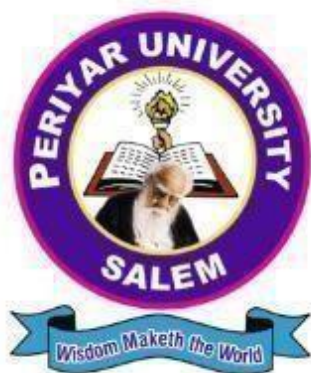


# **PERIYAR UNIVERSITY**

**PERIYAR PALKALAI NAGAR**

**SALEM – 636011**



**DEGREE OF BACHELOR OF SCIENCE**

*Syllabus for*

**B.Sc., CLINICAL LABORATORY TECHNOLOGY**

**CHOICE BASED CREDIT SYSTEM**

**(SEMESTER PATTERN)**

**(For Candidates admitted in the Colleges affiliated to  
Periyar University from 2022 – 2023 onwards)**

### **Program specific outcome (PSO) –Clinical Laboratory Technology**

Bachelor of Science in **Clinical Laboratory Technology** students will gain fundamental knowledge about

- ❖ To provide an extensive training in the fields of Biochemistry, Microbiology and Pathology to the students to enable them for supervising the entire laboratory.
- ❖ To carry out clinical diagnosis in all fields of laboratory medicine (Biochemistry, Microbiology, Pathology and Blood bank departments respectively).
- ❖ To understand and perform basic cytology and haematology procedures.
- ❖ To perform grossing, cutting & staining procedures in histopathology.

### **Condition for admission (OBE pattern)**

A candidate who has passed Higher Secondary Examination of Tamil Nadu Higher Secondary Board or an equivalent Examination under other state board is accepted. A pass in +2 passed with **Chemistry as compulsory** subject and studied **Botany and Zoology or Biology** shall be eligible for admission for **B.Sc., Clinical Laboratory Technology** degree examination of this University after a course of study of **three** academic years.

### **Duration of the course**

The course for the degree of Bachelor of Clinical Laboratory Technology shall consist of three academic years divided into six semesters.

### **Course of study**

The course of study shall comprise instruction about the following subjects according to the syllabus and books prescribed from time to time.

### **Examinations**

The theory examination shall be three hours duration to each paper at the end of each semester. The candidate failing in any subject (s) will be permitted to appear for each failed subject (s) in the subsequent examinations. The practical examinations for UG course should be conducted in the **even semesters**.

### **Passing Minimum**

A candidate shall be declared to be passed the examination if he /she secure not less than 40 % of the marks in each theory and practical. The candidates who do not secure the required minimum marks for pass in a theory and practical shall be required to reappear to pass the same at a subsequent appearance. For the practical the minimum pass includes the record mark too. There is no passing minimum for the record. However, submission of a record notebook is a must.

### **Classification of Successful Candidates**

Candidates who secured not less than 60 % of the aggregate marks in the whole examination shall be declared to have passed the examination in **First Class**. Candidates secured above 50 % less than 60 % shall be declared to have passed in **Second Class**.

Candidates who obtain 75 % and above in the aggregate shall be declared to have passed the examination in **First Class with Distinction** provided they pass all the examination in prescribed period at first appearance.

### **Ranking**

Candidates who pass all the examinations for the prescribed course in the first attempt / appearance and within a period of three academic years from the year of admission to the course only are eligible for **University Ranking**.

### **Maximum Duration for the completion**

The maximum duration for completion of the UG Program shall not exceed **twelve semesters**.

### **Commencement of this Regulation**

These regulations shall take effect from the academic year 2021-22, i.e., for students who are to be admitted to the first year of the course during the academic year 2022-23 and thereafter.

**COURSE OF STUDY AND SCHEME OF EXAMINATIONS**  
**SEMESTER – I**

Part	Paper Code	Course	Title	Inst. Hrs/ week	Credit	Exam Hours	Marks		Total
							Int	Ext	
I	21UFTA01	Language-I (LC)	Tamil-I /Malayalam – I /Hindi-I	6	3	3	25	75	100
II	20UEN01	Language-I (ELC)	Communicative English – I	6	3	3	25	75	100
III	21UCLT01	Core -I (CC)	General Biochemistry	3	4	3	25	75	100
	21UCLTP01	Core Practical-I (CP)	General Biochemistry	3	-	-	-	-	-
	21UCLTA01	Allied- I(AC)	Human Anatomy and Physiology	3	4	3	25	75	100
	21UCLTAP01	Allied Practical-I(AP)	Human Anatomy, Physiology and Histopathology – I	3	-	-	-	-	-
IV	20UPEL01	Add-on Course	Professional English for life Science – I	4	3	3	25	75	100
	21UVE01	Value Education	Manavalakkalai yoga	2	2	3	25	75	100
<b>Total</b>				<b>30</b>	<b>19</b>				<b>600</b>
<b>SEMESTER – II</b>									
I	21UFTA02	Language - II (LC)	Tamil-II / Malayalam – II / Hindi -II	6	3	3	25	75	100
II	20UEN02	Language – II(ELC)	Communicative English – II	4	3	3	25	75	100
II		<b>NMSDC</b>	<b>Language Proficiency for Employability-Effective English</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>25</b>	<b>75</b>	<b>100</b>
III	21UCLT02	Core – II (CC)	Analytical Techniques	3	4	3	25	75	100
	21UCLTP02	Core Practical – II(CP)	Analytical Techniques	3	3	6	40	60	100
	21UCLTA02	Allied- II (AC)	Histopathology	3	4	3	25	75	100
	21UCLTAP01	Allied Practical - I (AP)	Human Anatomy, Physiology & Histopathology – Practical	3	2	6	40	60	100
	21UCLTP01	Core Practical - I (CP)	General Biochemistry	-	3	6	40	60	100
IV	20UPEL02	Add-on Course	Professional English for life Science – II	4	3	3	25	75	100
	21UES01	Environmental Studies	Environmental Studies	2	-	3	25	75	100
<b>Total</b>				<b>30</b>	<b>27</b>				<b>1000</b>
<b>SEMESTER – III</b>									
I	21UFTA03	Language - III (LC)	Tamil -III / Malayalam - III / Hindi -III	6	3	3	25	75	100
II	20UEN03	Language – III (ELC)	Communicative English – III	6	3	3	25	75	100
III	21UCLT03	Core – III (CC)	Intermediary Metabolism	3	3	3	25	75	100
	21UCLTP03	Core Practical- III(CP)	Intermediary Metabolism	3	-	-	-	-	-
	21UCLTA03	Allied – III (AC)	General Microbiology	3	4	3	25	75	100
	21UCLTAP02	Allied Practical – II	Microbiology and Haematology – Practical	3	-	-	-	-	-
	21UCLTS01	SBEC – I	Techniques in histopathology and cytology	2	2	3	25	75	100
		NMEC – I	Choose from other department	1	1	3	25	75	100
	20UPEL03	Add-on Course	Professional English for life Science – III	3	3	3	25	75	100
<b>Total</b>				<b>30</b>	<b>19</b>				<b>700</b>
<b>SEMESTER – IV</b>									
I	21UFTA04	Language-IV (LC)	Tamil – IV / Malayalam – IV / Hindi -IV	6	3	3	25	75	100
II	20UEN04	Language – IV (ELC)	English – IV	6	3	3	25	75	100
III	21UCLT04	Core –IV (CC)	Clinical Biochemistry	3	3	3	25	75	100
	21UCLTP04	Core Practical - IV (CP)	Clinical Biochemistry	3	3	6	40	60	100
	21UCLTP03	Core Practical – III (CP)	Intermediary Metabolism	-	3	6	40	60	100
	21UCLTA04	Allied – IV (AC)	Haematology	2	4	3	25	75	100
	21UCLTAP02	Allied Practical - II (AP)	Microbiology and Haematology – Practical	2	2	3	25	75	100
	21UCLTS02	SBEC – II	Cell Biology	1	2	3	25	75	100
		<b>NMSDC</b>	<b>SBEC-Digital Skills for Employability-Office Fundamentals</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>25</b>	<b>75</b>	<b>100</b>
IV		NMEC – II	Choose from other department	1	2	3	25	75	100
		Add-on Course	Internship	-	2				
	20UPEL04	Add-on Course	Professional English for life Science – IV	4	3	3	25	75	100
<b>Total</b>				<b>30</b>	<b>32</b>				<b>1100</b>

SEMESTER – V									
III	21UCLT05	Core – V (CC)	Medical Microbiology	6	5	3	25	75	100
	21UCLT06	Core – VI (CC)	Medical Parasitology	6	5	3	25	75	100
	21UCLT07	Core- VII (CC)	Clinical Laboratory Technology	6	5	3	25	75	100
	21UCLTP05	Core Practical – V (CP)	Medical Microbiology, Parasitology, and Clinical laboratory technology	3	-	-	-	-	-
	21UCLTE01	Elective – I	Drug Biochemistry	3	2	3	25	75	100
	21UCLTS03	SBEC – III	Clinical Sociology and Ethics	4	2	3	25	75	100
			Physical / Moral Education	2	-	-	-	-	-
<b>Total</b>				<b>30</b>	<b>20</b>				<b>500</b>
SEMESTER – VI									
III	21UCLT08	Core –VIII (CC)	Medical Biochemistry	6	5	3	25	75	100
	21UCLT09	Core – IX(CC)	Immunology	6	5	3	25	75	100
	21UCLT10	Core – X (CC)	Recent advances in Medical Physiology	6	5	3	25	75	100
	21UCLTP06	Core Practical– VI (CP)	Medical Biochemistry, Immunology and Medical Physiology- Practical	3	3	6	40	60	100
	21UCLTP05	Core Practical– V (CP)	Medical Microbiology, Parasitology, and Clinical laboratory technology	-	3	6	40	60	100
	21UCLTE02	Elective – II	Clinical Nutrition	3	2	3	25	75	100
	21UCLTS04	SBEC – IV	Automation and Documentation in CLT	4	2	3	25	75	100
		Add on Course	Employability Readiness	-	-	-	-	-	-
V		Extension Activities		2	2	-	-	-	-
<b>Total</b>				<b>32</b>	<b>27</b>	-	-	-	<b>700</b>
<b>Grand Total</b>				<b>180</b>	<b>143</b>				<b>4600</b>

**B.Sc., CLINICAL LABORATORY TECHNOLOGY**  
**(CBCS Pattern)**  
**THEORY QUESTION PAPER PATTERN**

Time: 3hour

Max. Marks: 75

**Part- A:** (15 Marks) (Answer all the Question)

15x 1 = 15 (Choose the best answer) (3 Questions each unit)

**Part - B:** (5 Marks) (Answer any two questions) 2 x 5 = 10

(One question in each unit)

**Part -C:** (50 Marks) (Either or Choice)

5 x 10 = 50 (Two question from each unit)

**B.Sc., CLINICAL LABORATORY TECHNOLOGY (CBCS Pattern)**  
**CORE PRACTICAL QUESTION PAPER PATTERN**

Time	:	6 hours
Maximum Marks (University Exam)	:	60
Major Practical – 1	:	20 Marks
Minor Practical - 1 & 2	:	2 X 10 = 20 (A &B)
Spotters	:	5 X 2 =10
Record	:	05
Viva voce	:	05
Internal Marks	:	40
Total	:	100

**LIST OF COURSES:-**

1. General Biochemistry
2. Analytical Techniques
3. Intermediary Metabolism
4. Clinical Biochemistry
5. Medical Microbiology
6. Medical Parasitology
7. Clinical Laboratory Technology
8. Medical Biochemistry
9. Immunology
10. Recent Advances in Medical physiology
11. Core practical - I
12. Core practical - II
13. Core practical - III
14. Core practical - IV
15. Core practical - V
16. Core practical - VI

**ELECTIVE COURSES:-**

1. Elective - I: Drug Biochemistry
2. Elective - II: Clinical Nutrition

**SKILL BASED ELECTIVE COURSES (SBEC):-**

1. SBEC - I: Techniques in Histopathology and Cytology
2. SBEC - II: Cell Biology
3. SBEC - III: Clinical Sociology and Ethics
4. SBEC - IV: Automation and Documentation in Clinical Laboratory Technology

**ALLIED COURSES:**

1. Human Anatomy and Physiology
2. Histopathology
3. General Microbiology
4. Haematology

**NON MAJOR ELECTIVE COURSES (NMEC)**

1. NMEC – I: Basics of Nutrition
2. NMEC – II: Tools and Techniques in Clinical Laboratory Technology

**PART-IV**

1. Environmental Studies
2. Value Education-Yoga

**PART-V**

1. Extension Activities (Awareness program conducted based on hygiene practices to the other department students / nearby school students / village people).



# **B.Sc., CLINICAL LABORATORY TECHNOLOGY**

## **SEMESTER-I**

### **CORE PAPER - I: GENERAL BIOCHEMISTRY**

#### **COURSE OBJECTIVES:**

To understand the basics of macromolecules, their basic structure, biological functions and its importance

#### **UNIT - I**

Introduction to Biochemistry – Biomolecules – Carbohydrates - Introduction and general classification, structural elucidation-glucose and fructose, Interconversion of sugars, Properties and biological functions of Monosaccharides, oligosaccharides – maltose, lactose and sucrose and Polysaccharides - Homopolysaccharides- starch, cellulose, glycogen and Heteropolysaccharides - Hyaluronic acid, chondroitin sulphate, chitin, heparin.

#### **UNIT - II**

Amino acids - structure, classification - essential and non-essential amino acids, properties. Peptides - structure, synthesis, peptide bonds, biological importance. Proteins – structure - primary, secondary, tertiary and quaternary structure- forces stabilizing level of structures, physical and chemical properties, biological importance.

#### **UNIT - III**

Lipids- structure, classification - simple, conjugated and derived lipids, phospholipids- glycolipids, sphingolipids and cholesterol, physical and chemical properties of lipids. Fatty acids- classification - saturated and unsaturated fatty acids, Essential fatty acids, Lipoproteins - Classification and composition, Chylomicrons, VLDL, LDL and HDL. Steroids and prostaglandins

#### **UNIT - VI**

Nucleic acids- Nucleotides - Purines and Pyrimidines, nucleosides, phosphodiester bonds. Polynucleotides – DNA – Structure - Watson and Crick model, biological importance. RNA - types, Structural features of mRNA, tRNA and rRNA - properties and functions.

