Head

Department of Biochemistry

Mata Gujri Memorial Medical College & Lions Seva Kendra Hospital, Kishanganj

Foreword

It gives me great pleasure to write this foreword for "Illustrated Handbook of Medical Biochemistry: Theory, Practical & Viva-Voce," prepared by Dr. Mrityunjay Halder and his co-authors, with sincerity, academic commitment, and a clear understanding of the needs of first-year MBBS students. Biochemistry often appears abstract to young learners until it is connected with laboratory practice and clinical interpretation. This book makes that connection effectively.

The authors have taken care to present practical biochemistry not merely as a set of experiments but as a disciplined approach to observation, analysis, reasoning, and correlation with disease. The strength of this manual lies in its student-friendly structure. The inclusion of principles, procedures, clinical significance, viva-oriented questions, reference ranges, flowcharts, and illustrations will help students understand the subject more clearly.

All topics have been presented in a manner that is relevant to both examinations and future clinical practice. I appreciate the effort of these dedicated faculty members in developing a useful academic resource for undergraduate medical education. I am confident that this manual will serve as a valuable companion for students and teachers alike.



Prof. Sadhana Sharma

Head, Department of Biochemistry

All India Institute of Medical Sciences, Patna

Foreword

This manual provides dedicated sections on precautions and safety measures within each experiment, and students are encouraged to review them carefully before commencing any practical work. This manual incorporates a large number of illustrations, diagrams, flowcharts, tables, and labeled figures to simplify complex concepts and improve conceptual understanding.

The manual serves several important purposes:

1. To demonstrate laboratory techniques step-by-step
2. To help students interpret experimental observations and calculations
3. To make learning interactive, memorable, and student-friendly
4. Special attention has been given to presenting experiments in a systematic and easy-to-follow format.

Each exercise typically includes:

- Aim of the experiment
- Principle involved
- Requirements and reagents
- Stepwise procedure
- Illustrated observations
- Result interpretation
- Precautions and safety measures
- Review questions and applications

The experiments outlined in this manual are carefully crafted in accordance with the undergraduate CBME curriculum outlined by NMC guidelines, ensuring relevance and rigor. Proper handling of chemicals, glassware, instruments, and biological samples is crucial for maintaining a safe and efficient laboratory environment. This manual provides dedicated sections on precautions and safety measures within each experiment, and students are encouraged to review these carefully before commencing any practical work.

I sincerely hope that this manual will serve as a valuable companion for undergraduate students, teachers, and laboratory instructors alike.



Prof. (Dr.) Navjot Kaur Bajwa

Professor & Head

Department of Biochemistry

ESIC Medical College & Hospital, Ludhiana

Foreword

It gives me great pleasure to present "Illustrated Handbook of Medical Biochemistry: Theory, Practical & Viva-Voce," authored by Dr. Mrityunjoy Halder, Associate Professor, Department of Biochemistry, AIIMS Patna, and his co-authors.

Biochemistry forms the foundation of modern medical science, helping students understand the molecular basis of health and disease. However, many students find the subject challenging during their early years of medical education. This handbook has been thoughtfully prepared with dedication, academic sincerity, and a clear understanding of the learning needs of first-year MBBS students.

One of the strengths of this book is its ability to connect theoretical concepts with practical laboratory exercises, clinical interpretation, and patient care. By linking basic biochemical principles to real-life medical practice, the authors have made the subject more meaningful, relevant, and easier to understand.

I warmly appreciate the endeavor of Dr. Halder and his co-authors in developing this valuable resource. I am confident that this handbook will serve as a useful guide and trusted companion for undergraduate medical students while also supporting teachers in their academic and practical teaching activities.

I congratulate the authors on this commendable contribution to medical education and wish this publication every success.



Prof. (Brig.) Dr. Raju Agarwal

Executive Director

All India Institute of Medical Sciences, Patna

Foreword

It is a matter of great pleasure and satisfaction to know that Dr. Abhra Ghosh and his co-authors are going to publish "Illustrated Handbook of Medical Biochemistry: Theory, Practical & Viva-Voce." I feel honored, as Dr. Ghosh happened to be my undergraduate student in Medical College, Kolkata. Because of his high level of intelligence, integrity, and regularity, he positioned himself at a different knowledge-seeking and politeness level among the other students.

