

PERIYAR UNIVERSITY
PERIYAR PALKALAI NAGAR
SALEM - 636 011

(Reaccredited by NAAC with 'A' Grade - State University
NIRF Rank 83 - ARIIA Rank 4)



DEGREE OF BACHELOR OF SCIENCE
(CHOICE BASED CREDIT SYSTEM)

SYLLABUS FOR B.Sc. MEDICAL BIOCHEMISTRY

**(FOR THE STUDENTS ADMITTED FROM THE ACADEMIC
YEAR 2021 - 2022 ONWARDS)**

REGULATIONS

Preamble and objectives of the Programme:

Indian healthcare has become one of the largest sector, both in terms of revenue and employability. Healthcare comprises hospitals, medical devices, clinical trials, outsourcing, telemedicine, medical tourism and health insurance. The Indian healthcare sector is growing at a fast pace dominated by public as well private players. The healthcare market can increase three-fold to Rs. 8.6 trillion (US\$ 133.44 billion) by 2022 (www.ibef.org). To cater to this fast growing industry there is scarcity skilled manpower and it is the absolute need of the hour to train students so as to be employable in this industry.

The syllabus strengthens to acquire an advanced knowledge and understanding of the core principles of Biochemistry in the field of health and disease. The programme makes the student to understand the biochemical mechanisms behind the pathogenesis, diagnosis, and management of human diseases. The course is intended to provide an understanding and knowledge of the modern concepts along with the practical skills in the field of medical biochemistry, molecular diagnostics and pharmaceutical sectors and so on.

The students will develop essential research in diagnostic and laboratory skills. The wide range of academic and professional skills gained on this course will prepare the students for different career paths within the field. The students can choose a hospital or private labs in the health sector, research institutions, and pharmaceutical and biotech industries for their career path in future in addition to joining higher education institutes/Universities which excel in the field of Medical Biochemistry.

Objectives

The students undertaking Medical Biochemistry course at undergraduate level become conversant with the fundamentals of Biochemistry and at the end of the program the students should be able to demonstrate advanced knowledge and understanding of the core areas in Medical Biochemistry. The students will acquire knowledge like understanding of discipline, critical thinking, problem solving, analytical and scientific reasoning, research/industry related

skills, etc. This will empower the students to develop their future career with a much better and meaningful orientation (UGC DOCUMENT ON LOCF-BIOCHEMISTRY).

Eligibility for Affiliation of the programme

The B.Sc. Medical Biochemistry programme offering university/college/institutes should get proper approval from competent authorities (NMC/MCI/ICMR) before offering this programme and this programme should be approved by Tamil Nadu Government higher education dept (As per Govt. order no. 13420/K2/2017-6 dt 27-10-2017) which states that “If any new courses or program are started the University/College/Institution should get an order or equivalence from the government as when as the courses are introduced”. The MoU signed by the college offering the B.Sc. Medical Biochemistry programme and the partnering allopathy hospitals should be submitted by the college/institute to the Periyar University for getting affiliation of the programme. The Periyar University should ensure that the B.Sc. Medical Biochemistry programme is recognized by both the NMC/MCI/ICMR and Tamil Nadu Government higher education dept so that the students are benefitted.

The courses like Anatomy & Physiology, Human genetics, Histopathology & cytology, Hematology & Blood banking, Community medicine, Diagnostic Biochemistry & Laboratory management, Medical Microbiology & Virology and Clinical disorders has to be handled by qualified allopathy hospital doctors (MBBS/MD) (MoU should be signed with hospitals in accordance with NMC/MCI/ICMR guidelines). The course handled by doctors and collaborative allopathy hospitals should be mentioned clearly in the MoUs.