#### **UNIT - V**

Vitamins - Introduction and classification and types, dietary sources, importance and vitamin deficiencies. Porphyrins - Structure and Classification. Haemoglobin - structure, properties and biological importance. Anemia - symptoms, types, dietary importance in anemia

## **COURSE OUTCOME:**

- Basic structure of carbohydrates, types, forms and its biological importance
- Importance of amino acids, types, formation of proteins and types of proteins.
- Concept of lipids, fatty acids and lipoproteins, its formation and related functions.
- Nucleic acids which are the building blocks of DNA and RNA, its structure, types and importance
- Importance of vitamins and porphyrins, its sources and deficiencies.

## **Text books:**

1. U. Satyanarayana & U. Chakrapani, 2021, Biochemistry, 6<sup>th</sup> Edition, Elsevier, Andhra Pradesh, India.
2. J. L. Jain, Nitin Jain, & Sunjay Jain, 2020, Fundamentals of Biochemistry, 7th Edition, S. Chand & Company Put Ltd, Coimbatore, India.
3. Harper, 2012, Biochemistry, 29<sup>th</sup> Edition, McGraw Hill, Uttar Pradesh, India.
4. D. M. Vasudevan, S. Sreekumari, & Kannan Vaidyanathan, 1995, Textbook of Biochemistry, 9th Edition, Jaypee Brothers Medical Publishers Pvt Ltd, New Delhi, India.
5. Pankaja Naik, 2017, Essentials of Biochemistry, 2nd Edition, Jaypee Brothers Medical Publishers Pvt Ltd, New Delhi, India.

## **Reference Books:**

1. West & Todd, 1966. Text Book of Biochemistry, 4<sup>th</sup> Edition, Macmillan, New York City, United States.
2. Donald Voet, Judith G. Voet, & Charlotte W Pratt, 1999, Fundamentals of Biochemistry, 1<sup>st</sup> edition, John Wiley & Sons, New York City, United States.
3. Zubay GL, 1988, Biochemistry, 4<sup>th</sup> Edition, WMC Brown Publishers, Iowa, United States.
4. Garette & Grisham, 2016, Principles of Biochemistry, 6<sup>th</sup> edition, Saunders College Publishing, Philadelphia, United States.
5. Nelson & Cox, 2013, Leninger Principles of Biochemistry, 7<sup>th</sup> Edition, Macmillan, New York City, United States.

## **Web reference:**

1. <https://worldofmedicalsaviours.com/u-satyanarayan-biochemistry-pdf-free-download/>
2. [https://bio.libretexts.org/Bookshelves/Biochemistry/Book%3ABiochemistry Online \(Ja kubowski\)](https://bio.libretexts.org/Bookshelves/Biochemistry/Book%3ABiochemistry%20Online%20(Ja%20Kubowski))
3. <https://biochem.oregonstate.edu/content/biochemistry-free-and-easy>
4. <https://med-mu.com/wp-content/uploads/2018/06/DM-Vasudevan-Textbook-of-Biochemistry-For-Medical-Students-6th-Edition.pdf>
5. <http://www.freebookcentre.net/Chemistry/BioChemistry-Books-Download.html>

# **B.Sc., CLINICAL LABORATORY TECHNOLOGY**

## **SEMESTER - I**

### **ALLIED PAPER – I: HUMAN ANATOMY AND PHYSIOLOGY**

#### **COURSE OBJECTIVE:**

The course provides a comprehensive, balanced introduction to this exciting, evolving and multi-disciplinary field of anatomy and physiology.

#### **UNIT - I**

Definition of Anatomy, location and positions, Fundamental planes, Vertebrae structure of man, Cell - structure and Function, Types of tissue: Epithelial, Connective, muscular & Nervous. Skeletal system – structure & types of bones.

#### **UNIT - II**

Circulatory System- Heart rate, cardiac cycle, cardiac output, BP, hypertension, radial pulse, measurement of pulse, auscultation of heart sounds, lymphatic system - basic study. Overview of the respiratory system - gross anatomy of respiratory tract, physiology of respiration, pulmonary ventilation, Alveolar ventilation, composition and partial pressure of inspired air, alveolar air and expired air, Exchange and transport of respiratory gases.

#### **UNIT-III**

Digestive system - Components of digestive system, Mouth, Tongue, Tooth, Salivary glands, Liver, Biliary apparatus, Pancreas, intestine - position and their brief functions. Secretions of digestive tract, digestive hormones, process of digestion, absorption, assimilation of carbohydrates, proteins, fats, nucleic acids. Absorption of vitamins, Minerals and water.

#### **UNIT-IV**

Central Nervous system: Spinal cord, Anatomy, Functions, Reflex - Arc, Meninges. Signal transmission at synapse, neurotransmitters. Excretory system - Kidneys - Ureters, Urinary Bladder, Urethra- structure and anatomy. Overview of renal system, Renal physiology - glomerular filtration, tubular re-absorption and secretion, production of dilute and concentrated urine.

#### **UNIT-V**

Reproductive System - Male Reproductive System - testis, Duct system. Female Reproductive System - Ovaries, Duct system and Accessory glands, spermatogenesis, oogenesis and follicular development, menstrual cycle, physiology of pregnancy, parturition and lactation. Special Senses: Physiology of Olfaction, Gustation, Vision, Hearing and equilibrium.

**COURSE OUTCOME:**

- Understand clearly on various alimentary parts of human body.
- Learn more specific on the absorption and assimilation process.
- Learn the mechanisms and actions of cells and vital organelles.

**TEXT BOOKS:**

1. Chatterjee & Shinde, 2012, Human Physiology, 8<sup>th</sup> edition, Jaypee Brothers Medical Publishers Pvt Ltd, New Delhi, India.
2. T.S. Ranganathan, 2000, A text book of Human Anatomy, 3<sup>rd</sup> edition, S. Chand & Company Put Ltd, Coimbatore, India.
3. Farhana, 2021, A Practical Book of Human Anatomy, 1<sup>st</sup> edition, Saunder's & Co Prism Publishers, Bangalore, India.
4. Choudhari, 1993, Concise Medical Physiology, 1<sup>st</sup> edition, New Central Books, Calcutta, India.
5. M. Ester & Greisheimer, 1945, Physiology and Anatomy, 5<sup>th</sup> edition, J.B. Lippin Cott Company, Philadelphia, United States.

**REFERENCE BOOKS:**

1. Guyton & Hall, 2011, Textbook of Medical Physiology, 12<sup>th</sup> edition. Saunders Elsevier, Philadelphia, United States.
2. Willam, 1997, Ganong's Review of Medical Physiology, 18<sup>th</sup> edition, McGraw Hill Education Lange, New York City, United States.
3. Wagh & Grant, 2014, Ross & Wilson Anatomy and physiology in health and illness, 12<sup>th</sup> edition, Elsevier Evolve, New York City, United States.
4. Romanes, 1986, Cunninghams's Manual of Practical Anatomy, 15<sup>th</sup> edition, Oxford publisher, Oxford, United Kingdom.
5. Peter, Jonathan, Marios, & Albert, 2019, Abhraham's & McMinn's Clinical Atlas of Human Anatomy, 8<sup>th</sup> edition, Elsevier, Amsterdam, Netherlands.

**WEB REFERENCE:**

1. <https://openstax.org/details/books/anatomy-and-physiology>
2. <https://open.umn.edu/opentextbooks/textbooks/169>
3. <https://libguides.cbu.edu/anatomy/books>
4. <https://libproxy.cbu.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1882225&site=ehost-live&scope=site>
5. <https://libproxy.cbu.edu/login?url=https://www.r2library.com/Resource/Title/1455704180>

## **B.Sc., CLINICAL LABORATORY TECHNOLOGY**

### **SEMESTER - II**

#### **CORE – II: ANALYTICAL TECHNIQUES**

##### **COURSE OBJECTIVES:**

This course focus on the biochemical techniques includes spectrophotometry, centrifugation, electrophoresis; radioactivity etc., learning these techniques will be very useful for operating instruments and become the basic knowledge in their future.

##### **UNIT –I**

Light Microscopy, Dark field Microscopy, Phase contrast Microscopy, Fluorescence Microscopy, Electron Microscope-SEM, TEM. PH and Buffers, Measurement of PH – glass electrode, Ion selective and gas sensing electrodes, Clark oxygen electrode, and their applications, Biosensors.

##### **UNIT-II**

Basic principles of sedimentation, Types of Rotors, Types of Centrifugation: Ultra centrifuge, Analytical and Preparative centrifuges and applications. Molecular weight and density determination, Sub cellular fractionation, Ultra-filtration; Principle, instrumentation and application..

##### **UNIT-III**

Principle, Working mechanism and applications of Colorimeter, UV - Visible and FTIR spectroscopy, Flame and Flameless spectrophotometer, Basic principles of NMR, ESR, Atomic Absorption Spectroscopy, Luminometry, X-Ray Crystallography.

##### **UNIT-IV**

Chromatographic techniques – General principle; adsorption and partition chromatography. Techniques and application of paper, column, thin layer, Ion-exchange chromatography, exclusion chromatography, affinity chromatography, GLC and HPLC, HPTLC.

##### **UNIT-V**

Electrophoresis: Principles, electrophoretic mobility, factors influencing electrophoretic mobility – paper, Agarose, SDS-PAGE electrophoresis, Isoelectric focusing, 2D PAGE, blotting techniques, capillary electrophoresis. Pulse field Electrophoresis, Isotachophoresis.

**COURSE OUTCOME:**

1. Have a strong and sound knowledge of the fundamental principles of Instrumentation.
2. Have the practical skills and techniques in biochemical analysis.
3. Have the practical knowledge of all the instrumental applications.

**TEXT BOOKS:**

1. Wilson & Walker, 2006, Principles and Techniques of Practical Biochemistry, 5<sup>th</sup> edition, Cambridge University Press, Cambridge, United Kingdom.
2. Upadhyay A, Upadhyay K & Nath N, 2002, Biophysical Chemistry – Principles and Techniques, Himalaya Publishing House, Mumbai, India.
3. Upadhyay A & Nath N, 2001, Biophysical Chemistry – Principles and techniques, Himalaya Publishers, Mumbai, India.
4. Brown S. B, 1980, An Introduction to spectroscopy for Biochemist, Academic Press, New York, London.
5. Cooper T. G, 1977, The Tools of Biochemistry, Wiley, New York City, United States.

**REFERENCE BOOKS:**

1. Marimuthu R, 2021, Microscopy and Microtechnique, Repro Books Ltd, Mumbai, India.
2. Charles R, Cantor I & Schimmel P. R, 2004, Biophysical Chemistry, Part II, W.H.Freeman & Co, New York City, United States.
3. Daniel M, 2007, Basic Biophysics for Biologist, Student Edition, Rajasthan, India.
4. Campbell I. D, 2012, Biophysical Techniques, Oxford University Press, Oxford, United Kingdom.
5. Varco J. S, 2001, Clinical Biochemistry: Techniques and instrumentation – A practical course, World Scientific, Singapore.

**WEB SOURCE:**

1. <https://www.amazon.in/Principles-Techniques-Biochemistry-Molecular-Biology/dp/0521731674>
2. <https://www.amazon.in/Basic-Techniques-Biochemistry-Molecular-Biology-ebook/dp/B01JOXTCVQ>
3. <https://www.cambridge.org/highereducation/books/wilson-and-walkers-principles-and-techniques-of-biochemistry-and-molecular-biology/2159004E019DDD87C0A97EE8DB72B79F>
4. <https://link.springer.com/book/10.1007/978-1-4419-9785-2>
5. <https://link.springer.com/book/10.1007/978-1-0716-0134-1>

# **B.Sc., CLINICAL LABORATORY TECHNOLOGY**

## **SEMESTER - II**

### **ALLIED PAPER – HISTOPATHOLOGY**

#### **COURSE OBJECTIVE:**

Students will learn about various histopathologies, handling and processing of tissue specimens as well as staining procedures.

#### **Unit - I**

Introduction to histopathology, laboratory organization, care & maintenance of equipments used in histopathology lab, Safety measures in histopathology lab. Reception, Recording, Labeling and transportation of tissue specimens.

#### **Unit - II**

Tissue and its types, Location and function, Grossing of tissues, whole mount, sections, smears, tissue processing and its steps, manual and automated method, components & principle of automatic tissue processor. Decalcification- decalcification methods, types of decalcifying fluid, Processing of bones and teeth, Embedding media, its type and properties. Microtome and sectioning.

#### **Unit - III**

Basic concepts of fixation and various types of fixatives used in histopathology and cytopathology. Fixation- purpose of fixation- Classification of fixation- Simple Fixatives, Compound Fixatives other methods for fixation.

#### **Unit - IV**

Specimen collection- BIOPSY, AUTOPSY- Examination of fresh specimens. Preservation of tissues, Immunohistochemistry: principle, types, applications, antigen retrieval, APAAP, PAP Staining.

#### **Unit - V**

Reception of organization, dispatch of reports, "Records keeping" coding the lessons of cases, Follow up programme, Quality control in histopathology.

#### **COURSE OUTCOME:**

Students would be able to carry out tissue processing and general staining.

**TEXT BOOKS:**

1. J. D. Bancroft & A. Stevens, 2012, Theory and Practice of Histological Techniques, 7th Edition, Elsevier Publications, Amsterdam, Netherlands.
2. Harshmohan, 2017, Textbook of Pathology, 7<sup>th</sup> edition, Jaypee Brothers Medical Publishers Pvt Ltd, New Delhi, India.
3. G. B. Praful, 2016, Textbook of MLT, 3<sup>rd</sup> edition, Bhalani Publications, New Delhi, India.

**REFERENCE BOOKS:**

1. C. F. A. Culling, 1974, Handbook of Histopathological and Histochemical Techniques: Including Museum Techniques, 3<sup>rd</sup> edition, Butterworths Publishers, Oxford United Kingdom.
2. K. Lakshminarayanan, 2020, Histopathology Techniques A Practical Manual, 3<sup>rd</sup> edition, Bhalani Publications, New Delhi, India.

**WEB REFERENCE:**

1. <https://www.bookdepository.com/Atlas-Forensic-Histopathology-Peter-M-Cummings/9780521110891?ref=grid-view>
2. <https://www.bookdepository.com/Histopathology-Guy-Orchard/9780198717331?ref=grid-view>
3. <https://www.bookdepository.com/Diagnostic-Criteria-Handbook-Histopathology-Paul-J-Tadrous/9780470519035?ref=grid-view>
4. <https://www.bookdepository.com/Techniques-Histopathology-Cytopathology-Sadhana-Vishwakarma/9789352701094?ref=grid-view>
5. <https://www.bookdepository.com/Recent-Advances-Histopathology-24-Adrienne-M-Flanagan/9781909836280?ref=grid-view>



## **B.Sc., CLINICAL LABORATORY TECHNOLOGY**

### **SEMESTER - III**

#### **CORE - III: INTERMEDIARY METABOLISM**

##### **COURSE OBJECTIVES**

To provide a deeper insight into the fundamentals of enzymes, kinetics and their role in control of metabolism.

