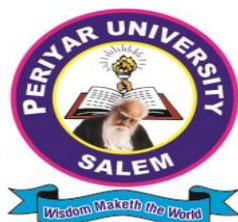


# PERIYAR UNIVERSITY

SALEM – 636011



## DEGREE OF BACHELOR OF SCIENCE

*(CHOICE BASED CREDIT SYSTEM)*

### **B.Sc. BIOCHEMISTRY** **OBE REGULATIONS AND SYLLABUS**

**(SEMESTER PATTERN)**

**(For Candidates admitted in the Colleges affiliated to Periyar  
University from 2021-2022 onwards )**

## REGULATIONS

### 1. Objectives of the Course

The syllabus strengthens to acquire an advanced knowledge and understanding of the core principles of Biochemistry.

The objectives of B.Sc., Biochemistry course

- To study the structures and functions of Biomolecules.
- To understand the Bioanalytical Techniques (principles, instrumentation and applications).
- To learn the major Metabolic pathways, Bioenergetics and Enzyme Catalysis.
- To understand the Molecular Techniques and Gene Expression.
- To know the essentials of Human Physiology and Nutritional requirements.
- To update the molecular concepts of body defenses and its mechanisms.
- To learn the principles and applications of Clinical Biochemistry.
- To gain knowledge in Pharmaceutical and Industrial Biochemistry.
- To acquire skills by hands on experience in Laboratory Experiments.
- To develop the candidates for a career in Clinical Research laboratories and Health care industry.

### PROGRAMME OUTCOME AND KNOWLEGE LEVEL

PO No	PROGRAMME OUTCOME	Knowledge Level
PO1	<b>Disciplinary knowledge:</b> Ability to understand fundamental concepts of Biochemistry; Ability to apply basic principles of chemistry to Biological Systems and Molecular Biology; Ability to relate various interrelated physiological and metabolic events; A general awareness of current developments at the forefront in Biochemistry and Allied subjects; Ability to critically evaluate a problem and resolve to challenge blindly accepted concepts; Zeal and ability to work safely and effectively in a laboratory; Good experimental and quantitative skills encompassing preparation of laboratory reagents, conducting experiments, satisfactory analyses of data and interpretation of results; Awareness of resources, and their conservation; Ability to think laterally and in an integrating manner and develop interdisciplinary approach; Overall knowledge of the avenues for research and higher academic achievements in the field of Biochemistry and allied subjects.	K3
PO2	<b>Communication Skills:</b> Ability to speak and write clearly in English; Ability to listen to and follow scientific viewpoints and engage with them.	K2
PO3	<b>Problem solving:</b> ability to closely observe the situation, and apply lateral thinking and analytical skills.	K4

PO4	<b>Analytical reasoning:</b> Ability to evaluate the strengths and weaknesses in scholarly texts spotting flaws in their arguments; Ability to use critics and theorists to create a framework and to substantiate one's argument in one's reading of scientific texts.	K4
PO5	<b>Team work /Time Management:</b> Ability to participate constructively in class room discussions; Ability to contribute to group work; Ability to meet a deadline.	K6
PO6	<b>Scientific reasoning:</b> Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective. Ability to formulate logical and convincing arguments.	K4
PO7	<b>Self-directed learning:</b> Ability to work independently in terms of organizing laboratory, and critically analyzing research literature; Ability to postulate hypothesis, questions and search for answers.	K6
PO8	<b>Digital literacy:</b> Ability to use digital sources, and apply various platforms to convey and explain concepts of Biochemistry	K3
PO9	<b>Moral and ethical awareness/reasoning:</b> Ability to interrogate one's own ethical values and to be aware of ethical and environmental issues; Ability to read values inherited in society and criticism vis a vis, the environment, religion and spirituality as also structures of power	K3
PO10	<b>Leadership readiness:</b> Ability to lead group discussions, to formulate questions related to scientific and social issues.	K6

K1 – Remember; K2-Understand; K3-Apply; K4-Analyse; K5-Evaluate; K6-Create

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

## 2. Eligibility for Admission

A candidate who has passed Higher Secondary Examination of Tamilnadu Higher Secondary Board or an equivalent Examination other state board 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., Biochemistry.

## 3. Duration of the Course

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

## 4. Course of study

The B.Sc. 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:** 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 (15 days) 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)

#### **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)

### **5. 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.

## 6. **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 paper and practical. The candidates who do not secure the required minimum marks for pass in a paper 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.

## 7. **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.

## 8. **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**.

## 9. **Maximum Duration for the completion of the UG Programme:**

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

## 10. **Commencement of this Regulation**

These regulations shall be effect from the academic year 2020-2021 onwards for candidates admitted during the academic year 2020-2021 and thereafter.

## 11. **Transitory Provision**

Candidates who were admitted to the UG course of study before 2017-2018 shall be permitted to appear for the examinations under those regulations for a period of three years i.e. up to April / May 2022 examination. Thereafter, they will be permitted to appear for the examination only under the regulations therein force.