I. PROGRAM EDUCATIONAL OUTCOME (PEO)

The programme aims to generate highly skilled human resources in the field of Medical Biochemistry with the ability to comprehend and analyze biological problems pertaining to human health and contribute to the development of updated, contemporary and appropriate solutions. The specific programme objectives are to develop under-graduates with the following competencies,

PE01	To acquire knowledge and skills in core principles and components of basic Medical Biochemistry
PE02	To demonstrate the Biological concepts knowledge from molecular to cellular level

PE03	to be able to understand, analyze and apply the studied basic and concepts in wide variety of applications in health, disease and at diagnostics level
PE04	To provide students with the knowledge and skill base that would enable them to go for self-employment and entrepreneurship
PE05	Develop their knowledge and skills throughout their careers as professionals

II. PROGRAMME SPECIFIC OBJECTIVES (PSOs)

PSO1	To demonstrate comprehensive knowledge on various areas of Medical Biochemistry.
PSO2	To acquire skills in areas related to the current and emerging developments.
PSO3	To communicate the concepts, constructs and techniques of the subject learnt in a clear, concise and lucid manner.
PSO4	To plan and execute the experiments to the relevant theories of Biochemistry.
PSO5	To apply critical thinking, scientific reasoning and mathematical skills in studied areas of Biochemistry.
PSO6	To train the students to acquire various relevant generic and competency skills in various aspects of biochemistry so as to be able to work independently in a group or individually
PSO7	To make a student life long learner with moral and ethical values

III. PROGRAMME OUTCOMES (PO'S):-

Program Outcomes (POs)	
On completion of the B. Sc. Medical Biochemistry programme, the students will be able to,	
PO1	demonstrate comprehensive knowledge of major concepts, theoretical principles and experimental findings in medical biochemistry
PO2	communicate, plan and execute the experiments , investigate, analyze and interpret data and relate to relevant theories of Biochemistry.
PO3	acquire skills in areas related to the current and emerging developments in the field of medical Biochemistry
PO4	identify and apply appropriate biochemical principles and methodologies to solve a wide range of problems in the field of Biochemistry.
PO5	acquire the ability to employ critical thinking, scientific reasoning and efficient problem solving .
PO6	demonstrate relevant generic skills and competency skill to work both independently and in a group.
PO7	demonstrate professional behaviour and follow moral and ethical practices
PO8	be a life long learner aimed at personal development and for improving knowledge/skill development and focus on issues related to social cause.

IV. PROGRAM SPECIFIC QUALIFICATION ATTRIBUTES

- Knowledge and understanding level (K1 and K2)
- Application level (K3)
- Analytical level (K4)
- Evaluation capability level (K5)
- Scientific or synthesis level (K6)

V. GRADUATE ATTRIBUTES

The graduate should acquire the following qualities at the completion of his graduation in B.Sc. Medical biochemistry

1. **Disciplinary Knowledge:**

- a) Ability to understand fundamental concepts of biochemistry and allied subjects and to apply basic principles of chemistry to biological systems and molecular biology.
- b) to have general awareness of current developments at the forefront in biochemistry
- c) Ability to critically evaluate and ability to work safely and effectively in a laboratory.
- d) to have good skills encompassing preparation of laboratory reagents, conducting experiments, satisfactory analyses of data and interpretation of results.
- e) Ability to think laterally and in an integrating manner and develop interdisciplinary approach.

2. Communication Skills: Ability to speak and write clearly in English and to place scientific statements and themes in contexts

3. Problem Solving: Ability to have lateral thinking and analytical skills.

4. Analytical Reasoning: Ability to evaluate the strengths and weaknesses in scholarly texts

5. Research-Related Skills: Ability to formulate hypothesis and research questions, and to find answers.

6. Teamwork and Time Management: Ability to contribute to group work and managing time to complete deadline

7. Scientific Reasoning: Ability to analyze texts, evaluating ideas and scientific strategies, formulate logical and convincing arguments.

8. Reflective Thinking: ability to think critically.

- 9. Self-Directing Learning:** ability to postulate hypothesis, questions and search for answers.
- 10. Digital Literacy:** ability to use digital sources, and apply various platforms to convey and explain concepts of biochemistry.
- 11. Multicultural Competence:** ability to understand and respect various cultural differences.
- 12. Moral and Ethical Values:** ability to interrogate one's own ethical values, and to be aware of ethical and environmental issues.
- 13. Leadership Readiness:**
- 14. Life-long Learning:** ability to update scientific knowledge and apply them in continuously

(Ref: UGC Document on LOCF – Biochemistry – UG – 2019)

VI. CANDIDATE ELIGIBILITY FOR ADMISSION

1. Eligibility for Admission

A candidate who has passed Higher Secondary Examination of Tamilnadu Higher Secondary Board or an equivalent Examination. A pass in +2 examination with Chemistry & Biology as compulsory subject and studied Botany and Zoology or Biology shall be eligible for admission for B.Sc., Medical Biochemistry.