I have gone through the book, and I must admire the way it is presented with plenty of well-thought-out pictures, diagrams, charts, and tables. These will be of immense help to the young student — and not uncommonly the unsure student — to taste the beauty of the subject, and everybody knows that once interest is instilled, they will proceed to learn the subject by their own conviction and enjoyment.

I warmly wish a very successful journey with this book. Many students from our country will accept it cordially and carry the high-level but simplified biochemistry knowledge throughout their practical professional life to serve mankind.



Prof. (Dr.) Pitbaran Chakraborty

Principal

Jagannath Gupta Institute of Medical Sciences & Hospital, Budge Budge

Foreword

Biochemistry is an ever-progressing area. Every day something new is coming.

Keeping this view in mind, this book, "Illustrated Handbook of Medical Biochemistry: Theory, Practical & Viva-Voce," authored by Dr. Mrityunjoy Halder and his co-authors, has been written. All the concepts are written in an up-to-date manner.

Readers will find this book an important armamentarium in their biochemistry study material. The more you read this book, the more interesting you will find it. The lucid manner of explanation with visual learning by pictorial illustrations, along with highlighting the clinical relevance of every estimation, has made even the difficult concepts easy to understand. This awesome book is going to bring a new horizon in the biochemistry field.



Prof. (Dr.) Manidip Pal

Principal

College of Medicine & JNM Hospital, Kalyani

Foreword

It is a matter of great pleasure for me to write a foreword for this practical manual of Biochemistry, "Illustrated Handbook of Medical Biochemistry: Theory, Practical & Viva-Voce," prepared by Dr. Mrityunjoy Halder and his co-authors, with dedication, academic sincerity, and thoughtful understanding of the learning needs of first-year MBBS students.

Biochemistry, for many young medical students, may initially appear to be a theoretical and abstract subject. Its true relevance becomes evident when biochemical principles are linked with laboratory procedures, interpretation of results, and their application in clinical medicine. This manual succeeds in establishing that important connection in a clear and meaningful manner.

The authors have made a commendable effort to present practical biochemistry not merely as a collection of experiments, but as a systematic method of scientific observation, analytical thinking, interpretation, and clinical correlation. Such an approach will help students appreciate the importance of laboratory medicine in patient care and understand the subject beyond examination requirements.

A notable strength of this manual is its student-friendly organization. The inclusion of underlying principles, stepwise procedures, clinical significance, reference ranges, viva-voce questions, flowcharts, and relevant illustrations makes the content comprehensive, practical, and easy to understand. The topics have been arranged in a manner that will be useful both for undergraduate examinations and for developing a sound foundation for future clinical practice.

I sincerely appreciate the initiative and hard work of the authors in developing this valuable academic resource for undergraduate medical education. I am confident that this manual will prove to be a useful companion for students and teachers alike and will contribute meaningfully to the teaching and learning of practical biochemistry.