##### **UNIT-I**

Enzymes: Introduction, International classification of enzymes, six main classes of enzymes. Factors affecting enzyme activity, Coenzymes, Holoenzymes, Apoenzymes, metallo enzymes, metal activated enzymes, monomeric enzymes, oligomeric enzymes, ribozymes. Enzyme specificity, Specific activity, Units of enzyme activity – IU and Katal. Active site-concept of ES complex.

##### **UNIT-II**

Carbohydrate metabolism-Glycolysis- Introduction, overview, pathway and energetics. Oxidation of pyruvate to acetyl Co A, TCA Cycle- Introduction, overview, pathway and energetics. Glycogenesis and Glycogenolysis - Introduction, overview pathway and energetics. Pentose phosphate pathway (HMP Shunt).

##### **UNIT-III**

Metabolism of proteins- Fate of dietary proteins, metabolic nitrogen pool. Catabolism of amino acid- oxidative deamination, non-oxidative deamination, transamination, decarboxylation.

##### **UNIT-IV**

Metabolism of Lipids- Fate of dietary lipids, Biosynthesis of saturated Fatty acids. Extra mitochondrial and microsomal system for synthesis of fatty acids. Oxidation of fatty acids, alpha oxidation, beta oxidation and omega oxidation. Biosynthesis of phospholipids.

##### **UNIT-V**

Metabolism of Nucleic acids - Metabolism of purines. Introduction, biosynthesis, de novo synthesis, salvage pathway and catabolism of purines. Regulation of purine metabolism. Metabolism of pyrimidines - Introduction, biosynthesis, de novo synthesis, salvage pathway and catabolism of pyrimidines, Regulation of pyrimidine metabolism.

##### **COURSE OUTCOME:**

- Basic features and classification of enzymes.
- Characteristics of active site ,nature of enzyme catalysis and enzyme kinetics
- Principles of metabolic pathways
- Carbohydrate, protein, lipid and nucleotide metabolism.

**TEXT BOOKS:**

1. T. Palmer, 1992, Understanding enzymes, 3<sup>rd</sup> edition, Ellis Horwood Ltd, Herts, United Kingdom.
2. N. C. Price & L. Stevans, 1998, Fundamentals of Enzymology, 1<sup>st</sup> edition, Oxford University Press, Oxford, United Kingdom.
3. Nelson & Cox, 2013, Leninger Principles of Biochemistry, 7<sup>th</sup> Edition, Macmillan, New York City, United States.
4. Harper, 2012, Biochemistry, 29<sup>th</sup> Edition, McGraw Hill, Uttar Pradesh, India
5. J. L. Jain, Nitin Jain, & Sunjay Jain, 2020, Fundamentals of Biochemistry, 7th Edition, S. Chand & Company Put Ltd, Coimbatore, India.

**REFERENCE BOOKS:**

1. Donald Voet, Judith G. Voet, & Charlotte W Pratt, 1999, Fundamentals of Biochemistry, 1<sup>st</sup> edition, John Wiley & Sons, New York City, United States.
2. M. F. Chaplin & C. Bucke, 1990, Enzyme technology, Cambridge University Press, Cambridge, United Kingdom.
3. Zubay GL, 1988, Biochemistry, 4<sup>th</sup> Edition, WMC Brown Publishers, Iowa, United States.
4. Lubert Stryer, 1995, Biochemistry, 4<sup>th</sup> edition, W. H. Freeman & Company, New York City, United States.

**WEB REFERENCE:**

1. [https://bio.libretexts.org/Bookshelves/Introductory\\_and\\_General\\_Biology/Book%3A\\_Biology\\_\(Kimball\)/04%3A\\_Cell\\_Metabolism/4.12%3A\\_Intermediary\\_Metabolism](https://bio.libretexts.org/Bookshelves/Introductory_and_General_Biology/Book%3A_Biology_(Kimball)/04%3A_Cell_Metabolism/4.12%3A_Intermediary_Metabolism)
2. <https://www.pnas.org/doi/10.1073/pnas.110153997>
3. [https://www.anaesthesiajournal.co.uk/article/S1472-0299\(20\)30003-5/fulltext](https://www.anaesthesiajournal.co.uk/article/S1472-0299(20)30003-5/fulltext).
4. extension://efaidnbmnnnibpcajpcglclefindmkaj/https://sist.sathyabama.ac.in/sist\_coursematerial/uploads/SBB1202.pdf
5. <https://www.biologydiscussion.com/biochemistry/intermediary-metabolism/metabolic-pathways-for-intermediary-metabolism-3-pathways/43715>

## **B.Sc., CLINICAL LABORATORY TECHNOLOGY**

### **SEMESTER – III**

#### **ALLIED PAPER - II: GENERAL MICROBIOLOGY**

##### **COURSE OBJECTIVE**

To gather knowledge on history and development of Microbiology to learn about the Morphology, identification growth, control of microorganisms and basic concept in culture of microorganism.

##### **UNIT- I**

Historical development of Microbiology - Theories of spontaneous generation – Biogenesis - The scope of Microbiology and the opportunities for microbiologists between the prokaryotic and eukaryotic microorganisms. General principles and nomenclature – Haeckel's three kingdom concept, Whittaker's five kingdom concept - Carl Woese three domain classification. Eight kingdom classification.

##### **UNIT-II**

Principles and types of staining – Simple, differential (Gram, Spore, AFB) Capsule staining (Negative), Sterilization: Principles and methods – physical moist heat, dry heat, filtration (Membrane and HEPA). Radiations chemical agents.

##### **UNIT- III**

General characteristics and nature of Archaeobacteria, Cyanobacteria, Mycoplasma, Rickettsiae, Chlamydia, Spirochaetes, Actinobacteria, Protozoa, Algae, Fungi and Viruses. Basic understanding of classification of viruses (ICTV), algae (Chapman Fritch), fungi (Alexopoulos) and protozoa.

##### **UNIT- IV**

Outline classification for bacteria as per the Bergey's Manual of Systematic Bacteriology (9th edition) -Structural organization of bacteria – Size, shape and arrangement of bacterial cells -Ultrastructure of a bacterial cell - cell wall, cell membrane, ribosomes, nucleoid, slime, capsule, flagella, fimbriae, spores , cysts, plasmid, mesosomes and cytoplasmic inclusions.

##### **UNIT - V**

Cultivation of microbes- Types of culture media with specific examples for each type. Aerobic and Anaerobic culture techniques-Pure culture techniques (Tube dilution, Pour plate, Spread plate and Streak plate)- Methods of maintenance and preservation of microbes, safe decontamination practices.

## **COURSE OUTCOME:**

Student would be able to learn

- Basics of Microbiology.
- Techniques in enumeration and culture of microorganisms in a sterile environment.
- Technology behind microbial world.

## **TEXT BOOKS:**

1. Ananthanarayan & Paniker, 2022, Textbook of Microbiology, 12<sup>th</sup> edition, Universities Press, Hyderabad, India.
2. R. C. Dubey & D. K. Maheswari, 2010, A Text Book of Microbiology, 4<sup>th</sup> edition, S Chand, New Delhi, India.
3. J. Willey, K. Sandman, & D. wood, 2019, Prescott's Microbiology, 11<sup>th</sup> edition, McGraw Hill, New York City, United States.
4. J. C. Pommerville, 2018, Fundamentals of Microbiology, 11<sup>th</sup> edition, Jones & Barlett Learning, Massachusetts, United States.
5. I. E. Alcamo, 2001, Fundamentals of Microbiology, 6<sup>th</sup> edition, Addison wesley Longman, Inc. California, United States.

## **REFERENCE BOOKS:**

1. C. J. Alexopoulos, C. W. Mims, & M. Blackwell, 2000, Introductory Mycology, 5<sup>th</sup> edition John Wiley and Sons, Chichester, United Kingdom.
2. R. C. Dubey & D. K. Maheswari, 2010, A Text Book of Microbiology, 4<sup>th</sup> edition, S Chand, New Delhi, India.
3. M. J. Pelczar, E. C. S. Chan, & N. R. Kreig, 2009, Microbiology, 5<sup>th</sup> edition, McGrawHill. Book Company, Singapore.
4. L. M. Prescott, J. P. Harley, & D. A. Klein, 2008, Microbiology, 7<sup>th</sup> edition, McGraw Hill, New York City, United States.

## **WEB REFERENCE:**

1. <https://openstax.org/details/books/microbiology>
2. <https://open.umn.edu/opentextbooks/textbooks/404>
3. <https://open.oregonstate.education/generalmicrobiology/>
4. <https://www.pdfdrive.com/bensons-microbiological-applications-laboratory-manual-in-general-microbiology-e34434101.html>
5. <https://www.pdfdrive.com/dairy-microbiology-handbook-the-microbiology-of-milk-and-milk-products-e183669501.html>

## **B.Sc., CLINICAL LABORATORY TECHNOLOGY**

### **SEMESTER – II**

#### **SBEC – I: TECHNIQUES IN HISTOPATHOLOGY AND CYTOLOGY**

##### **COURSE OBJECTIVE**

To gather knowledge on information about instruments and techniques used in histopathology and learn about various staining procedures for demonstration of different materials & various cytological investigations.

##### **UNIT - I**

Introduction to histopathological techniques- Reception of specimens- fixation- Formalin fixation – tissue processing and embedding. Tissue sectioning: Frozen section techniques- Co<sub>2</sub> Cryostat and freezing microtome. Techniques and principles of sections cutting and routine staining and special stains. Mounting Techniques.

##### **UNIT - II**

Staining techniques: Staining of smears – theory of staining - types of staining - mordants - haematoxylin and eosin staining - PAS staining- Special stains - Stain for carbohydrates and amyloid - Mucicarmine Alcian blue stain, colloidal iron method - PAS method - Beta carmine method for glycogen.

##### **UNIT - III**

Specimen preparation and maintenance: Use of microscope, polarisers. Introduction to Electron Microscopy and technique of preparing slides, Maintenance of records and filing slides, Familiarisation with computer. Microphotography and its application. Museum technology - preservation, Application of computer in Pathology Coding - ICDS - Classification.

##### **UNIT- IV**

Instruments and equipments used in cytology. Fixation and Fixatives used in cytology, Adhesive and mounting media, Cell block and cytopsin technique, Staining such as PAP, Diff-Quik, MGG, H&E, Shorr staining, significance of PAP - HPV, Aspiration and exfoliative cytology, Sample collection, Fixation, Processing and Staining FNAC, collection, processing of sample and staining.

##### **UNIT- V**

PAP staining, Progressive & Regressive, Hormonal cytology in different age groups, Collection and processing of sputum, BAL, CSF, Pleural, peritoneal and pericardial fluid, Gynaecologic sample. Sex chromatin demonstration, Introduction of Immunocytochemistry,

different markers and its applications, Automation in cytology, Liquid based preparation & automated screening device

### **COURSE OUTCOME:**

- Basic procedures of histopathology.
- Techniques and instruments in histopathology.
- Maintenance and record of interpreted data.
- Students would be able to perform collection, processing, staining and quality control in cytological diagnosis.

### **TEXT BOOKS:**

1. C. F. A. Culling, R. T. Allison, & W. T. Barr, 1985, Cellular pathology techniques, 4<sup>th</sup> edition, Butterworth, Oxford, United Kingdom.
2. S. Gupte, 2014, Short text book of medical laboratory for technicians, 2<sup>nd</sup> edition, Jaypee Brothers Medical Publishers Pvt Ltd, New Delhi, India.
3. Ramani Sood, 1995, Colour Atlas of Practical Pathology and Microbiology, 2<sup>nd</sup> edition, Jaypee Brothers Medical Publishers Pvt Ltd, New Delhi, India.

### **REFERENCE BOOKS:**

1. Dycie and Lewis, 2016, Practical haematology, 12<sup>th</sup> edition, Elsevier, Amsterdam, Netherlands.
2. Bibbo, 1997, Comprehensive Cytopathology, 2<sup>nd</sup> edition, Saunders Elsevier, Philadelphia, United States.
3. Koss, 2006, Diagnostic Cytology, 5<sup>th</sup> edition, Lippincott, Philadelphia, United States.

### **WEB REFERENCE:**

1. <https://www.jaypeedigital.com/book/9789350255995>
2. <https://www.pathologyoutlines.com/books?sp=20>
3. [https://books.google.co.in/books?id=HR3X4hL7XCcC&printsec=copyright&redir\\_esc=y#v=onepage&q&f=false](https://books.google.co.in/books?id=HR3X4hL7XCcC&printsec=copyright&redir_esc=y#v=onepage&q&f=false)
4. <https://www.google.com/search?q=haematology++and+histopathology+books&rlz>
5. <https://libguides.tulane.edu/hematology/books>

# **B.Sc., CLINICAL LABORATORY TECHNOLOGY**

## **SEMESTER – IV**

### **CORE – IV: CLINICAL BIOCHEMISTRY**

#### **Objective**

- To understand the clinical biochemistry and its related biochemical disorders that can be applied to medical diagnosis, treatment and management.
- To demonstrate clinical disorders, inborn defects in metabolism and correlate with deficiency of key metabolic enzymes.

#### **UNIT – I**

Collection, processing, preservation and transport of clinical specimens. Automation and quality control. Normal, abnormal constituents and clinical significance of urine.

#### **UNIT – II**

Blood: - composition and their functions, Anemia: - classifications, erythrocyte indices. Blood coagulation system, Clotting time, Bleeding time, Prothrombin time, RBC count, WBC count, Platelet count, Differential count, determination of Hemoglobin, PCV and ESR. Hemoglobinopathies, Thalassemias.

#### **UNIT – III**

Diabetes mellitus - Aetiology, classification, Clinical features, complications, laboratory investigations - GTT. Inborn errors of carbohydrate metabolism: - Galactosaemia, Fructosuria, Lactose intolerance, Pentosuria and Glycogen Storage Diseases.

#### **UNIT – IV**

Inborn errors of amino acid metabolism: - Phenylketonuria, alcaptonuria, cystinuria, albinism and tyrosinemia. Gout, Lesch - Nyhan syndrome, xanthinuria, orotic aciduria. Jaundice - classification, clinical features.

#### **UNIT – V**

Tests based on abnormalities of bile pigment metabolism, carbohydrate metabolism, lipid metabolism, amino acid metabolism, detoxification and excretory function of liver. Tests based on Glomerular filtration, renal plasma flow and tubular function.