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

### **Semester - III**

Fundamentals of Human physiology (or) Biochemistry in Nutrition

### **Semester - IV**

Biochemistry and Health (or) Biochemistry in Diagnosis



	IV	NMEC - I		2	T	2			
		SBEC - I	Cell Biology	4	T	3	25	75	<b>100</b>
				<b>30</b>		<b>19</b>			

#### SEMESTER – IV

<b>IV</b>	I	Language	Tamil -IV	6	T	3	25	75	<b>100</b>
	II	Language	English -IV	6	T	3	25	75	<b>100</b>
	III	Core-- IV	Intermediary Metabolism	4	T	5	25	75	<b>100</b>
		Allied IV	Computer applications	4	T	3	25	75	<b>100</b>
		Core Practical II		3	P	4	40	60	<b>100</b>
		Allied Practical II		3	P	4	40	60	<b>100</b>
			Internship			1			
	IV	NMEC – II		2	T	2	25	75	<b>100</b>
		SBEC- II	Plant Biochemistry	2	T	3	25	75	<b>100</b>
			<b>Total</b>	<b>30</b>		<b>28</b>			

#### SEMESTER – V

<b>V</b>	III	Core-V	Clinical Biochemistry	5	T	4	25	75	<b>100</b>
		Core-VI	Molecular Biology	5	T	4	25	75	<b>100</b>
		Core-VII	Human Physiology	5	T	4	25	75	<b>100</b>
		Core Practical III		3	P	2			
		Core Practical IV		3	P	2			
		Elective-I	Nutritional Biochemistry	4	T	3	25	75	<b>100</b>
			Mini Project (group)	2					
	IV	SBEC–III	Genetic Engineering	3	T	3	25	75	<b>100</b>
			<b>Total</b>	<b>30</b>		<b>22</b>			

#### SEMESTER – VI

<b>VI</b>	III	Core VIII	Immunology	5	T	5	25	75	<b>100</b>
		Core- IX	Endocrinology	5	T	5	25	75	<b>100</b>
		Core -X	Pharmaceutical Biochemistry	5	T	4	25	75	<b>100</b>
		Core Practical		3	P	2	40	60	<b>100</b>

		III		3	P	2	40	60	<b>100</b>
		Core Practical IV Elective-II	Industrial Biochemistry	4	T	3	25	75	<b>100</b>
			Mini Project (group)	2		4	40	60	<b>100</b>
	IV	SBEC-IV	Bioinformatics and Nanotechnology	3	T	3	25	75	<b>100</b>
	V		Extension activity			1			
				<b>30</b>		<b>29</b>			

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

**13. 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. BIOCHEMISTRY

### SEMESTER – I

#### CORE I - BASICS OF BIOCHEMISTRY

#### PAPER CODE - 21UBC01

#### Objective

- To understand the simple and molecular structure of the different types of biomolecules.
- To identify from a group of molecular formulae, diagrams or models those which correspond to the different types of biomolecules.
- To gain knowledge the physicochemical properties and biological importance of biomolecules.

#### Course Outcome

On successful completion of this course, students should be proficient to

Course No	Course Outcome Details	Knowledge level
CO1	Summarize structures, isomerism and functions of different types of carbohydrates.	K2
CO2	Understand the nature of amino acids and proteins with their structure and their roles.	K2
CO3	Demonstrate about the lipids and lipoproteins along with their role.	K2
CO4	Explain the structure and properties of Nucleic acids and Nucleoproteins.	K3
CO5	Describe about source and importance of Vitamins.	K3

#### Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	M	M	S	M	L	S	M	S
CO2	S	L	M	M	S	M	L	S	M	S
CO3	S	L	M	M	S	M	L	S	M	S
CO4	S	L	S	S	S	S	L	S	M	S
CO5	S	L	L	L	S	L	S	S	M	S

S- Strong M-Medium L-Low

## UNIT-I

**Carbohydrates:** Introduction and general classification of carbohydrates.

**Monosaccharides:** Structures, properties and biological functions of monosaccharides. Isomerism - structural and stereo isomerism, interconversion of sugars, muta-rotation.

**Oligosaccharides:** Dissaccharides - structures, properties and biological functions of maltose, Lactose and Sucrose.

**Polysaccharides:** Classifications of polysaccharides, Structures, properties and biological functions of Homo-polysaccharides - starch, cellulose, glycogen, pectin and Hetero-polysaccharides -Hyaluronic acid, Chondroitin sulphate, chitin and Heparin.

## UNIT-II

**Amino acids:** Structure, classification, physical, chemical and electrochemical properties, Non-standard aminoacids, Non-protein aminoacids.

**Peptides:** Features of peptide bond, naturally occurring peptides – Glutathione, enkaphalins and endorphins.

**Proteins:** Classification, physical and chemical properties of proteins, structural organization of proteins - Primary, secondary, tertiary and quaternary structures, Forces stabilizing each level of structure.

## UNIT-III

**Fatty acids:** Definition, nomenclature, classification of fatty acids-saturated and unsaturated fatty acids. Essential fatty acids.

**Lipids:** Classification of lipids- simple, conjugated and derived lipids, occurrence, structure and physical and chemical properties of phospholipids, glycolipids, sphingolipids and cholesterol.

**Lipoproteins:** Types and functions of lipoproteins – Chylomicrons, VLDL, LDL and HDL.

## UNIT-IV

**Nitrogenous bases:** - purines and pyrimidines, nucleosides, nucleotides, formation of phosphodiester bonds.

**DNA:** - Types of DNA, Structure of DNA – Watson and Crick double helix model, physic-chemical properties and functions of DNA. Special base sequences of DNA – palindromic sequence, cruciforms.

**RNA:** - Types and basic structural features of RNA – mRNA, tRNA and rRNA, properties and functions of RNA.

**Nucleoproteins:** structure and functions of Histones and protamines.

## UNIT-V

**Vitamins:** Introduction to vitamins, classification of vitamins - structures, sources, RDA, functions, deficiency diseases of fat soluble and water-soluble vitamins.

## REFERENCES

- 1.Fundamentals of Biochemistry(2005) J.L.Jain, 6<sup>th</sup> Edition, S. Chand & Co Ltd.,
- 2.Lehninger's Principles of Biochemistry (2000) Nelson, David I. and Cox, M.M. Macmillan/worth, NY.