Prof. (Dr.) Punam Prasad Bhadani

Dean Academics

All India Institute of Medical Sciences, Patna

BIOCHEMISTRY COMPETENCIES: BC14 2024 COMPETENCIES

★ Procedures requiring certification

Competency No.	Competency / Topic Description
BC14.1	Describe commonly used laboratory apparatus, good laboratory practice, biomedical hazards and waste management.
BC14.2	Describe estimation of pH by pH meter or ABG analyser and interpret results with paper case scenarios.
BC14.3 ★	Describe the physical properties, chemical constituents of normal urine and abnormal constituents of urine and perform urine analysis to determine normal and abnormal constituents (including dipstick method demonstration).
BC14.4 ★	Identify abnormal constituents in urine, interpret the findings and correlate these with pathological states and prepare a urine report.
BC14.5	Describe screening of urine for inborn errors and describe the use of paper chromatography.
BC14.6	Describe the principles of colorimetry and spectrophotometry.
BC14.7 ★	Perform estimation of glucose by manual/semi-automated method and demonstrate glucometer usage with interpretation of results in clinical scenarios.
BC14.8 ★	Perform estimation of urea and calculate BUN and interpret the results in clinical scenarios.
BC14.9 ★	Perform estimation of serum creatinine and calculate creatinine clearance.
BC14.10 ★	Perform estimation of uric acid in serum and interpret results in clinical scenarios.
BC14.11 ★	Perform estimation of serum proteins, albumin and calculate A:G ratio.
BC14.12 ★	Perform estimation of serum total cholesterol.
BC14.13 ★	Perform estimation of serum bilirubin by manual/semi-automated method.
BC14.14	Describe estimation of calcium and phosphorus and interpret the results.
BC14.15	Describe estimation of triglycerides, HDL and calculation of LDL and interpretation of results in clinical scenarios.
BC14.16	Describe estimation of SGOT (AST), SGPT (ALT) and alkaline phosphatase and interpretation of results in clinical scenarios.
BC14.17	Describe briefly various body fluids and discuss the composition of CSF.
BC14.18	Observe the use of commonly used instruments/techniques in the biochemistry laboratory including pH meter, paper chromatography, protein electrophoresis, TLC, PAGE, electrolyte analysis by ISE, ABG analyser, ELISA, immunodiffusion, autoanalyser and DNA isolation from liquid/tissue.
BC14.19	Explain the basis and rationale of biochemical tests and interpretation of laboratory results in diabetes mellitus, obesity, dyslipidaemia, fatty liver,

Competency No.	Competency / Topic Description
	myocardial infarction, renal failure, gout, proteinuria, nephrotic syndrome, jaundice, liver diseases, pancreatitis, acid–base disorders, thyroid disorders, genetic disorders, nutritional disorders, vitamin deficiency disorders, disorders of mineral metabolism and electrolyte disorders.
BC14.20 ★	Describe and identify pre-analytical (especially blood collection, tourniquet technique), analytical and post-analytical errors.
BC14.21 ★	Describe quality control and identify basic Levey–Jennings charts in the clinical biochemistry laboratory.
BC14.22	Describe the performance of OGTT, Glucose Challenge Test and HbA1c and interpret the results with clinical scenarios.
BC14.23	Calculate energy content of different food items, identify food items with high and low glycaemic index and explain the importance of glycaemic index in diet.
BC14.24	Observe, interpret and discuss the baseline, diagnostic, prognostic and discharge investigations of clinical biochemistry.

Total competencies under this topic: 24 | Procedures requiring certification (★): 11
 (BC14.3, BC14.4, BC14.7, BC14.8, BC14.9, BC14.10, BC14.11, BC14.12, BC14.13, BC14.20, BC14.21)

Number required to certify = 1 for each, except BC14.3 (Number required to certify = 2).

Source: Competency-Based Undergraduate Curriculum for the Indian Medical Graduate, NMC, Vol. I (2024) — Biochemistry (BC14).