2. Duration of the Course

The duration of the course is three academic years comprising six semesters.

3. Course of study

The B.Sc. Medical Biochemistry course comprises the following subjects in the syllabus,

- i) Foundation Courses (Languages and English)
- ii) **Core Courses:** (Major/Allied/Skilled Based Elective Course and Non Major Elective Course subjects)

Major Course: Medical Biochemistry

Allied I-Chemistry (Compulsory),

Allied II-Chemistry (Compulsory),

Allied III-Biostatistics (Compulsory),

Allied IV- Computer Applications (Compulsory).

Non-major elective course may be chosen by the respective colleges and the same must be communicated to the University.

I - SEMESTER

1. Language -Paper I
2. English - Paper I
3. Core -Paper I
4. Allied I - Paper I
5. Value Education – Yoga

II - SEMESTER

6. Language – Paper II
7. English - Paper II
8. Core -Paper II
9. Allied I - Paper II
10. Core-Practical-I
11. Allied-Practical-I
12. Environmental Studies

III - SEMESTER

13. Language - Paper III
14. English- Paper III
15. Core - Paper III
16. Allied II - Paper I
17. Skill Based Elective Course - I
18. Non-Major Elective Course- I

IV - SEMESTER

19. Language – Paper IV
20. English – Paper IV
21. Core - Paper IV
22. Allied II - Paper II
23. Core – Practical- II
24. Allied –Practical- II
25. Skill Based Elective Course - II
26. Non-Major Elective Course – II

27. Internship **has to be done in hospitals** for a minimum of 2 weeks (including Sundays). Attendance should be submitted to the department (Attendance & Mini report mandatory).

V - SEMESTER

28. Core Paper -V
29. Core Paper –VI
30. Core Paper –VII
31. Elective Paper -I
32. Skill Based Elective Course III
33. Core-Practical – III
34. Core-practical – IV
35. Mini Project (Group)–**Project should be done in Clinical/Medical Biochemistry field only**

VI - SEMESTER

36. Core Paper - VIII
37. Core Paper - IX
38. Core Paper - X
39. Elective Paper - II
40. Skill Based Elective Course IV
41. Core- Practical – III
42. Core- Practical – IV
43. Mini Project (Group) **Project should be done in Clinical/Medical Biochemistry field only**

4. Examinations

There shall be six semester examinations for three years – two semester examination per year. Candidates failing in any subject / subjects will be permitted to reappear for failed subject / subjects in subsequent examinations. The syllabus has been divided into six semesters. The odd semester examinations (I, III and V) will be held in November/ December and even semester examinations (II, IV and VI) will be held in April / May. The practical examination I will be held at the end of I year (II-semester). II will be held at the end of II year (IV-semester). III and IV will be held at the end semester of III year (VI-semester). The mini project (group) viva-voce should be conducted at the end of VI semester.

5. **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.

6. **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.

7. **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**.

8. **Maximum Duration for the completion of the UG Programme**

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

9. **Commencement of this Regulation**

These regulations shall be effect from the academic year 2021-2022 onwards for candidates admitted during the academic year 2021-2022 and thereafter.

10. **Courses given by the board as Non – Major Elective Course**

Semester – III

1. Introduction to Clinical chemistry (or)
2. Diagnostic Biochemistry

Semester – IV

3. Communicable and non communicable disorders (or)
4. Quality control in Clinical labs

11. Skill based subjects and Electives given by the board

Skill based subjects

1. Human Genetics
2. Gene expression and control
3. Gene Technology
4. Biomedical Instrumentation
5. Histopathology & Cytology
6. Hematology & Blood banking
7. Community medicine
8. Medical coding

Electives

1. Cancer Biology
2. Pharmacogenomics
3. Developmental Biology
4. Intellectual Property Rights, Biosafety and Bioethics
5. Pharmaceutical chemistry
6. Medical Microbiology & virology
7. Bioinformatics & drug designing
8. Clinical disorders

Note:

- For skill based courses the student has to select from the given list of courses. Courses should not be repeated. The courses selected should be informed to the University for the setting of question papers in accordance with the rules and regulations of the Periyar University.
- For **Elective-1**, the students has to select from first four and for the **Elective-2** the student has to select from 5 to 8.
- The courses like Anatomy & Physiology, Human genetics, Histopathology & cytology, Hematology & Blood banking, Community medicine, Diagnostic Biochemistry & Laboratory management, Medical Microbiology & Virology and Clinical disorders has to be handled by qualified hospital doctors & technicians (MoU should be signed with hospitals in accordance with ICMR guidelines).
- Internship has to be done in hospitals for a minimum of 2 weeks(including Sundays)
- Mini project and Extension activities must be related to Clinical/Medical Biochemistry field

12. Question Paper Pattern (For Core, Allied, SBEC and NMEC)

Maximum marks – 75

Duration – 3 hours

Section –A (15 x 1 = 15 marks)

Answer all the questions

Multiple-choice questions

(3 questions from each unit)

Section –B (2 x 5 = 10 marks)

(One question from each unit)

Answer any TWO questions out of FIVE

Section –C (5 x 10 = 50 marks)

Answer ALL questions

(Internal choice from the same unit)

B.Sc. MEDICAL BIOCHEMISTRY

COURSE OF STUDY AND SCHEME OF EXAMINATIONS

SEM	PART	SUB CODE	COURSE	Hrs.		CREDIT	MARKS		
				Lect.	T/P		CIA	EA	TOTAL
SEMESTER – I									
I	I	Language	Tamil - I	6	T	3	25	75	100
	II	Language	English-I Communicative English	6	T	3	25	75	100
	III	Core - I	Chemistry of Biomolecules	3	T	4	25	75	100
		Allied - I	Allied Chemistry - I	5	T	3	25	75	100
	III	Core Practical -I		2	P				
	III	Allied Practical- I		3	P				
	IV	Value Education	Yoga	1	T	1	25	75	100
	IV	Add on Course	Professional English - I	4	T	4			
			Total	30		18			
SEMESTER – II									
II	I	Language	Tamil - II	6	T	3	25	75	100
	II	Language	English -II Communicative English	6	T	3	25	75	100
	III	Core - II	Analytical techniques	3	T	3	25	75	100
		Allied - II	Allied Chemistry -II	5	T	3	25	75	100
		Core Practical - I		2	P	4	40	60	100
		Allied Practical -I		3	P	4	40	60	100
	IV		Environmental Studies	1	T		25	75	100
			Professional English - II	4	T	4			
			Total	30		24			
SEMESTER – III									
II	I	Language	Tamil - III	6	T	3	25	75	100
I	II	Language	English - III	6	T	3	25	75	100

	III	Core -III	Cell and Molecular Biology	5	T	5	25	75	100
		Allied -III	Biostatistics	4	T	3	25	75	100
		Core Practical - II		3	P				
	IV	NMEC - I	Choice- to be communicated to the University	2	T	2			
		SBEC - I	Choice- to be communicated to the University	4	T	3	25	75	100
				30		19			

SEMESTER – IV

IV	I	Language	Tamil -IV	6	T	3	25	75	100
	II	Language	English -IV	6	T	3	25	75	100
	III	Core- IV	Intermediary Metabolism & Bioenergetics	4	T	5	25	75	100
		Allied IV	Computer applications	4	T	3	25	75	100
		Core Practical II		3	P	4	40	60	100
		Allied Practical II		3	P	4	40	60	100
			Internship (2 weeks in hospitals)			1			
	IV	NMEC – II	Choice- to be communicated to the University	2	T	2	25	75	100
		SBEC- II	Choice- to be communicated to the University	2	T	3	25	75	100
			Total	30		28			

SEMESTER – V

V	III	Core-V	Endocrinology	5	T	4	25	75	100
		Core-VI	Immunology	5	T	4	25	75	100
		Core-VII	Anatomy & Human Physiology	5	T	4	25	75	100
		Core Practical III		3	P	2			
		Core Practical IV		3	P	2			