3. Biochemistry (2013) U. Satyanarayana and U. Chakrapani, 4th edition, Elsevier.
4. Fundamentals of Biochemistry (1999) Donald Voet, Judith G. Voet and Charlotte W Pratt, John Wiley & Sons, NY.
5. Biochemistry, 3rd (1994) Lubert stryer, W H freeman and co, Sanfrancisco.
6. Biochemistry, 4th edition (1988) Zubay G L, W M C Brown Publishers.
7. Principles of Biochemistry (1994) Garrette & Grisham, Saunders College publishing.

### **WEB RESOURCES**

1. [https://www.phys.sinica.edu.tw/TIGP-NANO/Course/2010\\_Spring/Classnotes/AAC\\_lehninger4e\\_ch03%20\(Protein\).pdf](https://www.phys.sinica.edu.tw/TIGP-NANO/Course/2010_Spring/Classnotes/AAC_lehninger4e_ch03%20(Protein).pdf)

**B.Sc. BIOCHEMISTRY**  
**SEMESTER – II**  
**CORE II - TOOLS OF BIOCHEMISTRY**  
**PAPER CODE - 21UBC02**

**Objective**

- To understand the basis and general methodology of the molecular separation techniques specified in the course.
- To gain in depth expertise on the application of these techniques to the separation of mixtures with known compositions.

**Course Outcome**

**On successful completion of this course, students should be proficient to**

Course No	Course Outcome Details	Knowledge level
CO1	Illustrate the cell fractionation techniques and clarify about the microscope handling.	K2
CO2	Disclose the chromatographic techniques for the separation components	K3
CO3	Explain the principles of centrifugation techniques for the separation of components	K4
CO4	Understand basic principles behind electrophoretic and spectroscopic techniques	K4
CO5	Describe about the measurement and the applications of radioisotopes	K5

**Mapping with Programme Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	M	S	M	S	L	M	M	S
CO2	S	L	M	S	M	S	L	M	M	S
CO3	S	L	M	S	M	S	L	M	M	S
CO4	S	L	M	S	M	S	L	M	M	S
CO5	S	L	M	S	M	S	M	M	M	L

S- Strong M- Medium L-Low

## UNIT - I

**pH and Buffers:** Definitions for Acids and bases, pH: - Definition and determination of pH. Buffer system of human body.

### **Cell Fractionation Techniques:**

Organ and tissue slice techniques, tissue homogenization, cell lysis - Methods of cell disruption, extraction, salting in and salting out.

Dialysis and Ultrafiltration – Artificial membranes, semipermeable membranes, Donnan membrane equilibrium and biological significance of osmosis.

Basic principles of cell sorting and counting. Maintenance and preservation of cells.

**Microscopy:** Simple, Light, Dark, Phase Contrast

## UNIT - II

### **Chromatographic 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.

## UNIT - III

### **Centrifugation:**

Basic principles of sedimentation, Svedberg's constant, sedimentation velocity and sedimentation equilibrium. Types of centrifuges – desk top, high speed and ultracentrifuges. Types of Rotors - swinging bucket, fixed angle, vertical tube and zonal rotor. Types of centrifugation: Preparative centrifugation - differential and density gradient centrifugation with applications, Analytical centrifugation – molecular weight determination.

## UNIT - IV

### **Electrophoretic Techniques:**

Principles, techniques and applications of paper electrophoresis, gel electrophoresis - agarose, SDS- PAGE, Capillary electrophoresis, isoelectric focusing, Factors affecting electrophoresis.

### **Spectroscopic Techniques:**

Laws of absorption - Beer - Lambert's law and its limitations. Principles, instrumentations and applications of colorimeter, spectrophotometer, spectrofluorimeter and flame photometer.

## UNIT - V

### **Radioisotope Techniques:**

Radioactivity, stable and radioactive isotopes, Radioactive decay - rate of radioactive decay and units of radioactivity. Methods of detection of radioisotopes: - GM counter, Scintillation counter. Autoradiography and its applications. Advantages, disadvantages and safety aspects of radio isotopic techniques.

**Radioisotopes in Biology:** Radioisotopes commonly used in biochemical studies –  $^{14}\text{C}$ ,  $^{32}\text{P}$ ,  $^{35}\text{S}$ ,  $^3\text{H}$ ,  $^{131}\text{I}$ .

#### **REFERENCE**

1. Cell biology, T. Devasena, 2012, Oxford University press.
2. Principles and techniques of practical Biochemistry, Keith Wilson and John Walker, 1995. Cambridge University Press.
3. An Introduction to Spectroscopy for Biochemist, Brown. SB Academic Press.
4. Biophysical chemistry Principles and Techniques - Avinash Upadhyaye and Nirmalendhe Nath, Himalaya Publishers.
5. A Biologist Guide to Principles and Techniques of Biochemistry, Keith Wilson and Kenneth Goulding, Edward Arnold publishers.

#### **WEB RESOURCES**

1. <https://link.springer.com/content/pdf/bfm%3A978-1-4419-9785-2%2F1.pdf>

**B.Sc. BIOCHEMISTRY**  
**SEMESTER – II**  
**CORE PRACTICAL – I**  
**PAPER CODE - 21UBCP01**

**Objective**

- To provide the students with an opportunity to develop their qualitative and quantitative skills.
- To learn and understand the biochemical analysis and identification of unknown compounds.
- **On successful completion of this course, students should be proficient to**

Course No	Course Outcome Details	Knowledge level
CO1	Facilitate the learners to prepare solutions for biochemical experiments	<b>K3</b>
CO2	Make the students to prepare buffer solution and to know the preparation of pH solution	<b>K3</b>
COs	Prepare crude macromolecules like starch, casein etc	<b>K3</b>
CO3	Facilitate the learners to correctly identify the carbohydrates, aminoacids and lipids	<b>K4</b>
CO4	Quantify the biomolecules	<b>K4</b>