CONTENTS PAGE WITH CORRESPONDING PAGE NUMBER

SECTION 1 : INFOGRAPHICS

III. No.	Illustration Title
1	DEVELOPMENT OF CLINICAL BIOCHEMISTRY LABORATORY
2	TYPES OF WEIGHING BALANCE
3	EQUIPMENT OVERVIEW: HOT AIR OVEN, WATER BATH, CENTRIFUGE
4	SIMPLE MANUAL PIPETTE AND AUTOMATIC PIPETTE
5	COLORIMETER AND SEMI AUTOMATIC ANALYZER
6	FULLY AUTOMATED ANALYZER
7	DIFFERENT VACUTAINERS AND ANTICOAGULANT
8	CARDINAL RULES TO BE FOLLOWED IN LABORATORY
9	LABORATORY HAZARDS
10	DISPOSAL OF LABORATORY WASTE
11	FIRST AID IN LABORATORY
12	URINE ANALYSIS – OVERVIEW AND PHYSICAL PROPERTIES
13	ORGANIC AND INORGANIC COMPONENTS OF NORMAL URINE
14	TRANSMITTANCE AND ABSORBANCE †
15	SIMPLE RAY DIAGRAM OF COLORIMETER
16	ILLUSTRATIVE DIAGRAM OF DIGITAL COLORIMETER
17	COMPARISON BETWEEN ENDPOINT AND KINETIC ASSAY
18	CAUSES OF HYPERGLYCEMIA AND HYPOGLYCEMIA
19	MECHANISM OF INSULIN SECRETION
20	DIAGNOSIS OF DIABETES MELLITUS AS PER ADA CRITERIA
21	DIAGNOSIS OF GESTATIONAL DIABETES MELLITUS
22	CAUSES OF VARIATION OF UREA LEVEL IN BLOOD
23	CREATININE BIOSYNTHESIS AND TISSUE DISTRIBUTION
24	CREATINE SHUTTLE
25	CAUSES OF VARIATION OF CREATININE LEVEL IN BLOOD
26	CREATININE CLEARANCE
27	COMPARISON BETWEEN CLINICAL UTILITY OF UREA AND CREATININE
28	METABOLISM OF CHOLESTEROL
29	COMPARISON BETWEEN HYPERCHOLESTEROLEMIA AND HYPOCHOLESTEROLEMIA

III. No.	Illustration Title
30	TRIGLYCERIDES
31	TRIGLYCERIDES – FUNCTIONS AND CLINICAL UTILITY
32	HDL-C – FUNCTIONS AND CLINICAL UTILITY
33	CALCIUM – FUNCTIONS AND CLINICAL UTILITY
34	CALCIUM HOMEOSTASIS
35	PHOSPHORUS – FUNCTIONS AND CLINICAL UTILITY
36	PHOSPHORUS HOMEOSTASIS
37	SERUM PROTEINS – FUNCTIONS AND CLINICAL UTILITY
38	BIURET TEST FOR TOTAL PROTEIN ESTIMATION
39	SERUM PROTEINS – CLINICAL UTILITY (CONT.)
40	BROMOCRESOL GREEN TEST FOR ALBUMIN ESTIMATION
41	ALBUMIN GLOBULIN (A:G) RATIO AND ITS CLINICAL UTILITY
42	BILIRUBIN METABOLISM
43	DIFFERENCE BETWEEN DIFFERENT TYPES OF JAUNDICE (1)
44	DIFFERENCE BETWEEN DIFFERENT TYPES OF JAUNDICE (2)
45	AST / SGOT – REACTIONS AND CLINICAL UTILITY
46	ALT / SGPT – REACTIONS AND CLINICAL UTILITY
47	COMPARISON BETWEEN ALT AND AST
48	ALKALINE PHOSPHATASE – REACTIONS AND CLINICAL UTILITY
49	INFOGRAPHICS ON ROLE OF ALP ON BONE DYNAMICS
50	DIFFERENCE BETWEEN ASCENDING AND DESCENDING CHROMATOGRAPHY
51	THIN LAYER CHROMATOGRAPHY
52	COLUMN CHROMATOGRAPHY
53	ION EXCHANGE CHROMATOGRAPHY
54	SIZE EXCLUSION CHROMATOGRAPHY
55	HIGH PERFORMANCE LIQUID CHROMATOGRAPHY
56	RADIAL CHROMATOGRAPHY
57	ELECTROPHORESIS
58	SODIUM DODECYL SULFATE (SDS)
59	SODIUM DODECYL SULFATE – POLYACRYLAMIDE GEL ELECTROPHORESIS (SDS – PAGE)
60	IMMUNOELECTROPHORESIS
61	LIPOPROTEIN SEPARATION THROUGH ELECTROPHORESIS

III. No.	Illustration Title
62	PRINCIPLE OF pH METER
63	pH OF DIFFERENT BODY FLUIDS
64	ABG ANALYSIS INSTRUMENT AND ITS PRINCIPLE
65	PROPERTIES OF ARTERIAL GAS
66	METABOLIC ACIDOSIS AND METABOLIC ALKALOSIS
67	RESPIRATORY ACIDOSIS AND RESPIRATORY ALKALOSIS
68	ACCURACY AND PRECISION
69	LEVEY – JENNINGS CHART
70	STEPS OF DNA ISOLATION PROCESS
71	PHYSIOLOGY OF CEREBROSPINAL FLUID
72	LUMBAR PUNCTURE
73	ANALYSIS OF CSF AND ITS CLINICAL UTILITY
74	OVERVIEW OF ENZYME LINKED IMMUNOSORBENT ASSAY
75	OVERVIEW OF CHEMILUMINESCENCE IMMUNOASSAY (CLIA)