		Elective-I	Choice- to be communicated to the University	4	T	3	25	75	100
			Mini Project (group)	2					
	IV	SBEC–III	Choice- to be communicated to the University	3	T	3	25	75	100
				30		22			
SEMESTER – VI									
VI	III	Core VIII	Clinical Biochemistry & Diagnostics	5	T	5	25	75	100
		Core- IX	Clinical Enzymology	5	T	5	25	75	100
		Core -X	Pharmacology & toxicology	5	T	4	25	75	100
		Core Practical III		3	P	2	40	60	100
		Core Practical IV		3	P	2	40	60	100
		Elective-II	Choice- to be communicated to the University	4	T	3	25	75	100
			Mini Project (group)	2		4	40	60	100
	IV	SBEC-IV	Choice- to be communicated to the University	3	T	3	25	75	100
	V		Extension activity			1			
				30		29			

	Study Components	First Year		Second Year		Third Year		No. of papers (subject-wise)	Total Credits (subject-wise)
		I	II	III	IV	V	VI		
Part-I	Tamil and other languages	3	3	3	3			4	12
Part-II	English	3	3	3	3			4	12
Part-III	Core subjects - Theory	5	5	5	5	15	15	10	50
	Core subjects - Practical		4		4	4	4	4	16
	Allied Subjects - Theory	3	3	3	3			4	12
	Allied Subjects - Practical		4		4			2	8
	Project/Electives					3	8	3	11
Part IV	NMEC			2	2			2	4
	SBEC			3	3	3	3	4	12
	Environmental studies							1	
	Value Education	2						1	2
Part V	Extension activities						1	1	1
No. of papers (semester-wise)		5	7	6	8	5	9	40	
Total credits		16	22	19	27	25	31		140

B.Sc. Medical Biochemistry
Semester 1

CHEMISTRY OF BIOMOLECULES

Course code: 21UMBC01

Course Objectives :

To understand the basis of biomolecules which will enable to demonstrate foundational knowledge about important biomolecules in cells and living organism, essential to life processes and relate them to their disorders.

Course Outcomes (Co)

After completion of the course, the students will be able to,

CO1	Understand, demonstrate and correlate how the structure of carbohydrates determines their chemical properties and reactivity.	K1, K2,K3,K4
CO2	Understand the structure, draw and recognize key structures of amino acids and proteins, their interactions and correlate clinically their importance in human body	K1, K2,K3,K4
CO3	Understand the structure and function of important biological macro molecules like lipids, its types , composition, its role in biological function.	K1, K2,K3,K4
CO4	Have knowledge of the structure, function and mechanism of DNA/RNA and their applications.	K1, K2,K3,K4
CO5	Know about the structure, types of minerals and vitamins in biological reactions, and its deficiency in human system.	K1, K2,K3,K4

UNIT –I

Carbohydrates: Definition, Biological importance of carbohydrates. Stereoisomerism and Optical isomerism of sugars. Classification, Structure and Biological importance of monosaccharides, disaccharides, homo and hetero polysaccharides. Clinical correlations to fructose Intolerance, Diabetes mellitus, lactic acidosis, galactosemia, pentosuria, blood group substances, Common Carbohydrate Marker of lysosomal targeting and I-Cell Disease, Chondrodystrophies due to sulfation defects and mucopolysaccharidose.

UNIT – II

Amino acids: Definition, Structure and classification of amino acids, Chemical reaction of amino acids. Essential and Non essential amino acids. **Peptide bond:** Structure and significance of peptide bond. **Protein structure:** Primary, Secondary, tertiary and Quaternary structure of proteins. Clinical correlations to Plasma Proteins in diagnosis of disease, Proteins as infectious agents: Human Transmissible Spongiform Encephalopathies(TSEs) and use of Amino Acid analysis in diagnosis of disease.

UNIT – III

Lipids : Definition, classification and biological role of lipids, Simple lipids - Properties and Characterization of fats, compound lipids - Structure and function of phospholipids and glycolipids. Classification, structure and properties of saturated and unsaturated fatty acids, Sterols –Structure, function and properties of Cholesterol. Types and functions of lipoproteins – Chylomicrons, VLDL, LDL and HDL. Clinical correlations to the following: lecithin-sphingomyelin ratio in amniotic fluid, Treatment of Hypercholesterolemia, diagnosis of Gaucher's disease in an adult, Diabetic Ketoacidosis, correlations to lipoproteins and cardiovascular disease.