#### **COURSE OUTCOME:**

- Understand clinical aspects of biochemistry. Describe about the blood components, blood coagulation system and perform the hematology-based analysis.
- Acquire insight into disorders of carbohydrates and lipids metabolism. Gain knowledge about various disorders of protein, nucleic acid and bilirubin metabolism.
- Comprehend different organ function tests and clinical enzymology.

**TEXT BOOKS:**

1. P. B. Godkar & D. P. Godkar, 2021, Textbook of Medical Laboratory Technology, 2<sup>nd</sup> edition, Bhalani, New Delhi, India.
2. Ramani Sood, 1999, Medical Laboratory Technology, 5<sup>th</sup> edition, Jaypee Brothers Medical Publishers Pvt Ltd, New Delhi, India.
3. T. M. Devlin, 2005, Text book of Biochemistry with clinical correlation, 6<sup>th</sup> edition, A. John Wiley - Liss Inc, New York City, United States.
4. Harold Varley, 2005, Practical Clinical Biochemistry, 4<sup>th</sup> edition, CBS Publication and Distributors, New Delhi, India.
5. Garette & Grisham, 2016, Principles of Biochemistry, 6<sup>th</sup> edition, Saunders College Publishing, Philadelphia, United States.

**REFERENCE BOOKS:**

1. Nelson & Cox, 2013, Leninger Principles of Biochemistry, 7<sup>th</sup> Edition, Macmillan, New York City, United States.
2. Teitz, 2007, Fundamentals of Clinical Chemistry, 6<sup>th</sup> edition, Elsevier Publications, Amsterdam, Netherlands.
3. Bishop, 2013, Clinical Chemistry, 7<sup>th</sup> edition, Wiley Publications, New Jersey, United States.
4. Henry, 2011, Clinical Diagnosis and Management by Laboratory Methods, 22<sup>nd</sup> edition, Elsevier, Amsterdam, Netherlands.

**WEB REFERENCE:**

1. <https://www.worldscientific.com/worldscibooks/10.1142/1741>
2. [https://www.academia.edu/41197490/Clinical Biochemistry Lecture Notes](https://www.academia.edu/41197490/Clinical_Biochemistry_Lecture_Notes)
3. Chromeextension://efaidnbmnnnibpcajpcglclefindmkaj/https://nios.ac.in/media/documents/dmlt/Biochemistry/Lesson-13.pdf
4. chromeextension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture\_notes/health\_science\_students/medicalbiochemistry.pdf
5. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://download.e-bookshelf.de/download/0003/9373/59/L-G-0003937359-0003185124.pdf



## **B.Sc., CLINICAL LABORATORY TECHNOLOGY**

### **SEMESTER – IV**

#### **ALLIED – IV: HAEMATOLOGY**

##### **COURSE OBJECTIVE:**

To gather knowledge on the haematological techniques, pathological test and quality control in laboratory.

##### **UNIT- 1**

Introduction for basic laboratory principles - Quality assurance in haematology, Sample collection - sample handling and preservation, Laboratory quality Control - Levey Jennings Chart, Safety measures in laboratory - Ethics in laboratory- Relationship maintenance with patient and patient care.

##### **UNIT - II**

Introduction - basic concepts, Blood grouping, Blood banking - Blood Collection methods and storage, Anticoagulants used in Haematology. Normal values in Haematology. RBC count and WBC count- Bulk and micropipette method, Platelet count - Eosinophil count – reticulocyte count – PCV – ESR - red cell indices - MCV, MCH, MCHC, Clinical significance of all the parameters.

##### **UNIT- III**

Structure and Functions of Hb- Haemoglobin estimation- physical method, calorimetric method, chemical method, gasometric method, Hb variants-Hb H, Hb S, Hb C, Hb E, Hb D, Estimation of Hb variants, Electrophoresis, HPLC.

##### **UNIT- IV**

Mechanism of coagulation, Collection and anticoagulants used in coagulation studies, Bleeding time and clotting time, coagulation studies PT, KPTT, TGT Assay of clotting factors. Test for blood fibrinolytic activity and detection of FDP Platelet function tests, Demonstration of LE cells. Cytochemistry.

##### **UNIT-V**

Automation in haematology lab, Electronic cell counter- Principle and working of coultercounter, Flow cytometry- Volume Histograms- Platelet indices.

##### **COURSE OUTCOME:**

- Examination of biological samples.
- Quality assurance in laboratory.
- Automation and maintenance of laboratory.

**TEXT BOOKS:**

1. Sood Ramnik, 2015, Text book of Medical Laboratory Technology, 2<sup>nd</sup> edition, Jaypee Brothers Medical Publishers Pvt Ltd, New Delhi, India.
2. Dycie and Lewis, 2016, Practical haematology, 12<sup>th</sup> edition, Elsevier, Amsterdam, Netherlands.
3. Wintrobe's Clinical Hematology, 2014, 13<sup>th</sup> edition, Lippincott Williams & Wilkins
4. Ramani Sood, 1995, Colour Atlas of Practical Pathology and Microbiology, 2<sup>nd</sup> edition, Jaypee Brothers Medical Publishers Pvt Ltd, New Delhi, India.

**REFERENCE BOOKS:**

1. Dycie and Lewis, 2016, Practical haematology, 12<sup>th</sup> edition, Elsevier, Amsterdam, Netherlands.
2. Sood Ramnik, 2015, Text book of Medical Laboratory Technology, 2<sup>nd</sup> edition, Jaypee Brothers Medical Publishers Pvt Ltd, New Delhi, India.
3. Harold Varley, 2005, Practical Clinical Biochemistry, 4<sup>th</sup> edition, CBS Publication and Distributors, New Delhi, India
4. Mukherjee .L.K, 2017, Medical Laboratory Technology, vol.1-3, 3<sup>rd</sup> edition, Tata Mcgraw Hill, New Delhi India.

**WEB REFERENCE:**

1. <https://app.pulsenotes.com/medicine/haematology/notes>
2. <https://www.studocu.com/en-gb/document/university-of-nottingham/cardiovascular-respiratory-and-haematology/revision-notes-haematology-1-6/132921>
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4. chromeextension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture\_notes/med\_lab\_tech\_students/ln\_hematology\_mlt\_final.pdf
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## **B.Sc., CLINICAL LABORATORY TECHNOLOGY**

### **SEMESTER – IV**

#### **SBEC – II: CELL BIOLOGY**

##### **LEARNING OBJECTIVE:**

This paper imparts knowledge on relationship between cellular organization and biological function of pro and eukaryotic cells.

##### **UNIT - I**

An overview of cells: origin and evolution of cells. Cell theory, Classification of cells - prokaryotic and eukaryotic cells: comparison of prokaryotic and eukaryotic cells. Molecular composition of cells - Water, carbohydrates, lipids, nucleic acid and proteins.

##### **UNIT - II**

Cell membrane - Fluid mosaic model of membrane structure. Membrane proteins and their properties. Membrane carbohydrates and their role. Transport across membrane - Diffusion, Osmosis, active and passive transport. Cytoskeleton: Types of filaments and their functions. Microtubules - chemistry and functions: cilia and flagella.

##### **UNIT - III**

Endoplasmic reticulum - Types, structure and functions. Golgi apparatus - structure and functions. Lysosomes - structure and functions, morphology and functions of peroxisomes and glyoxysomes.

##### **UNIT - IV**

Mitochondria - structure and functions. Biological oxidation - Electron transport chain, theories of oxidative phosphorylation, uncouplers and inhibitors of oxidative phosphorylation.

##### **UNIT - V**

Nucleus - structure and functions. Chromosomes; chromatin structure. The cell cycle - Phases of cell cycle. Meiotic and mitotic cell divisions.

##### **Learning Outcome:**

- After the exposure of the current paper, students can identify different cellular activities and the basic ways that cells associate to form tissues.

**TEXT BOOKS:**

1. David E. Sadava, Cell biology: Organelle structure and functions, 1993, 1<sup>st</sup> edition, Jones Bartlett publishers, Massachusetts, United States.
2. Cooper. M, 1995, The cell molecular approach, 4<sup>th</sup> edition, ASM Press, Washington, United States.
3. Lewis J. Kleinsmith and Valerie M. Kish, 1997, Principle of cell and molecular biology, 2<sup>nd</sup> edition, AbeBooks, British Columbia, Canada.

**REFERENCE BOOKS:**

1. Eduardo D. P. De Robertis and Eduardo M. F. De Robertis, 1980, Cell and molecular biology, 7<sup>th</sup> edition, Saunders College, Philadelphia, United States.
2. Harvey Lodish, 1995, Molecular cell biology, 3<sup>rd</sup> edition, WH Freeman & Co (Sd) Ltd, New York, United States.

**WEB REFERENCE:**

1. [https://www.larberthigh.com/documents/%5B1405%5DUnit\\_1Cell\\_biology\\_summary\\_notes.pdf](https://www.larberthigh.com/documents/%5B1405%5DUnit_1Cell_biology_summary_notes.pdf)
2. <https://www.uou.ac.in/sites/default/files/slm/BSCZO-102.pdf>
3. <https://www.britannica.com/science/cell-biology>
4. <https://nios.ac.in/media/documents/SrSec314NewE/Lesson-04.pdf>

## **B.Sc., CLINICAL LABORATORY TECHNOLOGY**

### **SEMESTER – V**

#### **CORE PAPER – V: MEDICAL MICROBIOLOGY**

##### **COURSE OBJECTIVES**

- The student will be able to identify common infectious agents and the diseases that they cause.
- The student will be able to evaluate methods used to identify infectious agents in the clinical microbiology lab.
- The student will be able to recall microbial physiology including metabolism, regulation and replication.

##### **UNIT - I**

Infections associated with following Gram-positive bacteria – *Bacillus anthracis*, *Clostridium*, *Pneumococcus*, *Corynebacterium*, Streptococcal infections, Staphylococcal infections. Infections associated with following Gram - negative bacteria – Enterobacteriaceae – *Salmonella*, *Shigella*, *Klebsiella*, *Proteus*, *Yersinia* and *Escheichia*. *Vibrio*, *Pseudomonas*, *Neisseria*, *Haemophilus*, *Campylobacter*, *Bordetella*, *Brucella*.

##### **UNIT - II**

Infections associated with *Mycoplasma*, *Mycobacterium tuberculosis* and *Mycobacterium leprae*. Spirochetes – *Treponema*, *Borrelia* and *Leptospira*. Actinomycetes. Rickettsiae and Chlamydiae.

##### **UNIT - III**

Dermatophytes and agents of superficial mycoses. Trichophyton, Epidermophyton and Microsporum. Opportunistic mycoses - Candidiasis, Cryptococcosis, Aspergillosis. Systemic mycoses - Histoplasmosis, Coccidioidomycosis, Blastomycosis. Subcutaneous mycoses- Sporotrichosis, Mycetoma

##### **UNIT - IV**

Pox viruses - Variola, Herpes viruses - Herpes Simplex Virus, Cytomegalo Virus, Epstein Barr Virus. Adena viruses, Hepatitis viruses, Papova viruses, Papilloma, Polyoma, Parvo virus, Retro virus - HIV. Picorna viruses - Polio, Rhino virus, Orthomyxovirus - Influenza, Paramyxo virus- Parainfluenza, Mumps, Measles, Rhabdo virus, Rota virus.

##### **UNIT - V**

Arbo viruses: Flavi viruses - Yellow fever viruses - Dengue virus - Chickungunya virus - Japanese encephalitis virus. Emerging viral diseases. Viral vaccines and immunization schedules. Antiviral agents.

**COURSE OUTCOME:**

- This course provides learning opportunities in the basic principles of medical microbiology and infectious disease.
- It covers mechanisms of infectious disease transmission, principles of aseptic practice, and the role of the human body's normal microflora.
- The course provides the conceptual basis for understanding pathogenic microorganisms and the mechanisms by which they cause disease in the human body.
- It also provides opportunities to develop informatics and diagnostic skills, including the use and interpretation of laboratory tests in the diagnosis of infectious diseases.

**TEXT BOOKS:**

1. Mandel G. L, Bennet J. E and Dolin R, 1995, Principles and practice of infectious disease, 4<sup>th</sup> edition, Churchill Livingstone. New York, United States.
2. Conrat H. F, Kimball P. C and Levy J. A, 1988, Virology, 2<sup>nd</sup> edition. Prentice Hall, Englewood Cliff, New Jersey, United States.
3. Timbury M. C, 1986, Medical Virology, 9<sup>th</sup> edition, Churchill Livingstone, London, United Kingdom.
4. Topley & Wilson, 1990, Principles of Bacteriology, Virology and Immunity, 8<sup>th</sup> edition, Edward Arnold, London, United Kingdom.
5. Luria S. E, Darnel J. E, Jr Baltimore D and Campbell A, 1978, General Virology, 3<sup>rd</sup> edition, John Wiley & Sons, New York, United States.

**REFERENCE BOOKS:**

1. Hayes W, 1968, The Genetics of Bacteria and their Viruses, Blackwell Scientific Publications, London, United Kingdom.
2. Bridge E. A, 1994, Bacterial and Bacteriophage Genetics, 3<sup>rd</sup> edition, Springer-Verlag, New York, United States.
3. Lennette E. H, 1974, Diagnostic Procedures for Viral and Rickettsial Diseases. American Public Health Association, New York, United States.
4. Hoeprich P. D, 1977, Infectious Diseases, 2<sup>nd</sup> edition, Harper & Row Publishers, New York, United States.
5. Roger Hull, 2002, Mathews' Plant Virology, 4<sup>th</sup> edition, Academic press-A Harcourt Science and technology company, New York, United States.

**WEB REFERENCE:**

1. [https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture\\_notes/env\\_occupational\\_health\\_students/medicalbacteriology.pdf](https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture_notes/env_occupational_health_students/medicalbacteriology.pdf)
2. <https://uploads.documents.cimpress.io/v1/uploads/3375e83a-3bb4-45de-ab68-fbc20df5db80~110/original?tenant=vbu-digital>
3. <https://www.studocu.com/en-au/document/university-of-southern-queensland/medical-microbiology-and-immunology-1/lectures-notes-1-to-23/319412>
4. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2158889/>
5. <https://bjgp.org/content/28/195/634.3>

# **B.Sc., CLINICAL LABORATORY TECHNOLOGY**

## **SEMESTER – V**

### **CORE PAPER – VI: PARASITOLOGY**

#### **COURSE OBJECTIVE**

The students acquire knowledge on parasitic infections and their manifestations.