**Mapping with Programme Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	S	S	S	M	M	M	M	S
CO2	S	L	S	S	S	M	M	M	M	S
CO3	S	L	S	S	M	M	M	M	M	S
CO4	S	L	S	S	M	S	M	M	M	S
CO5	S	L	S	S	M	S	M	M	M	S

S- Strong; M-Medium; L-Low

## **I. Preparations**

- a) Percentage solutions
- b) Molar Solutions
- c) Normal Solutions
- d) Simple problems for preparation of solutions

## **II. Preparation of Buffers and determination of pH.**

## **III. Biochemical Preparations**

1. Starch from potato.
2. Casein from milk.
3. Lecithin from egg yolk.

## **IV. Qualitative Analysis**

1. Monosaccharides, Disaccharides and Polysaccharides.
2. Amino acids.
3. Lipids.

## **V. Quantitative Analysis**

1. Determination of reducing sugar- Benedict's method – Titrimetric Analysis.
2. Estimation of Glycine- Formal Titration.
3. Determination of Acid number.
4. Determination of Saponification number.
5. Determination of Ascorbic acid – DCPIP method.
6. Estimation of Calcium–Titrimetric method.

## **REFERENCENCES**

1. Biochemical Methods 1992, S.Sadasivam and A. Manickam, Second Edition, New Age International Publishers, New Delhi.
2. Laboratory Manual in Biochemistry, 1981. J.Jayaraman, New Age International publishers, New Delhi.

## **WEB RESOURCES**

1. [https://biolympiads.com/wp-content/uploads/2014/08/metodich\\_1.pdf](https://biolympiads.com/wp-content/uploads/2014/08/metodich_1.pdf)

**B.Sc. BIOCHEMISTRY**  
**SEMESTER – III**  
**CORE III – ENZYMES**  
**PAPER CODE - 21UBC03**

**Objectives**

- To provide a deeper insight into the fundamentals of enzyme kinetics and their role in control of metabolism and industrial application of enzymes.
- To learn the current applications and future potential of enzymes.

**Course Outcome**

**On successful completion of this course, students should be proficient to**

Course No	Course Outcome Details	Knowledge level
CO1	Understand the basic features and classification of enzymes	K2
CO2	Figure out the characteristics of active site and nature of enzyme catalysis	K2
CO3	Understand the enzyme kinetics, enzyme inhibition and enzyme regulation with relevant examples	K3
CO4	Demonstrate the coenzymes, allosteric enzymes and multienzyme complex	K3
CO5	Explain the various immobilization techniques and application of enzymes in different fields	K4

**Mapping with Programme Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	M	M	M	S	M	S	S	S
CO2	S	L	S	S	S	S	M	S	S	S
CO3	S	L	S	S	S	S	S	S	S	S
CO4	S	L	M	S	M	S	S	S	S	S
CO5	S	L	S	S	S	S	S	S	S	S

S- Strong M-Medium L-Low

## UNIT – I

### Introduction to Enzymes:

History and terminology, nomenclature and IUB classification of enzymes. Holoenzymes, Apoenzymes, metalloenzymes, metal activated enzymes, monomeric enzymes, oligomeric enzymes, ribozymes. Enzyme specificity, specific activity, Units of enzyme activity – IU and Katal. Enzyme turn over.

## UNIT - II

### Active Site:

Structure of active site and its characteristics, theories of ES complex - Lock and key, induced fit and substrate strain theory.

### Nature of Enzyme Catalysis:

Acid - base catalysis, covalent catalysis, Metal ion catalysis, Electrostatic catalysis.

### Mechanism of Action of Specific Enzyme: - lysozyme.

## UNIT - III

### Enzyme Kinetics:

**Michaelis-Menten Equation:** - Initial velocity and steady state approach,  $V_{max}$ ,  $K_m$  and their significance, Linear transformation of Michaelis-Menten Equation; - Lineweaver-Burk Plot, Eadie-Hofstee Plot, Hanes Plot.

**Factors Affecting Enzyme Activity:** - Effect of pH, temperature, enzyme concentration, substrate concentration, and the presence of inhibitors and activators.

**Enzyme Inhibition:** -Types of inhibition - Reversible inhibition - Competitive, Non-competitive and Uncompetitive inhibition. Irreversible inhibition, Feedback inhibition,

**Regulation of Enzyme Activity:** Allosteric inhibition, covalent modification.

## UNIT - IV

**Coenzymes:** The structure and function of following coenzymes in enzyme catalyzed reactions – Thiamine pyrophosphate, nicotinamide nucleotides, Flavin nucleotides, Coenzyme A, Lipoate, Folate and biotin.

**Isoenzymes:** Definition, features and clinical significance with examples – Lactate dehydrogenase (LDH) and creatine kinase (CK).

**Allosteric Enzymes:** Definition, structure and properties with example - Aspartate transcarbamoylase.

**Multienzymes Complex** – Pyruvate dehydrogenase complex (PDH complex)

## UNIT - V

**Immobilized Enzymes:** Principles, methods and applications of immobilized enzymes.

**Isolation and Purification of Enzymes:** Methods of isolation and purification of enzymes from microbial, plant and animal sources, determination of purity of isolated enzymes.

Applications of enzymes- in food, textile and leather industries and role of enzymes in medicine.

## **REFERENCE**

1. Enzymes - Dixon, E.C Webb, CJR Thorne and K.F. Tipton, Longmans, London.
2. Fundamentals of Enzymology 2 ed., (1998) - Nicholas C.Price, Lewis Stevans, Oxford University Press, First Edition (1990).
3. Understanding Enzymes, Trevor Palmer, Ellis Horwood Limited, Third Edition (1991).
4. Protein Biotechnology, Gary Walsh and Denis Headon, John Wiley and Sons, 1994.
5. Protein Biochemistry and Biotechnology, Gary Walsh and John Wiley and Sons Ltd. 2002.