UNIT – IV

Nucleic acids Structure of Purines and Pyrimidines; Nucleosides and nucleotides and phosphodiester linkages, structure and functions of DNA – Watson & Crick Model, A, B and Z forms of DNA. Properties of major classes of RNA. Clinical correlations to diagnostic use of DNA Arrays in Medicine & genetics and DNA Vaccines.

UNIT – V

Vitamins and Minerals : Vitamins: Introduction, structures, sources, RDA, functions of fat soluble and water soluble vitamins. Macro and micro elements – Dietary source, structures, RDA, functions of Iron, calcium, phosphorus, magnesium, iodine, Zinc and copper. Clinical correlations to deficiency of fat soluble and water soluble vitamins. Deficiency of macro and micro elements in human body. Thiamine deficiency in diabetes mellitus.

TEXT BOOKS

1. Textbook of Biochemistry with clinical correlations (2010) by Thomas M. Devlin. 8th edition, Wiley-Liss
2. Fundamentals of Biochemistry (2005) by J.L Jain, 6th Edition, S. Chand & Co Ltd.,
3. Lehninger's Principles of Biochemistry (2000) by Nelson, David I. and Cox, M.M. Macmillan/worth, NY.
4. Biochemistry (2013) by U.Satyanarayana and U. Chakrapani, 4th edition, Elsevier.
5. Fundamentals of Biochemistry (1999) by Donald Voet, Judith G.Voet and Charlotte W Pratt, John Wiley & Sons, NY.
6. Biochemistry, 3rd (1994) by Lubert stryer, W H freeman and co, Sanfrancisco.
7. Biochemistry, 4th edition (1988) by Zubay G L, W M C Brown Publishers.
8. Principles of Biochemistry (1994) Garrette & Grisham, Saunders college publishing.

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1. <https://ncert.nic.in/textbook/pdf/lech205.pdf>
2. <https://www.the-scientist.com/features/left-handed-dna-has-a-biological-role-within-a-dynamic-genetic-code-67558>
3. https://onlinecourses.nptel.ac.in/noc20_cy07/preview
4. <https://www.youtube.com/watch?v=3ALdt06Tgko>
5. <https://www.youtube.com/watch?v=haO3ChM2wUs>
6. <https://www.youtube.com/watch?v=wwIe0ypBw00>

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	S	M	M	M	S	M	L	M
CO2	S	M	M	M	S	M	L	M
CO3	S	M	M	M	S	M	L	M
CO4	S	L	S	S	S	S	L	M
CO5	S	L	L	L	S	L	S	M

*S-Strong; M-Medium; L-Low

B.Sc. Medical Biochemistry
Semester 1& 2

CORE PRACTICAL –I
Course code: 21UMBP01

I. General Laboratory safety rules

II. Ethics for Clinical laboratory practices

III. Calculations and preparation of Normal, molar, molal, percent, stock and working standard solutions

IV. Preparation of Buffers and determination of pH.

V. Qualitative Analysis

1. Monosaccharides, Disaccharides and Polysaccharides.
2. Aminoacids.
3. Lipids.

VI. Quantitative Analysis

1. Estimation of blood glucose from plasma/serum
2. Estimation of total protein and albumin from plasma/serum.
3. Determination of Ascorbic acid – DCPIP method.
4. Estimation of Calcium–Titrimetric method.
5. Estimation of hemoglobin from biological samples.
6. Estimation of glycogen from biological samples.
7. Estimation of triacylglycerol from plasma
8. Estimation of phospholipids and free fatty acids in serum.

VII. Biochemical Preparations

1. Casein from milk.
2. Lecithin from egg yolk.

Text Books

1. Laboratory Manual in Biochemistry by Pattabhiraman T.N. & Mr. U.S. Acharya - 1986 All India Traveler Book Seller Publishers a Distributors - Delhi 110 051.
2. Practical Biochemistry for Medical Students - by G. Rajagopal, S. Ramakrishnan - 1983 - Orient Longman Limited.
3. Practical Clinical Chemistry by Varyley H. Vol. I and II. Latest.
4. Biochemical Methods 1992, by S.Sadasivam and A. Manickam, Second Edition, New Age International Publishers, New Delhi.
5. Laboratory Manual in Biochemistry, 1981. J.Jayaraman, New Age International publishers, New Delhi.