#### **UNIT - I**

Introduction to Medical Parasitology – General characters & Classification of medically important human parasites. Morphology, transmission, lifecycle and laboratory diagnosis of Protozoans – *Entamoeba* – *Plasmodium*, *Toxoplasma*, *Leishmania* – *Trypanosoma* – *Giardia* – *Trichomonas* – *Balantidium*.

#### **UNIT - II**

Platyhelminthes – Morphology, transmission, lifecycle and laboratory diagnosis of *Taenia* – *Fasciola* – *Paragonimus* – *Schistosoma*.

#### **UNIT-III**

Nematoda: Morphology, transmission, lifecycle and laboratory diagnosis of Nematoda – *Ascaris* – *Ankylostoma* – *Enterobius* – *Trichuris* – *Trichinella* – *Wuchereria* – *Dracunculus*.

#### **UNIT-IV**

Introduction to Arthropoda – General characteristics of arthropods and its importance in medical parasitology. Classification of medically important arthropods, General characters & medical importance of vectors: Mosquitoes, fleas, lice, ticks, mites and housefly.

#### **UNIT-V**

Laboratory techniques in parasitology. Safety measures in parasitology lab. Examination of faeces for ova and cysts – Concentration methods. Blood smear examination for parasites. Culture of protozoan parasites

#### **COURSE OUTCOME:**

- Parasitic interaction with the host.
- Pathogenicity and life cycle of parasites.
- Laboratory diagnosis of pathogenesis.

**TEXT BOOKS:**

1. Subhas Chandra Parija, 2013, Textbook of Medical Parasitology, 4<sup>th</sup> edition, All India publishers and distributors, New Delhi, India.
2. Ananthanarayan R and Paniker C. K. J, 2009, Textbook of Microbiology, 8<sup>th</sup> edition, University Press Publication, Oxford, United Kingdom.
3. Chatterjee K.D, 2019, Textbook of Parasitology, 13<sup>th</sup> edition, CBS publishers and distributors, New Delhi, India.
4. Jayaram paniker, 2021, Medical parasitology, 9<sup>th</sup> edition, Jaypee Brothers, New Delhi, India.

**REFERENCE BOOKS:**

1. Patrick R. Murray and Ellen Jo Baron, 2007, Manual of Clinical Microbiology, 9<sup>th</sup> edition, ASM Press, Washington, United States.
2. Pelzar J, 2001, Microbiology, 5<sup>th</sup> edition, Himalaya Publishing House, Mumbai, India.
3. Brooks G. F, Carroll K. C, Butel J. S, Morse S. A and Mietzner T. A, 2013, Medical Microbiology, 26<sup>th</sup> edition, Scientific research, Wuhan, China.
4. Adelberg, 2019, Medical Microbiology. 28<sup>th</sup> edition. McGraw Hill Publication, New York, United States

**WEB REFERENCE:**

1. <https://microbenotes.com/category/parasitology/>
2. [https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture\\_notes/med\\_lab\\_tech\\_students/ln\\_parasitology\\_final.pdf](https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture_notes/med_lab_tech_students/ln_parasitology_final.pdf)
3. [https://ksumsc.com/download\\_center/Archive/2nd/427/Term%20II/Microbiology/Girls/Parasitology%20Lecture%20Notes%281%29.docx](https://ksumsc.com/download_center/Archive/2nd/427/Term%20II/Microbiology/Girls/Parasitology%20Lecture%20Notes%281%29.docx)
4. [https://www.researchgate.net/publication/326803716\\_lecture\\_notes](https://www.researchgate.net/publication/326803716_lecture_notes)
5. <https://nios.ac.in/media/documents/dmlt/Microbiology/Lesson-37.pdf>



## **B.Sc., CLINICAL LABORATORY TECHNOLOGY**

### **SEMESTER – V**

#### **CORE PAPER – VII: CLINICAL LABORATORY TECHNOLOGY**

##### **COURSE OBJECTIVE**

To learn about the techniques and methods used in a clinical laboratory.

##### **UNIT - I**

Clinical pathology - Urine examination - Physical, Chemical & Microscopic, Examination of body fluids - cell counts, Semen analysis, CSF (Cerebrospinal Fluid), Stool Examination.

##### **UNIT - II**

Blood Bank Procedures - Principles and practice of - Blood Grouping, Blood Transfusion, Blood Donation, Blood Collection, Storage & Transport, Maintenance of Blood Bank Records, Compatibility Testing, Blood Components, Blood Transfusion Reactions

##### **UNIT - III**

Principle and methods of staining of Blood smears and bone marrow smears. Supravital stain. Reticulocyte count. Heinz bodies. Thrombocytopenia, thrombocythemia, platelet function test, platelet count. Clot retraction test. Platelet factor III Test.

##### **UNIT- IV**

Overview of approaches to clinical laboratory automation and its goal- general concepts used in automated instruments and specific applications of these concepts to selected instruments. Criteria to be used in evaluating and selecting appropriate laboratory instrumentation.

##### **UNIT - V**

Definition and concepts of reference values and related terminology, criteria for specimen collection and procedure for collecting data. Analytical goals. Performance criteria for laboratory tests, Clinical relevance - appropriate and optional use of laboratory and data generation.

##### **COURSE OUTCOME**

- Learn about the basic clinical test in a laboratory.
- Automated techniques and laboratory management.
- Clinical relevance of laboratory tests.

**TEXT BOOKS:**

1. Mukherjee K. L, 2017, Medical Laboratory Technology, Procedures Manual for Routine Diagnostic Tests, 3<sup>rd</sup> edition, McGraw Hill Education, Tennessee, United States.
2. Harold Varley, 2005, Practical Clinical Biochemistry, 4<sup>th</sup> edition, A manual of laboratory Diagnostic tests Fischback c) Practical clinical Biochemistry, CBS, Karnataka, India.
3. Burtis, 2012, Tietz's Text book of Clinical Chemistry and Molecular Diagnostics, 5<sup>th</sup> edition, Elsevier, Amsterdam, Netherlands.
4. Kalpan, 2003, Clinical chemistry – Theory, Analysis, Correlation, 4<sup>th</sup> edition, CBS Publishers and Distributors Pvt. Ltd, Bangalore, India.

**REFERENCE BOOKS:**

1. West & Todd, 1966. Text Book of Biochemistry, 4<sup>th</sup> Edition, Macmillan, New York City, United States.
2. Sood Ramnik, 2015, Text book of Medical Laboratory Technology, 2<sup>nd</sup> edition, Jaypee Brothers Medical Publishers Pvt Ltd, New Delhi, India.
3. Thomas M. Devlin, 2010, Text book of Biochemistry with clinical correlation, 7<sup>th</sup> edition, John Wiley & Sons, New Jersey, United States.
4. Harold Varley, 2005, Practical Clinical Biochemistry, 4<sup>th</sup> edition, A manual of laboratory Diagnostic tests Fischback c) Practical clinical Biochemistry, CBS, Karnataka, India.

**WEB REFERENCE:**

1. <https://www.studocu.com/en-gb/document/university-of-nottingham/clinical-laboratory-sciences-i/complete-lecture-notes-clinical-laboratory-sciences-cls/132920>
2. [https://www.academia.edu/32040390/LECTURE\\_NOTES\\_For\\_Medical\\_Laboratory\\_Students](https://www.academia.edu/32040390/LECTURE_NOTES_For_Medical_Laboratory_Students)
3. [https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture\\_notes/med\\_lab\\_tech\\_students/medicallabtechnology.pdf](https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture_notes/med_lab_tech_students/medicallabtechnology.pdf)
4. <https://www.studypool.com/documents/4702704/medical-laboratory-technology-lecture-notes>
5. <https://fddocuments.in/download/for-medical-laboratory-technology-students-lecture-notes-for-medical-laboratory>

## **B.Sc., CLINICAL LABORATORY TECHNOLOGY**

### **SEMESTER – V**

#### **ELECTIVE – I: DRUG BIOCHEMISTRY**

##### **COURSE OBJECTIVE**

This course focuses on the chemical principles and concepts used in drug discovery based on human ethics.

##### **UNIT-I**

Introduction to drugs, classification of drugs, passage of drugs across biological membrane, absorption and distribution of drugs, binding of drugs to plasma proteins. Drug receptor interaction and its consequences, binding forces in drug - types of receptors, receptor theories.

##### **UNIT-II**

Drug metabolism and elimination- Metabolism via hydroxylation, conjugation, deamination, N-oxidation, azo and nitro reduction, non-microsomal oxidation, oxidative deamination, purine oxidation, dehalogenation, hydrolysis, action of choline esterase, Elimination of drugs from the body with reference to renal system.

##### **UNIT-III**

Chemotherapy- Mode of action of sulfonamides, antimetabolites of folate, purines and pyrimidines, Antibacterials - mode of action and resistance to penicillin, streptomycin, tetracycline. chloramphenicol. Antiviral, antimalarials, and anti TB drugs.

##### **UNIT-IV**

Drugs acting on CNS and cardiovascular system. Action of barbiturates, salicylates, MAO inhibitors, drugs for Parkinson disease. Cardiovascular disease: Structure and mode of action of cardiac glycosides, Heparin and Coumarin.

##### **UNIT-V**

Drugs of plant origin - Drug dependence and abuse - Management of self poisoning, cancer. Cytotoxic drugs, immunosuppressive drug therapy. Narcotics - definition, types and effects on human body

##### **COURSE OUTCOME:**

- Development of the traditional and modern methods used for drug discovery; of
- Interaction of drug molecules in the human body.
- Concept of psychoactive drug and its effects.

**TEXT BOOKS:**

1. Satoskar R. S, Bhandakar S. D and Ainapure S. S, 1995, Pharmacology and Pharmacotherapeutics, 14<sup>th</sup> edition, Popular Prakashan, Bombay, India.
2. Mukesh Bhatia, 2022, Medicine simplified, 10<sup>th</sup> edition, Harrison Publishing House, New Hampshire, united States.
3. Bhise S. B, Bhise M. S and Ishan Panchal, 2020, Biochemistry for pharmacist, 2<sup>nd</sup> edition, Nirali Prakashan, Pune, India.

**REFERENCE BOOKS:**

1. Willam Foye, 1986, Principles of Medicinal Chemistry, 3<sup>rd</sup> edition, Lippincott Williams and Wilkins, Philadelphia, United States.
2. Patrik L. Grahm, 2013, An Introduction to Medicinal Chemistry, 5<sup>th</sup> edition, Oxford University Press, United Kingdom.

**WEB REFERENCE:**

1. <https://www.intechopen.com/chapters/41543>
2. <https://www.hktechnical.com/2020/04/bp203t-pharmaceutical-biochemistry.html>
3. [http://www.actabp.pl/pdf/Supl4\\_10/S4.pdf](http://www.actabp.pl/pdf/Supl4_10/S4.pdf)

## **B.Sc., CLINICAL LABORATORY TECHNOLOGY**

### **SEMESTER – VI**

#### **SBEC – III: CLINICAL SOCIOLOGY AND ETHICS**

##### **COURSE OBJECTIVE:**

The students will be made aware of the basic ethics, good lab practices including awareness/ safety in a clinical lab.

##### **UNIT - I**

Ethical Principles and standards for a clinical laboratory professional duty to the patient, duty to colleagues and other professionals, Good Laboratory Practice (GLP), Introduction to Basics of GLP and Accreditation, Aims of GLP and Accreditation, Advantages of Accreditation, Brief knowledge about National and International Agencies for clinical laboratory accreditation

##### **UNIT - II**

Awareness / Safety in a clinical laboratory, General safety precautions. Contagious and non-contagious disease sample: pre- and post-exposure guidelines, Hepatitis B & C: pre- and post-exposure guidelines, Drug Resistant Tuberculosis Patient management for clinical samples collection, transportation and preservation, Sample accountability, Purpose of accountability, Methods of accountability

##### **UNIT - III**

Sample analysis: Introduction, factors affecting sample analysis, reporting results, basic format of a test report, reported reference range, clinical alerts, abnormal results, results from referral laboratories, release of examination results, alteration in reports

##### **UNIT - IV**

Quality Management system: Introduction, Quality assurance, Quality control system, Internal and External quality control, quality control chart. Biomedical Introduction and importance of calibration and Validation of Clinical Laboratory instrumentation.

##### **UNIT - V**

Ethics in Medical laboratory Practice, Ethics in relation to Pre - Examination procedures, Examination procedures, reporting of results, preserving medical records Procurement of equipment and Inventory Control. Audit in a Medical Laboratory, Introduction and Importance, NABL & CAP, Responsibility, Planning, Horizontal, Vertical and Test audit, Frequency of audit, Documentation

**COURSE OUTCOME:**

- Students would be competent enough to understand sample accountability, quality management system, biomedical waste management, calibration and validation of clinical laboratory instruments, Laboratory Information system (LIS), Hospital Information system (HIS) and financial management.

**TEXT BOOKS:**

1. Teitz, 2007, Fundamentals of Clinical Chemistry, 6<sup>th</sup> edition, Elsevier Publications, Amsterdam, Netherlands.
2. Bishop, 2013, Clinical Chemistry, 7<sup>th</sup> edition, Wiley Publications, New Jersey, United States.

**REFERENCE BOOKS:**

3. Henry, 2011, Clinical Diagnosis and Management by Laboratory Methods, 22<sup>nd</sup> edition, Elsevier Publications, Amsterdam, Netherlands.

**WEB REFERENCE:**

1. <https://revisesociology.com/2017/06/16/experiments-sociology-revision-notes/>
2. <https://revisesociology.com/2020/07/26/laboratory-experiments-sociology/>
3. [https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture\\_notes/health\\_science\\_students/ln\\_sociology\\_final.pdf](https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture_notes/health_science_students/ln_sociology_final.pdf)

**B.Sc., CLINICAL LABORATORY TECHNOLOGY**  
**SEMESTER – VI**  
**CORE PAPER – VIII: MEDICAL BIOCHEMISTRY**

**COURSE OBJECTIVE:**

- This paper is framed to provide basic knowledge on Medical Biochemistry.
- Endocrinology involves the evaluation and management of disorders of the body's glands, hormonal secretions, and resultant changes in body metabolic activity.
- Describe an example of how a single bioregulator can have overlapping functional roles.

**UNIT - I**

Introduction to metabolic disorders- disorders of carbohydrate, lipid and protein metabolism. Disorders of endocrine system.