## **WEB RESOURCES**

1. [https://biochem.wisc.edu/sites/default/files/symposia/steenbock/36th/36th\\_Steenbock\\_Abstract\\_Book\\_web.pdf](https://biochem.wisc.edu/sites/default/files/symposia/steenbock/36th/36th_Steenbock_Abstract_Book_web.pdf)

**B. Sc. BIOCHEMISTRY**  
**SEMESTER – III**  
**SKILL BASED ELECTIVE COURSE I**  
**SBEC-I - CELL BIOLOGY**  
**PAPER CODE - 21UBCS01**

**Objectives**

- To understand the structure and functions of prokaryotes and Eukaryotic cells.
- To understand the cellular components and energy utilization process in the cell.
- To understand the cellular molecules and applying the knowledge in cell biology.

**Course Outcome**

**On successful completion of this course, students should be proficient to**

Course No	Course Outcome Details	Knowledge level
CO1	Understand the structure and function of different types of cell	K1
CO2	Succeed in understanding structural organization and role different organelles	K1
CO3	Expound the chromosomal organization.	K2
CO4	Analyze cell cycle and types of cell division	K2
CO5	Describe the role of extracellular matrix and cell interactions	K3

**Mapping with Programme Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	M	S	M	S	S	S	S	S
CO2	S	L	M	S	M	S	S	S	S	S
CO3	S	L	M	S	M	S	S	S	S	S
CO4	S	L	M	S	M	S	S	S	S	S
CO5	S	L	S	S	M	S	S	S	S	S

S- Strong M-Medium; L-Low

## **UNIT I**

**Cell:** Introduction, cell theory, types of cell - Prokaryotic cell and eukaryotic cell structure, difference between plant cell and animal cell. Structure, composition, functions of cell membrane, bacterial cell wall and plant cell wall.

## **UNIT II**

**Cell Organelles:** Structure and functions of nucleus, mitochondria, chloroplast, endoplasmic reticulum, golgi bodies, ribosomes, lysosomes, peroxisomes and cytoskeleton.

## **UNIT III**

**Chromosome Organization:** Structure of chromatin, types of euchromatin and heterochromatin, structure of chromosome, special types of chromosome.

## **UNIT IV**

**Cell Cycle:** Stages of cell cycle, cell division - various stages and significance of Mitosis and Meiosis, difference between Mitosis and Meiosis.

## **UNIT V**

**Extracellular Matrix and Cell Interactions:** ECM: - Collagen, Elastin, Fibronectin, Laminins, Cell – ECM interactions: - Integrins, Focal adhesions, Hemidesmosomes. Cell – cell interactions: - Cadherins, IgSF, Selectins, Intracellular junctions: Gap junctions, tight junctions, adherens junction, desmosomes.

## **REFERENCES**

1. Cell Biology by T. Devasena, 2012, Oxford University press.
2. VK Agarwal and PS Varma Cytology (Cell Biology and Molecular Biology), 2000 4/e S Chand & Company, New Delhi.
3. Cell and Molecular Biology by Prakash S Lohar, 2007, MJP publishers.
4. The Cell, a molecular approach by Geoffrey M Cooper, 5 th Edition, 2009, ASM press, Washington.
5. Cell and Molecular Biology by Gerald Carp, 3<sup>rd</sup> Edition, 2002, John wiley & sons.

## **WEB RESOURCES**

1. <https://www.easybiologyclass.com/>

**B.Sc. BIOCHEMISTRY**  
**SEMESTER – IV**  
**CORE IV - INTERMEDIARY METABOLISM**  
**PAPER CODE: 21UBC04**

**Objectives**

- To understand the principles of cellular energy metabolism.
- To learn and schematize the oxidative pathways of carbohydrates, Lipids, Proteins & Nucleic acids.
- To gain knowledge on mitochondrial Electron transport chain and Oxidative Phosphorylation.

**Course Outcome**

**On successful completion of this course, students should be proficient to**

Course No	Course Outcome Details	Knowledge level
CO1	Understand the basic principles of metabolic pathways	K3
CO2	Comprehend carbohydrate metabolism and its regulation	K3
CO3	Give the big picture about the biological oxidation process	K3
CO4	Comprehend the concepts of lipid metabolism and amino acid metabolism and urea cycle	K3
CO5	Understand concepts of nucleotide metabolism nucleic acid metabolism	K4

**Mapping with Programme Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	S	S	M	S	M	S	S	S
CO2	S	L	S	S	M	M	M	S	S	S
CO3	S	L	S	S	M	M	M	S	S	S
CO4	S	L	S	S	M	M	M	S	S	S
CO5	S	L	S	S	M	S	M	S	S	S

S- Strong M-Medium L-Low

## **UNIT – I**

### **Introduction to metabolism:**

Types of metabolic reactions. Bioenergetics - Principles of thermodynamics, concepts of free energy, standard free energy, Biological oxidation- reduction reactions, redox potential, high energy phosphate compounds.

## **UNIT – II**

### **Carbohydrate metabolism:**

Glycolysis, TCA cycle and its energy production. Glycogen metabolism: Glycogenesis and Glycogenolysis, Alternative pathways: HMP pathway, gluconeogenesis, glucuronic acid pathway.

## **UNIT – III**

### **Biological oxidation:**

Mitochondrial Electron Transport Chain: electron carriers, sites of ATP production, inhibitors of ETC, Oxidative phosphorylation: - structure of ATPase complex, chemiosmotic theory, inhibitors of oxidative phosphorylation and uncouplers, Mitochondrial shuttle system.