B.Sc. Medical Biochemistry Semester 2

ANALYTICAL TECHNIQUES Course code: 21UMBC02

Course objectives

Provide a broad exposure to all basic techniques (Biochemical and Biophysical) used in contemporary modern biology research. Impart a basic conceptual understanding of principles of these techniques and emphasize on the biochemical utility of the same. Transform students to skilled workers for executing research with the aid of modern analytical instruments.

Course outcomes

CO1	Gain a basic knowledge on biochemical calculations and principles of basic microscope used in research activities	K1,K2
CO2	Obtain a comprehensive knowledge about different spectroscopic techniques	K2,K3,K4
CO3	Gain an in-depth understanding of various forms of chromatographic and electrophoretic techniques	K2,K3,K4
CO4	Understand the working principle, instrumentation and application of centrifugation techniques	K2, K3, K4
CO5	Have a comprehensive knowledge on radioisotopes and its application in biology	K2,K3,K4

Unit I Basics

Units of measurement of solutes in solution; Normality, molality, molarity, millimol and ppm; Water- structure and properties; Principles of glass and reference electrodes, types of electrodes, complications of pH measurement (dependence of pH on ionic strength), pH, pOH, Hendersen-Hasselbach equations, buffers, pH of body fluids, buffers in body fluids, red blood cells and tissues. Microscopy: principle, instrumentation and applications of Light, Dark and Phase Contrast microscope, Electron microscope.

Unit II Spectroscopy

Energy, wavelength, wave number and frequency; Absorption and emission spectra, Beer-Lambert's law, light absorption and its transmittance; Basic principles, instrumentation and applications of UV-visible, IR, fluorimetry, atomic absorption and emission spectrophotometry. IR-Raman Spectroscopic applications in biology.

UNIT - III

Chromatographic & Electrophoretic Techniques

Principles, procedure and applications of paper chromatography, thin layer chromatography, column chromatography - ion exchange chromatography, gel filtration chromatography, affinity

chromatography. Gas Liquid Chromatography, High performance Liquid Chromatography and mass spectroscopy. Principles, techniques and applications of paper electrophoresis, gel electrophoresis - agarose, SDS- PAGE, Capillary electrophoresis, isoelectric focusing, Factors affecting electrophoresis.

Unit IV

Centrifugation

Basic principles and types of centrifugation-rotors, boundary, differential, density gradient, zonal isopycnic centrifugation, equilibrium; Sedimentation - sedimentation velocity, preparative and analytical ultracentrifugation techniques: principles & applications in biochemical fractionation methods and molecular weight determination.

Unit V

Radioactivity

Radioactivity, stable and radioactive isotopes, concepts of half-life and decay, principles of scintillation counting, GM counters, applications of isotopes. Nature of radioactivity, properties of α , β and γ -rays. Radioisotopes commonly used in biology- ^{14}C , ^{32}P , ^{35}S , ^3H , ^{131}I . Radiation hazards and methods for contaminant prevention .

Text Books

1. Principles and techniques of practical Biochemistry, Keith Wilson and John Walker, 1995. Cambridge University Press.
2. An Introduction to Spectroscopy for Biochemist, Brown. SB Academic Press.
3. Biophysical chemistry Principles and Techniques - Avinash Upadhyaye and Nirmalendhe Nath, Himalaya Publishers.
4. A Biologist Guide to Principles and Techniques of Biochemistry, Keith Wilson and Kenneth Goulding, Edward Arnold publishers.

Weblink

1. <https://nptel.ac.in/content/storage2/courses/103108100/module6/module6.pdf>
2. https://nptel.ac.in/content/storage2/courses/103105060/Sde_pdf/Module-7.pdf
3. <https://nptel.ac.in/content/storage2/courses/102103044/pdf/mod5.pdf>
4. <https://nptel.ac.in/content/storage2/courses/104103069/module6/lec1/1.html>
5. https://onlinecourses.nptel.ac.in/noc20_cy08/preview

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	M	M	L	M	S	M	L	M
CO2	M	M	L	M	M	L	L	M
CO3	M	M	M	M	M	L	L	M
CO4	S	L	S	S	S	S	L	M
CO5	S	L	L	L	S	L	S	M

*S-Strong; M-Medium; L-Low