**UNIT - II**

Organ Function Tests- Liver Function Tests, Renal Function Tests, Thyroid function tests and Pancreatic Function tests

**UNIT - III**

Cardiac Profile - Hypertension, Angina, Myocardial Infarction. Pattern of Cardiac Enzymes in heart diseases. Diabetic Profile - Regulation of Blood Glucose, Glucose tolerance test, Glycosylated Hemoglobin, Microalbuminuria etc.

**UNIT - IV**

Infertility profile: LH, FSH, TSH, Estrogen, Progesterone, Total Testosterone, Free testosterone, DHEA-S, 17- Ketosteroids, Prolactin, their estimation and clinical significance, reference range, hypo and hyper secretion, Triple Test

**UNIT - V**

Thyroid function test: Thyroid hormones, biological function, hypothyroidism, hyperthyroidism, Determination of T3, T4, TSH, FT3, FT4, TBG, Disorder associated with thyroid dysfunction.

**COURSE OUTCOME:**

- After the exposure of the current paper students would be able to detect the metabolic disorders and basis of endocrine disorders.
- Clinical outcomes are broadly agreed, measurable changes in health or quality of life that result from our care.

- Constant review of our clinical outcomes establishes standards against which to continuously improve all aspects of our practice.

### **TEXT BOOKS:**

1. Vasudevan D. M, 2011, Text book of Medical Biochemistry, 6<sup>th</sup> edition, Jaypee Publishers, New Delhi, India.
2. Chatterjee M. N & Rana Shinde, 2012, Text book of Medical Biochemistry, 8<sup>th</sup> edition, Jaypee Publications, New Delhi, India.
3. Singh & Sahni, 2008, Introductory Practical Biochemistry, 2<sup>nd</sup> edition, Alpha Science, New Delhi, India.
4. Elsevier Publications, Amsterdam, Netherlands.
5. David G. Gardner, Dolores Shoback, 2017, Greenspan's Basic and Clinical Endocrinology, 10th edition, McGraw Hill, New York, United States.

### **REFERENCE BOOKS:**

1. Teitz, 2007, Fundamentals of Clinical Chemistry, 6<sup>th</sup> edition, Elsevier Publications, Amsterdam, Netherlands.
2. Bishop, 2013, Clinical Chemistry, 7<sup>th</sup> edition, Wiley Publications, New Jersey, United States.
3. Lehninger, 2013, Principles of Biochemistry, 6<sup>th</sup> edition, WH Freeman & Co (Sd) Ltd, New York, United States.

### **WEB REFERENCE:**

1. <https://www.mednotes.in/2019/10/biochemistry.html>
2. [http://www.freebookcentre.net/medical\\_books\\_download/Medical-Biochemistry-Lecture-Notes.html](http://www.freebookcentre.net/medical_books_download/Medical-Biochemistry-Lecture-Notes.html)
3. <https://www.studocu.com/en-gb/document/university-of-york/molecular-biology-biochemistry/medical-biochemistry-lecture-notes-biochem/1573352>
4. <https://www.jaypeedigital.com/book/9788180615382>
5. <https://www.googleadservices.com/pagead/aclk>



# **B.Sc., CLINICAL LABORATORY TECHNOLOGY**

## **SEMESTER – VI**

### **CORE PAPER - IX: IMMUNOLOGY**

#### **COURSE OBJECTIVE**

To understand the basic concepts of immune mechanisms taking place through host antigen interactions and the functions of immune system.

#### **UNIT- I**

History of immunology, types of immunity – Innate and acquired immunity, Physiology of immune response – Humoral immune response and cell mediated immune response, cells and organs of immune system.

#### **UNIT – II**

Antigen – types, properties and functions, Immunoglobulin – types, structure and function, monoclonal and polyclonal antibody production

#### **UNIT - III**

Antigen – antibody interactions: agglutination and precipitation reactions, Enzyme immune assay, Radio immune assay, Immunofluorescence, complement fixation, immunoelectrophoresis. Immunohaematology – ABO blood groups and RH incompatibility.

#### **UNIT - IV**

Complement pathways. Hypersensitivity reactions. Autoimmune disorders. Transplantation immunology. HLA tissue typing – Types and structure of Major histocompatibility complex.

#### **UNIT - V**

Principles and types of Vaccines. Vaccination - its rationale, vaccination schedules and importance of vaccination in public health

#### **COURSE OUTCOME:**

- The foundation for the future subjects in immunology.
- Basic terminology and techniques in immunology.
- How immune system is important to the humans.

#### **TEXT BOOKS:**

1. Chapel, H and Halbey, 1986, Essentials of Clinical Immunology. ELBS, London, United Kingdom.
2. Tizard R. I, 1983, Immunology: An Introduction. Saunders College Publishing, Philadelphia, United States.
3. Kuby J, 1994, Immunology, 2<sup>nd</sup> edition, HW Freeman and Company, New York, United States.

4. Elgert K. D, 1996, Immunology: Understanding the Immune System, Wiley – Liss, New York, United States.
5. Donald M. Weir and John Steward, 1993, Immunology, 7<sup>th</sup> edition, ELBS, London, United Kingdom.
6. Hue Davis, 1997, Introductory Immunology, 1<sup>st</sup> edition, Chapman & Hall Publisher, London, United Kingdom.
7. Ivan M. Roit, 1994, Essential Immunology, Blackwell Scientific Publications, Oxford, United Kingdom.
8. Paul, 1998, Fundamental Immunology, 2<sup>nd</sup> edition, Raver Press, New York, United States.

#### **REFERENCE BOOKS:**

1. Peter J. Delves, Ivan M. Roit, 1998, Academic Press Encyclopedia of Immunology – 2<sup>nd</sup> edition, Elsevier Publications, Amsterdam, Netherlands.
2. Ridklad M. Aydl, 1995, Immunology, 2<sup>nd</sup> edition, NMS Publication, Tamil Nadu, India.
3. Roitt J. M, Brostaff J. J and Male D. K, 1996, Immunology, 4<sup>th</sup> edition, C.V. Mosby Publisher, St. Loius Missouri, United States.
4. Peter J. Delves, Ivan M. Roit, 2020, Essential Immunology, 18<sup>th</sup> edition, Blackwell Scientific Publications, Oxford, United Kingdom.
5. Abdul K. Abbas, 2020, Basic Immunology, 6<sup>th</sup> edition, Elsevier Publications, Amsterdam, Netherlands.
6. Janeway Travers, 1997, Immuno biology, 3<sup>rd</sup> edition, Current Biology Ltd, London, United States.
7. Somnath De, 2000, Instant notes on Immunology, EduPedia Publication Pvt Ltd, New Delhi, India.
8. Mark Peakman and Diego Vergani, 2009, Basic and Clinical Immunology, 2<sup>nd</sup> edition, Elsevier Publications, Amsterdam, Netherlands.
9. Richard M. Hyde, 1995, Immunology, 3<sup>rd</sup> edition, Harvard Publishing Company, Massachusetts, United States.
10. Clark W. R, 1991, The experimental foundations of Modern Immunology, John Wiley and Sons Inc. New York, United States.

#### **WEB REFERENCE:**

1. <http://www.helmberg.at/immunology.pdf>
2. <https://www.studocu.com/en-gb/document/imperial-college-london/medicine/immunology-notes-from-year-1/964032>
3. <https://ocw.mit.edu/courses/hst-176-cellular-and-molecular-immunology-fall-2005/pages/lecture-notes/>
4. [https://hmmcollege.ac.in/uploads/3\\_Immunology.pdf](https://hmmcollege.ac.in/uploads/3_Immunology.pdf)
5. [http://repository.stikesbcm.ac.id/id/eprint/168/1/books\\_5453\\_0.pdf](http://repository.stikesbcm.ac.id/id/eprint/168/1/books_5453_0.pdf)
6. <https://www.googleadservices.com/pagead/aclk>

## **B.Sc., CLINICAL LABORATORY TECHNOLOGY**

### **SEMESTER – VI**

#### **CORE PAPER – X: RECENT ADVANCES IN MEDICAL PHYSIOLOGY**

##### **COURSE OBJECTIVE:**

This syllabus introduces advanced techniques related to medical physiology.

##### **UNIT- I**

Recent advances in medical physiology- introduction - advanced techniques in medical physiology. Respiratory system - pulmonary ventilation. Respiratory insufficiency - pathophysiology, diagnosis, oxygen therapy- respiration in deep-sea diving and hyperbaric conditions.

##### **UNIT - II**

Cardiovascular system- rhythmical excitatory and conductive system of heart. CPR, ECG, PFT, cardiac arrhythmias and electrocardiographic findings in cardiac and systemic disease, Sonography.

##### **UNIT - III**

Electrophysiology- EMV & NCV- principles and applications, Repetitive nerve stimulation. ECG and EEG patterns, Polysomnography, NMR, MRI – principles and advantages.

##### **UNIT - IV**

Blotting techniques, southern blotting and Western blotting. Introduction to chromosomes – structural and numerical disorders, Karyotyping, Chromosomal studies in hematological disorders (PBLC and Bone marrow), FISH.

##### **UNIT - V**

Radioisotopes and its application in measurement of blood volume, determination of red cell volume and plasma volume, red cell life span, platelet life span, radiation hazards and its prevention disposal of radioactive material. Introduction and applications of Flow cytometry, Stem cell banking, Prenatal Diagnosis.

**COURSE OUTCOME:** Students will take up advanced studies in medical physiology and the techniques involved.

##### **TEXT BOOKS:**

1. Misra U. K, 2018, Clinical Electronecephalography, 2<sup>nd</sup> edition, Elsevier, New Delhi, India.

2. J. L. Jain, Nitin Jain, & Sunjay Jain, 2020, Fundamentals of Biochemistry, 7th Edition, S. Chand & Company Put Ltd, Coimbatore, India.
3. Singh & Sawhney, 2009, Introductory Practical Biochemistry, 2<sup>nd</sup> edition, Alpha Science, New Delhi, India.
4. Teitz, 2007, Fundamentals of Clinical Chemistry, 6<sup>th</sup> edition, Elsevier Publications, Amsterdam, Netherlands.
5. Richard A. McPherson and Matthew R. Pincus, 2011, Henry's Clinical Diagnosis and Management by Laboratory Methods, 22<sup>nd</sup> edition, Elsevier Publications, Amsterdam, Netherlands.

#### **REFERENCE BOOKS:**

1. Lehninger, 2013, Principles of Biochemistry, 6<sup>th</sup> edition, WH Freeman & Co (Sd) Ltd, New York, United States.
2. Jun Kimura, 2014, Electro diagnosis in disease of nerve and muscles. Principles and practice, 4<sup>th</sup> edition, F.A. Davis Company, Pennsylvania, United States.
3. Willam, 1997, Ganong's Review of Medical Physiology, 18<sup>th</sup> edition, McGraw Hill Education Lange, New York City, United States.

#### **WEB REFERENCE:**

1. <https://journals.physiology.org/toc/advances/41/1>
2. <https://www.medicalnewstoday.com/articles/248791>
3. <https://www.routledge.com/Advances-in-Medical-Biochemistry-Genomics-Physiology-and-Pathology/Bawa-Chang-Audette-Diwan-Faiz/p/book/9789814877442>
4. <https://www.nature.com/articles/119596a0>

## **B.Sc., CLINICAL LABORATORY TECHNOLOGY**

### **SEMESTER – VI**

#### **ELECTIVE – II : CLINICAL NUTRITION**

##### **COURSE OBJECTIVE:**

To understand and learn about the importance of nutrition in overall metabolism of the body and related life style disorder.

##### **UNIT - I**

Introduction to Nutrition- definition, types, food as a source of nutrients, balanced diet and its importance, adequate, optimum and good nutrition, malnutrition. Nutrition and health, Antioxidants. Diet therapy- purpose of therapeutic diets, modification of normal diet, Routine hospital diets – Clear fluid, full fluid diet, soft diet, regular diet. Enteral and Parenteral Nutrition.

##### **UNIT - II**

Hypertension – Prevalence, Aetiology, Symptoms, Dietary management Cardiovascular Diseases – Prevalence, Clinical effects, Risk factors, Role of fat in the development of atherosclerosis, Dietary management

##### **UNIT - III**

Diabetes Mellitus - Prevalence, types, aetiology and symptoms, Diagnosis, Dietary management, Food exchange list.

##### **UNIT- IV**

Cancer- Risk factors and Symptoms, Nutritional requirements and Dietary management, Role of food in the prevention of cancer. Autoimmune diseases

##### **UNIT - V**

Kidney – Functions, Symptoms and Principles of dietary management –Glomerulonephritis, Nephrosis, Acute renal failure, Chronic renal failure, Dialysis, Renal transplant, Urinary calculi

##### **COURSE OUTCOME:**

The students will gain knowledge on

- The definition, importance, concepts of nutrition, and therapeutic nutrition.
- Lifestyle disorders and their prevention.

##### **TEXT BOOK:**

1. B.Srilakshmi, 2019, Dietetics, 8<sup>th</sup> edition, New Age International (P) Ltd, New Delhi, India.
2. Michael Zimmerman, 2011, Handbook of Nutrition, Micronutrients in Prevention and Therapy of Disease, 1<sup>st</sup> edition, Thieme Medical and Scientific Publishers Ltd, Uttar Pradesh, India.

3. Antia F. P and Philip Abraham, 1997, Clinical Nutrition & Dietetics, 4<sup>th</sup> edition, Oxford University Press, New Delhi, India.
4. Roach Benyan, 2003, Metabolism and Nutrition, 2<sup>nd</sup> edition, Elsevier Science Ltd. Philadelphia. United States.
5. Susan G. Dudek, 2007, Nutrition Essentials for Nursing Practice, 9<sup>th</sup> edition, Lippincot Willeams d Wilkias, Philadelphia, United States.
6. Swaminathan M, 1991, Advanced Text Book on Food & Nutrition, 2<sup>nd</sup> edition, Bangalore printing & Publishing Ltd, Karnataka, India.

#### **REFERENCE BOOKS:**

1. Kathleen Mahan, 2000, Food, Nutrition & Diet Therapy 11<sup>th</sup> edition, W.B. Saunder's Company London, United Kingdom.
2. Scrimshaw N. S and Gleason G. R, 1992, Assessment Procedures. Qualitative Methodologies for Planning and Evaluation of Health related Programmes, International Nutrition foundation for Developing Countries, Boston, United States.
3. Anderson L, Dibble M. V, Tukki, P. R, Mitchall H. S and Rynbergin H. J, 1982, Nutrition in Health and Disease, 17<sup>th</sup> edition, J. B. Lipincott & Co. Philadelphia, United States.
4. Robinson C. H, Lawler M. R, Chenoweth W. L and Garwick A. E, 1986, Normal and Therapeutic Nutrition, 17<sup>th</sup> edition, Mac Milan Publishing Co, New York, United States.
5. Willam Foye, 1986, Principles of Medicinal Chemistry, 3<sup>rd</sup> edition, Lippincott Williams and Wilkins, Philadelphia, United States.