## **UNIT - IV**

### **Lipid metabolism:**

Fatty acid oxidation –  $\alpha$ ,  $\beta$ ,  $\omega$  oxidation. Biosynthesis of saturated and unsaturated fatty acids. Metabolism of cholesterol, triglycerides and ketone bodies.

### **Protein metabolism:**

Ketogenic and Glucogenic amino acids. Degradation of proteins: - Deamination, Transamination and Decarboxylation, Urea cycle.

## **UNIT - V**

### **Nucleic acid metabolism:**

Biosynthesis and degradation of purine and pyrimidine nucleotides.

## **REFERENCES**

1. Fundamentals of Biochemistry, J.L. Jain, S.Chand publications, 2004.
2. Lehninger's Principles of Biochemistry (2000) - Nelson, David I. and Cox, M.M. Macmillan / Worth, NY.
3. Harper's Biochemistry Robert K. Murray, Daryl K. Granner, Peter A. Mayes, Victor W. Rodwell, 24th edition, Prentice Hall International. Inc.
4. Principles of Biochemistry, Geoffrey L. Zubay, 3rd edition William W. Parson, Dennis E. Vance, W.C. Brown Publishers, 1995.

5. Principles of Biochemistry, David L. Nelson, Michael M.Cox, Lehninger, 4th edition, W.H. Freeman and company.
6. Biochemistry, Lubert Stryer, 4th edition, W.H. Freeman & Co, 1995.
7. Fundamentals of Biochemistry (1999) - Donald Voet, Judith G.Voet and Charlotte W Pratt, John Wiley & Sons, NY.

### **WEB RESOURCES**

1. [http://www.wormbook.org/chapters/www\\_intermetabolism/intermetabolism.html](http://www.wormbook.org/chapters/www_intermetabolism/intermetabolism.html)

**B.Sc. BIOCHEMISTRY**  
**SEMESTER – IV**  
**SKILL BASED ELECTIVE COURSE - II**  
**SBEC – II -PLANT BIOCHEMISTRY**  
**PAPER CODE – 20UBCS02**

**Objective**

- To understand plant cell structure and specific biochemical functions to all compartments of the plant cell.
- To learn the mechanism of photosynthesis and biosynthetic pathways in plants.
- To gain knowledge about secondary metabolites and their role in medicine.

**Course Outcome**

**On successful completion of this course, students should be proficient to**

Course No	Course Outcome Details	Knowledge level
CO1	Understand the plant cell physiology.	K2
CO2	Comprehend process of photosynthesis and photorespiration	K2
CO3	Demonstrate nitrogen fixation in plants	K2
CO4	Illustrate about the plant growth through seed germination and seed dormancy	K2
CO5	Explain hormones and secondary metabolites of plants	K3

**Mapping with Programme Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	M	S	S	S	S	S	M	M
CO2	S	L	M	S	S	S	S	S	M	M
CO3	S	L	M	S	S	S	S	S	M	M
CO4	S	L	S	S	S	S	S	S	M	M
CO5	S	L	S	S	S	S	S	S	M	M

S- Strong M-Medium L-Low

## **UNIT - I**

### **Physiology of Plants:**

Diffusion and Osmosis in plants and their significance, relationship among turgor pressure, wall pressure and osmotic pressure, water potential concept. Mechanism of water absorption, Ascent of sap, Transpiration: - types, mechanism of transpiration and factors affecting transpiration.

## **UNIT - II**

### **Photosynthesis:**

Photosynthetic apparatus, Photosynthetic pigments, Light reactions - cyclic and non-cyclic phosphorylation, Calvin cycle, Photorespiration, C4 plants, CAM plants. Glyoxylate cycle.

## **UNIT - III**

### **Nitrogen Metabolism and Nitrogen Cycle:**

Nitrogen in soil, nitrate reduction in plants, Nitrogen fixation: - Nonbiological and biological nitrogen fixation, biochemistry of symbiotic and nonsymbiotic nitrogen fixation, nitrogen cycle, sulphur cycle, phosphorus cycle.

## **UNIT - IV**

### **Biochemistry of Plant Growth:**

Biochemistry of seed development: - dormancy and germination. Phytochrome, photoperiodism and vernalization.

## **UNIT - V**

### **Plant Growth Regulators:**

Chemistry, biosynthesis, storage, distribution, mode of action and physiological effects of Auxins, Gibberellins, Cytokinins, ABA and Ethylene.

Secondary metabolites: Terpenes, Phenols, flavonoids and nitrogenous compounds and their roles in alternative medicine.

## **REFERENCES**

1. Plant physiology, Verma, 7<sup>th</sup> Revised edition, Emkay Publications, 2001.
2. Plant Physiology, S. N. Pandey and B.K. Sinha, Vikas Publishing Pvt. Ltd, 3<sup>rd</sup> Edition, 1999.
3. Plant Biochemistry and Molecular Biology, Peter Jhea, Richard C. Leegood,
4. Introduction to plant physiology, William. G.Hopkins, Norman. P.A. Hunger, 3<sup>rd</sup> Edition.
5. Handbook of medicinal plants by Prajapathi, Purohit and Sharma kumar.
6. Plant Biochemistry by P.M. Dey and J.B. Harborne
7. Biochemistry and Molecular Biology of plants by Buchannan, Grvissem and Jones.

## **WEB RESOURCES**

1. <https://pdfs.semanticscholar.org/7e66/3f57cfeaaaf89878708a7b33aec28b7d77123.pdf>

**B.Sc. BIOCHEMISTRY**  
**SEMESTER - IV**  
**CORE PRACTICAL – II**  
**PAPER CODE – 21UBCP02**

**Objective**

- To practice calorimetric determinations, enzyme assays and molecular separation techniques.