SECTION 2 : HANDS – ON PRACTICALS

Ch.	Chapter Title	Illustration number	Page Number
1	LABORATORY APPARATUS AND EQUIPMENT, GOOD AND SAFE LABORATORY PRACTICE, AND WASTE DISPOSAL SYSTEM IN THE LABORATORY	1 – 11	43-44
2	COLOR REACTIONS OF CARBOHYDRATES	—	45-48
3	COLOR REACTIONS OF PROTEINS	—	49-53
4A	ANALYSIS OF PHYSICAL AND CHEMICAL COMPOSITION OF PHYSIOLOGICAL URINE	12 – 13	54-67
4B	ANALYSIS AND INTERPRETATION OF PHYSICAL AND CHEMICAL COMPOSITION OF PATHOLOGICAL URINE	12 – 13	54-67
5	PRINCIPLES OF PHOTOMETRY	14 – 17	68-71
6A	QUANTITATIVE ESTIMATION OF BLOOD GLUCOSE LEVELS	18 – 21	72-75
6B	GLUCOSE TOLERANCE TEST (GTT)	20 – 21	76-80
7	QUANTITATIVE ESTIMATION OF BLOOD UREA LEVELS	22	81-85
8	QUANTITATIVE ESTIMATION OF SERUM CREATININE	23 – 25	86-89

Ch.	Chapter Title	Illustration number	Page Number
9	QUANTITATIVE ESTIMATION OF CREATININE IN URINE AND CREATININE CLEARANCE	26 – 27	90-92
10	QUANTITATIVE ESTIMATION OF SERUM CHOLESTEROL LEVELS	28 – 29	93-97
11	QUANTITATIVE ESTIMATION OF SERUM TRIGLYCERIDE LEVELS	30 – 31	98-99
12	QUANTITATIVE ESTIMATION OF SERUM HDL – C LEVELS	32	100-102
13	QUANTITATIVE ESTIMATION OF SERUM CALCIUM LEVELS	33 – 34	103-105
14	QUANTITATIVE ESTIMATION OF SERUM PHOSPHORUS LEVELS	35 – 36	106-107
15	QUANTITATIVE ESTIMATION OF SERUM TOTAL PROTEIN LEVELS	37 – 39	108-109
16	QUANTITATIVE ESTIMATION OF SERUM ALBUMIN LEVELS	40 – 41	110-113
17	QUANTITATIVE ESTIMATION OF SERUM BILIRUBIN LEVELS	42 – 44	114-116
18	QUANTITATIVE ESTIMATION OF AST AND ALT LEVELS	45 – 47	117-119
19	QUANTITATIVE ESTIMATION OF SERUM ALKALINE PHOSPHATASE (ALP)	48 – 49	120-121
20	CHROMATOGRAPHY	50 – 56	122-124
21	ELECTROPHORESIS	57 – 61	125-127
22	pH METER	62 – 63	128-129
23	ARTERIAL BLOOD GAS ANALYSIS	64 – 67	130-132
24	QUALITY CONTROL IN CLINICAL LABORATORY	68 – 69	133-135
25	DNA ISOLATION FROM BLOOD AND TISSUE	70	136-137
26	ANALYSIS OF CEREBROSPINAL FLUID (CSF)	71 – 73	138-140
27	ENZYME LINKED IMMUNO SORBENT ASSAY (ELISA)	74	141-143
28	CHEMILUMINESCENCE IMMUNOASSAY (CLIA)	75	144-147
—	KEYWORD INDEX	—	148-156

“Dedicated to our patients, who are the heart of every lesson, every effort, and every advancement in healthcare.”