#### **WEB REFERENCE:**

1. <https://cctbnd.files.wordpress.com/2015/08/clinical-nutrition-lecture-note-1.pdf>
2. <https://www.subhartidde.com/slms/M.Sc%20-202%20Clinical%20and%20Therapeutic%20Nutrition.pdf>
3. [https://wisconsinchiropractic.site-ym.com/resource/resmgr/convention/Nutrition\\_1\\_Part\\_1.pdf](https://wisconsinchiropractic.site-ym.com/resource/resmgr/convention/Nutrition_1_Part_1.pdf)
4. [http://cbseacademic.nic.in/web\\_material/Curriculum20/publication/srsec/F&N\\_ClassXII\\_unitI.pdf](http://cbseacademic.nic.in/web_material/Curriculum20/publication/srsec/F&N_ClassXII_unitI.pdf)
5. <http://ecoursesonline.iasri.res.in/course/view.php?id=178>

## **B.Sc., CLINICAL LABORATORY TECHNOLOGY**

### **SEMESTER – VI**

#### **SEBC – IV: AUTOMATION AND DOCUMENTATION IN CLT**

##### **Course objective**

To enable the students learn about the automated techniques, report submission and maintenance of a laboratory.

##### **UNIT-I**

Quality Control- definition. Quality assurance in haematology, Sample collection-sample handling and preservation, Laboratory quality Control - Levey Jennings Chart, Safety measures in laboratory

##### **UNIT-II**

Automated techniques- importance and benefits of automation, Auto analysers, Electronic cell counter-Principle and application, Flow cytometry - Volume Histograms-Platelet indices

##### **UNIT- III**

Laboratory organization management – Personal safety measures-Laboratory safety . Handling equipments, Sample spills, Biohazards and infectious waste-Radioactive materials and radiation producing equipment- safety measures. Receiving specimens, storage and maintenance.

##### **UNIT-VI**

Sterilization- Principles and methods of sterilization, physical and chemical methods. Disinfectants - modes of action, testing of disinfectants. Basic solutions and reagents in a laboratory. Coagulants and Anticoagulants used in a laboratory

##### **UNIT-V**

Data maintenance- Maintenance of Lab record - Entering dates, table contents, essential parts of reports formal and informal reports. Referral range for clinical tests, Maintenance of equipments-calibration

##### **COURSE OUTCOME:**

- Maintaining a laboratory in a sterile and hygienic environment.
- Automated instruments used in a laboratory.
- Documentation, report maintenance and issue of reports.

**TEXT BOOK:**

1. Harold Varley, 2005, Practical Clinical Biochemistry, 4<sup>th</sup> edition, CBS Publication and Distributors, New Delhi, India.

**REFERENCE BOOK:**

2. Ramani Sood, 1995, Colour Atlas of Practical Pathology and Microbiology, 2nd edition, Jaypee Brothers Medical Publishers Pvt Ltd, New Delhi, India.

**WEB REFERENCE:**

1. <https://nios.ac.in/media/documents/dmlt/Biochemistry/Lesson-25.pdf>
2. <https://www.degruyter.com/document/doi/10.1515/tjb-2016-0234/html?lang=en>
3. <https://www.studocu.com/in/document/bharathiar-university/analytical-biochemistry/automation-in-clinical-laboratory/23443549>
4. <https://www.jprog.com/public/HI7%20Manuals/CH13%20Clinical%20Lab%20Automation.PDF>
5. <https://www.science.gov/topicpages/l/laboratory+automation+system>



## **B.Sc., CLINICAL LABORATORY TECHNOLOGY**

### **NMEC – I: BASICS OF NUTRITION**

#### **COURSE OBJECTIVE**

To gain knowledge on basic concept of nutrition science.

#### **UNIT - I**

History of Nutrition - Nutrition as science - Foods- Food groups – RDA - Food Guides - Food Pyramid - Balanced Diet - Limitations of daily food – Diet planning

#### **UNIT- II**

Carbohydrates- Classification- functions- sources, Dietary fiber. Disorders of carbohydrate metabolism - causes and symptoms.

#### **UNIT- III**

Units of energy - Measurement and energy value of food - Energy expenditure - Calorific value - Total energy / calorie requirement for different age groups, BMR, Energy imbalance – obesity - underweight.

#### **UNIT- IV**

Protein - Sources and function - Essential and non-essential amino acids, Incomplete and complete proteins Supplementary food. Nitrogen balance - Changes in the protein requirement. Fats - Functions and sources - Essential and Non - Essential fatty acids - Excess and deficiency disorders

#### **UNIT- V**

Vitamins - General functions-food sources - Fat and Water Soluble vitamins - Vitamin deficiency disorders. Minerals - General functions and sources - Macro and micro minerals - Excess and deficiency disorders.

#### **COURSE OUTCOME:**

- The students understand
- The importance of nutrients to the body.
- Deficiency disorders caused due to lack of proper diet.

**TEXT BOOKS:**

1. B.Srilakshmi (2017), Nutrition Science, Sixth edition, New Age International (P) Ltd, New Delhi, India.
2. Michael Zimmerman, 2011, Handbook of Nutrition, Micronutrients in Prevention and Therapy of Disease, 1<sup>st</sup> edition, Thieme Medical and Scientific Publishers Ltd, Uttar Pradesh, India.
3. Dietetics, B.Srilakshmi, 2019, 8<sup>th</sup> edition, New Age International (P) Ltd, New Delhi, India.
4. Antia F. P and Philip Abraham, 1997, Clinical Nutrition & Dietetics, 4<sup>th</sup> edition, Oxford University Press, New Delhi, India.
5. Roach Benyan, 2003, Metabolism and Nutrition, 2<sup>nd</sup> edition, Elsevier Science Ltd. Philadelphia. United States.
6. Susan G. Dudek, 2007, Nutrition Essentials for Nursing Practice, 9<sup>th</sup> edition, Lippincott Williams & Wilkins, Philadelphia, United States.

**REFERENCE BOOKS:**

1. Scrimshaw N. S and Gleason G. R, 1992, Assessment Procedures. Qualitative Methodologies for Planning and Evaluation of Health related Programmes, International Nutrition foundation for Developing Countries, Boston, United States.
2. Anderson L, Dibble M. V, Tukki, P. R, Mitchall H. S and Rynbergin H. J, 1982, Nutrition in Health and Disease, 17<sup>th</sup> edition, J. B. Lipincott & Co. Philadelphia, United States.
3. Robinson C. H, Lawler M. R, Chenoweth W. L and Garwick A. E, 1986, Normal and Therapeutic Nutrition, 17<sup>th</sup> edition, Mac Milan Publishing Co, New York, United States.
4. Willam Foye, 1986, Principles of Medicinal Chemistry, 3<sup>rd</sup> edition, Lippincott Williams and Wilkins, Philadelphia, United States.

**WEB REFERENCE:**

1. [https://med.libretexts.org/Courses/Dominican\\_University/DU\\_Bio\\_1550%3A\\_Nutrition\\_\(LoPresto\)/1%3A\\_Basic\\_Concepts\\_in\\_Nutrition/1.1%3A\\_Introduction\\_to\\_Nutrition](https://med.libretexts.org/Courses/Dominican_University/DU_Bio_1550%3A_Nutrition_(LoPresto)/1%3A_Basic_Concepts_in_Nutrition/1.1%3A_Introduction_to_Nutrition)
2. <https://www.eatrightpro.org/practice/practice-resources/international-nutrition-pilot-project/how-to-explain-basic-nutrition-concepts>
3. <https://mynutrition.wsu.edu/nutrition-basics>
4. <https://www.studocu.com/row/document/east-africa-institute-of-certified-studies/diploma-in-nutrition-and-dietetics/nutrition-notes/11011299>

## **B.Sc., CLINICAL LABORATORY TECHNOLOGY**

### **NMEC – II: TECHNIQUES IN CLINICAL LABORATORY TECHNOLOGY**

#### **COURSE OBJECTIVE**

This course presents the various clinical laboratory techniques and its interpretation.

#### **UNIT- I**

Blood group & Rh factor, Coomb's test – Direct / Indirect. Coagulation studies

#### **UNIT-II**

Estimation of Blood glucose, Glycosylated Hb, Fructosamine, Glucose tolerance test, Uric acid, Calcium, Phosphorous, CSF analysis, Electrolytes - Sodium, Potassium, Chloride and Bicarbonate, Serum protein electrophoresis.

#### **UNIT-III**

Profile - Liver function test, Renal function tests, Lipid profile.

#### **UNIT-IV**

Serodiagnostic procedures - Precipitation tests, VDRL test, Khan test, Immunodiffusion test, Agglutination test - Widal test.

#### **UNIT-V**

Complement fixation test- Wasserman test, Immunofluorescence test, FT A test, Enzyme linked immunosorbent assay HIV test, Hepatitis markers

#### **Course outcome:**

On completion of the course students gain knowledge on knowledge in clinical chemistry tests, microbiology and blood bank.

#### **TEXT BOOKS:**

1. Harold Varley, 2005, Practical Clinical Biochemistry, 4<sup>th</sup> edition, CBS Publication and Distributors, New Delhi, India.
2. Teitz, 2007, Fundamentals of Clinical Chemistry, 6<sup>th</sup> edition, Elsevier Publications, Amsterdam, Netherlands.

#### **REFERENCE BOOKS:**

1. Jacques Wallach, 1992, Interpretation of Diagnostic Tests - A Synopsis of Laboratory Medicine, 5<sup>th</sup> edition, Little Brown & Co, London, United Kingdom.
2. Hughes J and Jefferson A, 2008, Clinical Chemistry in Diagnosis & Treatment. Churchill Livingstone. New York, United States.

#### **WEB REFERENCE:**

1. <https://www.studocu.com/en-gb/document/university-of-nottingham/clinical-laboratory-sciences-i/complete-lecture-notes-clinical-laboratory-sciences-cls/132920>
2. <https://www.slideshare.net/HusseinAltameemi2/introduction-to-medical-laboratory-technology>
3. [https://nanohub.org/resources/27918/download/Clinical\\_Lab\\_MEMS\\_Presentation.pdf](https://nanohub.org/resources/27918/download/Clinical_Lab_MEMS_Presentation.pdf)

## **B.Sc., CLINICAL LABORATORY TECHNOLOGY**

### **SEMESTER: I**

#### **CORE PRACTICAL – I: GENERAL BIOCHEMISTRY**

1. Preparation of Molar, Normal and Percentage solutions.
2. Preparation of Buffers and determination of pH.
3. Handling of microscope- parts and uses
4. Qualitative Analysis of
  - Monosaccharides, Disaccharides and Polysaccharides
  - Aminoacids
  - Lipids
5. Quantitative Analysis
  - Determination of reducing sugar by Benedict's method - Titrimetric Analysis
  - Estimation of amino acid-Formal Titration
  - Estimation of Ascorbic acid using 2,6- dichlorophenol indophenol- Titrimetric Analysis
  - Estimation of Acid number of Edible oil.
  - Determination of saponification number of Edible oil.
  - Estimation of Iodine value of oil.

#### **TEXT BOOKS:**

1. Sadasivam S and Manickam A, 1992, Biochemical Methods, 2<sup>nd</sup> edition, New Age International Publishers, New Delhi, India.
2. Anil Kumar, Sarika Garg and Neha Garg, 2012, Biochemical tests - Principles and Protocols, Viva Books Pvt Ltd, Karnataka, India.

#### **REFERENCE BOOKS:**

1. Jayaraman J, 1981, Laboratory Manual in Biochemistry, Willey Eastern, New Delhi, India.
2. Plummer, 2000, Practical Biochemistry, Mcgraw Hill Publishing Company, New Delhi, India.

#### **WEB REFERENCE:**

3. [https://www.researchgate.net/publication/301647645\\_PRACTICAL\\_BIOCHEMISTRY](https://www.researchgate.net/publication/301647645_PRACTICAL_BIOCHEMISTRY)
4. <https://www.slideshare.net/sardar1109/biochemistry-lab-manual>

**B.Sc., CLINICAL LABORATORY TECHNOLOGY**  
**SEMESTER: II**  
**CORE PRACTICAL – II: ANALYTICAL TECHNIQUES**

1. To perform separation of amino acids by paper chromatography
2. To perform separation of amino acids by thin layer chromatography
3. To perform separation of DNA by Agarose gel electrophoresis.
4. Separation of protein by SDS PAGE
5. Separation of protein by paper electrophoresis

**TEXT BOOKS:**

1. Sherman R. E & Rhodes I, 1996, Analytical Instrumentation: Practical Guides for Measurement and Control. ISA publication, Kerala, India.
2. Cooper T. G, 1977, The Tools of Biochemistry, Wiley, New York City, United States.
3. Daniel M, 2007, Basic Biophysics for Biologist, Student Edition, Rajasthan, India.
4. Upadhay A, Upadhay K & Nath N, 2002, Biophysical Chemistry – Principles and Techniques, Himalaya Publishing House, Mumbai, India.
5. Marimuthu R, 2021, Microscopy and Microtechnique, Repro Books Ltd, Mumbai, India.

**REFERENCE BOOKS:**

1. Charles R, Cantor I & Schimmel P. R, 2004, Biophysical Chemistry, Part II, W.H.Freeman & Co, New York City, United States.
2. Campbell I. D, 2012, Biophysical Techniques, Oxford University Press, Oxford, United Kingdom

**WEB REFERENCE:**

1. <https://tk.elte.hu/dstore/document/871/book.pdf>
2. <https://tk.elte.hu/dstore/document/871/book.pdf>
3. <https://www.studocu.com/en-gb/course/university-college-london/biochemistry-and-molecular-biology/4531411>

## **B.Sc., CLINICAL LABORATORY TECHNOLOGY**

### **SEMESTER: I & II**

#### **ALLIED PRACTICAL – I: HUMAN ANATOMY, PHYSIOLOGY AND HISTOPATHOLOGY**

1. Demonstration of major organs through models and permanent slides.
2. Demonstration of
  - Circulatory system
  - Respiratory system
  - Skeletal and muscular system
  - Digestive system
  - Nervous system
  - Excretory and reproductive system
3. Structure of eye and ear.
4. Measurement of pulse rate and blood pressure.
5. Demonstration of ECG and EEG.
6. Identification of various blood cells.
7. Estimation of hemoglobin by Sahli's method.
8. Grossing of tissue
9. To perform tissue processing by manual method.
10. To perform section cutting of paraffin embedded tissue.
11. To perform hematoxylin and eosin staining.
12. To perform PAS staining.