**On successful completion of this course, students will be able to**

Course No	Course Outcome Details	Knowledge level
CO1	Know about analytical techniques of separation of sugar, aminoacids lipids and plant pigments	K3
CO2	Analyse the biomolecules by colorimeter	K4
CO3	Analyse the enzyme assay	K5

**Mapping with Programme Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	M	S	S	L	S	S
CO2	S	M	S	S	M	S	S	L	S	S
CO3	S	M	S	S	M	S	S	L	S	S

S- Strong M-Medium L-Low

## I. ANALYTICAL TECHNIQUES

- 1 Separation of sugar & amino acid by paper chromatography
- 2 Separation of lipid by thin layer chromatography
- 3 Separation of plant pigments by column chromatography

## II. COLORIMETRIC ANALYSIS

1. Estimation of fructose – Seliwanoff's method
2. Estimation of Ribose- Bial's method
3. Estimation of Protein - Biuret method
4. Estimation of Phosphorus – Fiske Subbarow method
5. Estimation of Iron – Wong's method.

## III. ENZYME ASSAY

1. Determination of specific activity, effect of pH, temperature and substrate concentration of
  - a. Salivary Amylase
  - b. Acid phosphatase

## REFERENCE

1. Biochemical Methods 1992, by S.Sadasivam and A. Manickam, Second Edition, New Age International Publishers, New Delhi
2. Laboratory Manual in Biochemistry, 1981. J.Jayaraman, New Age International publishers, New Delhi

## WEB RESOURCES

- 1.[https://biolympiads.com/wp-content/uploads/2014/08/metodich\\_1.pdf](https://biolympiads.com/wp-content/uploads/2014/08/metodich_1.pdf)

**B.Sc. BIOCHEMISTRY**  
**SEMESTER – V**  
**CORE V - CLINICAL BIOCHEMISTRY**  
**PAPER CODE – 21UBC05**

**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, in born defects in metabolism and correlate with deficiency of key metabolic enzymes.

**Course outcome**

**On successful completion of this course, students should be proficient to**

Course No	Course Outcome Details	Knowledge level
CO1	Understand clinical aspects of biochemistry	K3
CO2	Describe about the blood components, blood coagulation system and Perform the hematology-based analysis.	K3
CO3	Acquire insight into disorders of carbohydrates and lipids metabolism	K3
CO4	Gain knowledge about various disorders of protein, nucleic acid and bilirubin metabolism	K3
CO5	Comprehend different organ function tests and clinical enzymology	K4

**Mapping with Programme Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	S	M	M	S	S	M	S	S
CO2	S	L	S	M	M	S	S	M	S	S
CO3	S	M	S	M	M	S	S	M	S	S
CO4	S	M	S	M	M	S	S	M	S	S
CO5	S	M	S	M	M	S	S	M	S	S

S- Strong M-Medium L-Low

## **UNIT – I**

### **Approaches to Clinical Biochemistry:**

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

## **UNIT – II**

### **Hematology:**

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**

### **Disorders of Carbohydrate Metabolism:**

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

### **Disorders of Lipid Metabolism:**

Hyperlipoproteinaemia – classifications, Hypercholesterolemia, ketosis and its significance, Cardiovascular disorders - Atherosclerosis – aetiology, clinical features and its complications. Lipid storage diseases – Niemann-pick disease, Fabry disease, Tay-Sachs disease and Gaucher's disease. Fatty liver – causes, types, symptoms and diagnosis.

## **UNIT – IV**

### **Disorders of Amino Acid and Protein Metabolism:**

Inborn errors of amino acid metabolism: - Phenylketonuria, alkaptonuria, cystinuria, albinism and tyrosinemia.

### **Disorders of Purine and Pyrimidine Metabolism:**

Gout, Lesh-Nyhan syndrome, xanthinuria, orotic aciduria.

### **Disorders of Bilirubin Metabolism:**

Jaundice: - classification, clinical features.

## **UNIT – V**

### **Liver Function Tests:**

Tests based on abnormalities of bile pigment metabolism, carbohydrate metabolism, lipid metabolism, amino acid metabolism, detoxification and excretory function of liver.

### **Renal Function Tests:**

Tests based on Glomerular filtration, renal plasma flow and tubular function.

### **Gastric Function Tests:**

Examination of resting contents in resting juice, Fractional gastric analysis using test meal and Examination of the contents after stimulation.

**Enzymology:**

Clinical significance of SGOT, SGPT, ALP, ACP, CPK and LDH.

**REFERENCE**

1. Textbook of Medical Laboratory Technology by Praful B. Godkar and Darshan P. Godkar
2. Medical Laboratory Technology - Ramnik sood, 5<sup>th</sup> Edition, 1999, Jaypee publishers.
3. Text book of Biochemistry with clinical correlation, Thomas M. Devlin, 3rd edition, A. JohnWiley-Liss Inc. Publication.
4. Practical Clinical Biochemistry, Harold Varley, 4th edition, CBS Publication and Distributors, New Delhi.
5. Medical Biochemistry - MN Chatterjee, Rana Shinde, 8<sup>th</sup> edition, 2013, Jaypee publications.

**WEB RESOURCES**

1. <http://www.grsmu.by/files/file/university/cafedry/klinicheskaya-immynologiya/files/fiu/4.pdf>

**B.Sc. BIOCHEMISTRY**  
**SEMESTER – V**  
**CORE – VI MOLECULAR BIOLOGY**  
**PAPER CODE: 21UBC06**

**Objective:**

- To describe the general principles of gene organization and expression in both Prokaryotes and eukaryotic organism.
- To explain various level of gene regulation and its functions.