#### **TEXT BOOKS:**

1. Rose & Wilson, 2014, Anatomy and Physiology in Health & Illness, 11<sup>th</sup> edition, Elsevier, Philadelphia, United States.
2. Gerald J. Tortora and Bryan H Derrickson, 2017, Principles of Anatomy and Physiology, 14<sup>th</sup> edition, Wiley publications, Massachusetts, United States.

#### **REFERENCE BOOKS:**

1. Guyton & Hall, 2011, Textbook of Medical Physiology, 12<sup>th</sup> edition. Saunders Elsevier, Philadelphia, United States.
2. Chaurasia B. D, 2016, Human Anatomy, 7<sup>th</sup> edition, CBS publishers, Karnataka, India.

#### **WEB REFERENCE:**

1. <http://anatomicalsciences.health.wits.ac.za/notices/ANAT2030/HISTOLOGY%20PRACTICAL%20Manual%20Part%201%202021.pdf>
2. <https://pharmacyinfoonline.com/human-anatomy-and-physiology-practical/>
3. [https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture\\_notes/nursing\\_students/ln\\_human\\_anat\\_final.pdf](https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture_notes/nursing_students/ln_human_anat_final.pdf)

## **B.Sc., CLINICAL LABORATORY TECHNOLOGY**

### **SEMESTER: III**

#### **CORE PRACTICAL – III: INTERMEDIARY METABOLISM**

1. Estimation of total protein- Bradford Method
2. Estimation of carbohydrate
3. Separation of lipids by paper chromatography.
4. Isolation of DNA.
5. Estimation of DNA.
6. Estimation of RNA.

#### **TEXT BOOKS:**

1. Sadasivam S and Manickam A, 1992, Biochemical Methods, 2<sup>nd</sup> edition, New Age International Publishers, New Delhi, India.

#### **REFERENCE BOOKS:**

1. Jayaraman J, 1981, Laboratory Manual in Biochemistry, Willey Eastern, New Delhi, India.
2. Plummer, 2000, Practical Biochemistry, McGraw Hill Publishing Company, New Delhi, India.

#### **WEB REFERENCE:**

1. <https://www.slideshare.net/sardar1109/biochemistry-lab-manual>
2. <https://skyfox.co/wp-content/uploads/2020/12/Practical-Manual-of-Biochemistry.pdf>
3. <https://jru.edu.in/studentcorner/lab-manual/bpharm/Lab%20Manual%20-%20Biochemistry.pdf>
4. <https://pharmacyinfoonline.com/biochemistry-practical/>

## **B.Sc., CLINICAL LABORATORY TECHNOLOGY**

### **SEMESTER: IV**

#### **CORE PRACTICAL – IV: CLINICAL BIOCHEMISTRY**

##### **URINE ANALYSIS**

- a) Estimation of Urea in urine by DAM–TSC method
- b) Determination of Creatine and Creatinine in urine – Alkali- Picrate method
- c) Estimation of Uric acid – Caraway's method
- d) Determination Chloride by VanSlyke's method
- e) Physical properties of urine: Microscopic and visual observation for normal and abnormal constituents, color, density, crystals and pH etc.

##### **1. Estimation of specific activity of**

- Acid phosphatases
- Alkaline phosphatases
- Alpha- Amylase
- CPK
- Cholinesterase
- SGOT
- SGPT

##### **2. Calorimetric analysis of**

- Fructose – Seliwanoff's method
- Ribose- Bial's method
- Protein - Biuret method
- Phosphorus – Fiske Subbarow method
- Iron – Wong's method.

##### **TEXT BOOKS:**

1. Harold Varley, 2005, Practical Clinical Biochemistry, 4<sup>th</sup> edition, CBS Publication and Distributors, New Delhi, India.
2. Singh & Sahni, 2008, Introductory Practical Biochemistry, 2<sup>nd</sup> edition, Alpha Science, New Delhi, India.
3. Sadasivam S and Manickam A, 1992, Biochemical Methods, 2<sup>nd</sup> edition, New Age International Publishers, New Delhi, India.



**REFERENCE BOOKS:**

1. Jayaraman J, 1981, Laboratory Manual in Biochemistry, Willey Eastern, New Delhi, India.
2. Raguhuramulu N, Madhavan Nair K and Kalayanasundaram S, 2003, A Manual of Laboratory Techniques, 2<sup>nd</sup> edition, National Institution of Nutrition, Hyderabad, India.

**WEB REFERENCE:**

1. <https://ttk.elte.hu/dstore/document/871/book.pdf>
2. <https://pharmacyinfo.com/biochemistry-practical/>  
<https://jru.edu.in/studentcorner/lab-manual/bpharm/Lab%20Manual%20-%20Biochemistry.pdf>

## **B.Sc., CLINICAL LABORATORY TECHNOLOGY**

### **SEMESTER: III & IV**

#### **ALLIED PRACTICAL - II: GENERAL MICROBIOLOGY AND HAEMATOLOGY**

1. Handling and Maintenance of bright held microscopy
2. Micrometry- measurement of micro organism
3. Motility determination — hanging drop method
4. Staining Techniques-
  - Simple Staining
  - Gram staining
  - Acid — fast Staining
  - Spore Staining-
  - Negative staining
5. Media Preparation
  - Liquid media
  - Solid media
  - Agar deep
  - Agar slant
  - Agar plate
6. Pure Culture Technique
  - Streak plate method
  - Pour plate method
  - Spread plate method
7. Haemoglobin - Estimation-Different methods-Colorimetric method and Physical method
8. Haemocytometry
  - RBC Count - micropipette method - Bulk dilution method
  - WBC count —micropipette method - bulk dilution method
  - Platelet Count Packed cell volume Erythrocyte sedimentation rate (Westergren method)

#### **HEMATOLOGY**

- a) Enumeration of RBC & WBC
- b) Differential Smear – Blood cells count
- c) Bleeding time & Clotting time
- d) Identification of blood grouping & Rh typing

- e) Evaluate ESR & PCV

### **BLOOD ANALYSIS**

- a) Estimation of blood glucose by Folin-wu method.
- b) Estimation of serum creatine and creatinine by– Alkaline Picrate method.
- c) Estimation of Determination of Total proteins in whole blood – Lowry's method
- d) Determination of urea in serum- DAM –TSC method
- e) Estimation of Cholesterol in serum- Zak's method
- f) Determination of Bilirubin [ Conjugated & Unconjugated] in serum.

### **TEXT BOOKS:**

- 1. Dubey R. C and Maheshwari D. K, 2002, Practical Microbiology, 1<sup>st</sup> edition, S. Chand & Co. Ltd, New Delhi, India.
- 2. Godkar B. Praful, 2016, Textbook of MLT, 3<sup>rd</sup> edition, Bhalani Publications, New Delhi, India.

### **REFERENCE BOOKS:**

- 1. Ochei J & Kolhatkar A, 2000, Medical Laboratory Science: Theory & Practice, 3<sup>rd</sup> edition, Mcgraw Hill Education, New York, United States.
- 2. Mukherjee K. L, 2017, Medical Laboratory Technology, Procedures Manual for Routine Diagnostic Tests, 3<sup>rd</sup> edition, McGraw Hill Education, Tennessee, United States.

### **WEB REFERENCE:**

- 1. <https://microbiologynotes.com/category/haematology/>
- 2. <https://paramedicsworld.com/category/hematology-practicals>
- 3. <https://e.itg.be/MTM/labcourse.pdf>

## **B.Sc., CLINICAL LABORATORY TECHNOLOGY**

### **SEMESTER: V**

#### **CORE PRACTICAL – V: MEDICAL MICROBIOLOGY, PARASITOLOGY AND CLINICAL LABORATORY TECHNOLOGY**

##### **MEDICAL MICROBIOLOGY**

1. Biochemical tests, antibiotic sensitivity testing
2. Food milk and water bacteriology
3. Air Sampling and theatre sterility
4. Detection of HBsAg by rapid method
5. Detection of HBsAg by ELISA
6. Detection of HIVTridot method.
7. Detection of HIV by ELISA
8. Detection of DengueIgG/IgM
9. Perform TORCH profile
10. Demonstration of PCR HBV
11. Demonstration of PCR HIV Viral load
12. Egg inoculation technique- All routes (Demonstration).

##### **PARASITOLOGY**

1. Blood smear examination for common blood parasite (Leishman and Giemsa staining).
2. Demonstration of permanent slide of *Trichuris*, *Ascaris* and Hookworm
3. Saline & Iodine wet mount for observing ova and eggs of parasites.
4. Faecal concentration methods for detection of intestinal parasites.
5. Staining methods for detection of malarial parasite.
6. Blood film examination for microfilaria.
7. Demonstration of various parasites by permanent slides.
8. Concentration of stool sample by floatation & sedimentation method.

##### **CLINICAL LABORATORY TECHNOLOGY**

1. Physical, chemical and microscopic examination of urine
2. Physical, chemical and examination of CSF
3. Physical, chemical and microscopic examination of semen.

**TEXT BOOKS:**

1. Jayaraman J, 1981, Laboratory Manual in Biochemistry, Willey Eastern, New Delhi, India.
2. Raguhuramulu N, Madhavan Nair K and Kalayanasundaram S, 2003, A Manual of Laboratory Techniques, 2<sup>nd</sup> edition, National Institution of Nutrition, Hyderabad, India.

**REFERENCE BOOKS:**

1. Bikash Medhi, 2017, Practical Manual of Experimental and Clinical Pharmacology, 2<sup>nd</sup> edition, Jaypee Brothers Medical Publishers Pvt Ltd, New Delhi, India.
2. Sood Ramnik, 2015, Text book of Medical Laboratory Technology, 2<sup>nd</sup> edition, Jaypee Brothers Medical Publishers Pvt Ltd, New Delhi, India.

**WEB REFERENCE:**

1. <https://www.vnmu.edu.ua/downloads/microbiology/20131218-135731.pdf>
2. [https://bio.libretexts.org/Learning\\_Objects/Laboratory\\_Experiments/Microbiology\\_Labs/Microbiology\\_Labs\\_II/Lab\\_20%3A\\_Parasitology](https://bio.libretexts.org/Learning_Objects/Laboratory_Experiments/Microbiology_Labs/Microbiology_Labs_II/Lab_20%3A_Parasitology)
3. [https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture\\_notes/health\\_science\\_students/medicalparasitology.pdf](https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture_notes/health_science_students/medicalparasitology.pdf)

## **B.Sc., CLINICAL LABORATORY TECHNOLOGY**

### **SEMESTER: VI**

#### **CORE PRACTICAL – VI: MEDICAL BIOCHEMISTRY, IMMUNOLOGY AND MEDICAL PHYSIOLOGY**

1. To determine T3 conc. in serum sample.
2. To determine T4 conc. in serum sample.
3. To determine TSH conc. in serum sample.
4. To determine LH conc. in serum sample.
5. To determine FSH conc. in serum sample.
6. To determine Prolactin conc. in serum sample.
7. To perform TRIPLE test.
8. Demonstration of male and female infertility test.
9. Beta HCG

#### **IMMUNOLOGY**

1. Agglutination Tests  
Widal Test  
RA latex agglutination test,  
ASO latex agglutination test,  
CRP Latex agglutination test,  
Beta HCG test
2. Flocculation Tests  
Rapid Plasma reagin test
3. Precipitation Tests  
Ouchterlony double immuno diffusion  
Radial immuno diffusion  
Immunoelectrophoresis
4. Enzyme Immuno Assay  
Detection of HBs Antigen using ELISA

#### **MEDICAL PHYSIOLOGY**

1. Isolation of DNA
2. Isolation of RNA
3. Separation of DNA by Agarose gel electrophoresis
4. Demonstration of PCR.
5. HBs test by Western Blotting.

6. Demonstration of PCR HLA B-27
7. Demonstration of PCR MTB
8. Demonstration of ECG, EEG, PFT, NMR and MRI

**TEXT BOOKS:**

1. Peter Igaz, 2021, Practical Clinical Endocrinology, Springer Nature Switzerland.
2. Bikash Medhi, 2017, Practical Manual of Experimental and Clinical Pharmacology, 2<sup>nd</sup> edition, Jaypee Brothers, New Delhi, India.
3. Sood Ramnik, 2015, Text book of Medical Laboratory Technology, 2<sup>nd</sup> edition, Jaypee Brothers Medical Publishers Pvt Ltd, New Delhi, India.
4. John P. Greer, John Foerster, 2014, Wintrobe's Clinical Hematology, 13<sup>th</sup> edition, Lippincott Williams & Wilkins, Philadelphia, United States.
5. Dacie & Lewis, 2011, Practical hematology, 11<sup>th</sup> edition, Elsevier, Amsterdam, Netherlands.
6. Ochei J & Kolhatkar A, 2000, Medical Laboratory Science: Theory & Practice, 3<sup>rd</sup> edition, Mcgraw Hill Education, New York, United States.

**REFERENCE BOOKS:**

1. Frank F, 2012, Gruchy's Clinical Haematology in Medical Practice, 6<sup>th</sup> edition, Wiley Publications, New York, United States.
2. Godkar B. Praful, 2016, Textbook of MLT, 3<sup>rd</sup> edition, Bhalani Publications, New Delhi, India.
3. Singh Tejinder, 2014, Atlas & Textbook of Haematology, 3<sup>rd</sup> edition, Avichal Publications, New Delhi, India.
4. Mukherjee .L.K, 2017, Medical Laboratory Technology, vol.1-3, 3<sup>rd</sup> edition, Tata Mcgraw Hill, New Delhi India.
5. Makroo R. N, 2009, Compendium of Transfusion Medicine, 2<sup>nd</sup> edition, Career Publications, Maharastra, India.

**WEB REFERENCE:**

1. [https://www.academia.edu/41901894/Practical\\_Textbook\\_of\\_BIOCHEMISTRY\\_for\\_Medical\\_Students](https://www.academia.edu/41901894/Practical_Textbook_of_BIOCHEMISTRY_for_Medical_Students)
2. [https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture\\_notes/health\\_scienc\\_e\\_students/medicalbiochemistry.pdf](https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture_notes/health_scienc_e_students/medicalbiochemistry.pdf)
3. <https://skyfox.co/wp-content/uploads/2020/12/Practical-Manual-of-Biochemistry.pdf>