**Course outcome:**

**On successful completion of this course, students should be proficient to**

Course No	Course Outcome Details	Knowledge level
CO1	Understand the replication process	K2
CO2	Comprehend basic principles and mechanism of transcription	K2
CO3	Understand translation process and post translational modification of proteins	K2
CO4	Understand the protein targeting and processing and regulation of gene expression in prokaryotes	K2
CO5	Understand types and causes of mutation, and DNA repairing mechanisms	K3

**Mapping with Programme Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	S	M	M	S	S	S
CO2	S	M	S	S	S	M	M	S	S	S
CO3	S	M	S	S	S	M	M	S	S	S
CO4	S	M	S	S	S	M	M	S	S	S
CO5	S	M	S	S	S	M	M	S	S	S

S- Strong M-Medium L-Low

## UNIT – I

**Replication:** Experimental evidence to prove DNA as genetic material, Semiconservative replication, experimental evidence for semiconservative replication, replication in prokaryotes and eukaryotes, enzymes involved in replication, mechanism of replication, inhibitors of DNA replication.

## UNIT – II

**Transcription:** Basic features of RNA synthesis, E.Coli RNA polymerases, initiation, chain elongation and termination of transcription, RNA processing. Inhibitors of transcription.

## UNIT - III

**Translation:** Genetic code and its features, tRNA and amino acyl tRNA synthetases. Initiation, elongation and termination of translation, post translational modifications, Inhibitors of protein synthesis.

## UNIT – VI

**Protein Targeting and Processing:** Signal sequences, signal recognition particle, signal hypothesis, molecular chaperons, Targeting of proteins – basic targeting pathways. Protein folding. Protein degradation.

**Regulation of Gene Expression in Prokaryotes: The Operon model:** Concept of positive and negative regulation. Operon concept – study of structure and regulation of Lac operon, Tryp operon and arab operon.

## UNIT – V

**DNA Damage and Repair:** Types of mutation: - Base substitution, insertion, deletion, inversion, duplication, translocation, mutagens. DNA Repair mechanisms: - Excision repair, mismatch repair, photoreactivation, direct demethylation, double strand break repair. Regulation of DNA repair: - SOS repair.

## REFERENCES

1. Text Book of Cell and Molecular Biology Dr. Ajay Paul, 2015, Arunabha Sen, Books & Allied (P) Ltd.,
2. Molecular biology, 3rd edition, Henry lodish et al.
3. Genes – IX, Benjamin Lewin, Oxford University.
4. Molecular biology of gene, James D. Watson, Nancy H.Hopkins, Jeffrey W.Roberts, Joan.
5. Argetsinger Steitz, Alan M. Weiner, 4th edition, The Benjammin Cummings Publishing Company, Inc.2002.
6. Friefelder's essentials of molecular biology, 4 th Edition, George M Malacinski, Narosa publishing House, 2006
7. Molecular Biology by David C Clark., Elsevier Academic press, 2005

## WEB RESOURCES

1. [https://molbiomadeeasy.files.wordpress.com/2013/09/fundamental\\_molecular\\_biology.pdf](https://molbiomadeeasy.files.wordpress.com/2013/09/fundamental_molecular_biology.pdf)

**B.Sc. BIOCHEMISTRY**  
**SEMESTER – V**  
**CORE VII - HUMAN PHYSIOLOGY**  
**PAPER CODE: 21UBC07**

**Objective:**

- To build a in depth knowledge about basic physiological principles of various organs in the human body.
- To understand physiology of various systems and its functions.
- To get adequate knowledge on sensory organs.

**Course outcome:**

**On successful completion of this course, students should be proficient to**

Course No	Course Outcome Details	Knowledge level
CO1	Illustrate about digestive secretions and absorptive mechanisms	K2
CO2	Comprehend the process of gaseous exchange in tissues and lungs	K2
CO3	Obtain an insight about muscle physiology and cardiovascular system	K2
CO4	Understand urine formation and physiology of reproductive system	K2
CO5	Get an idea about neuron structure and sensory physiology	K2

**Mapping with Programme Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	M	M	S	S	M	S
CO2	S	M	S	S	M	M	S	S	M	S
CO3	S	M	S	S	M	M	S	S	M	S
CO4	S	M	S	S	M	M	S	S	M	S
CO5	S	L	S	S	M	M	S	S	M	S

S- Strong M-Medium L-Low

## UNIT – I

**Digestive System:** Overview of the digestive system, secretions of digestive tract, digestive hormones, process of digestion, absorption, assimilation of carbohydrates, proteins, fats, nucleic acids. Absorption of vitamins, minerals and water.

## UNIT – II

**Respiratory System:** Overview of the respiratory system, pulmonary ventilation, Alveolar ventilation, composition and partial pressure of inspired air, alveolar air and expired air, exchange and transport of respiratory gases.

## UNIT – III

**Muscle physiology and Cardiovascular System:** overview of muscle tissue, contraction and relaxation of skeletal muscle, cardiac muscle tissue and cardiac conduction system, cardiac cycle, cardiac output, blood pressure and E.C.G.

**Skeletal System:** Introduction to human skeletal system, skeletal divisions and functions of skeleton.

## UNIT – IV

**Excretory System:** Overview of renal system, Renal physiology: - glomerular filtration, tubular reabsorption and secretion, production of dilute and concentrated urine.

**Reproductive System:** Overview of male and female reproductive system, spermatogenesis, oogenesis and follicular development, menstrual cycle, physiology of pregnancy, parturition and lactation.

## UNIT – V

**Nervous System:** Overview of nervous system, classification of nervous system, signal transmission at synapse, neurotransmitters.

**Special Senses:** Physiology of Olfaction, Gustation, Vision, Hearing and equilibrium.

## REFERENCES

1. Essentials of Medical Physiology, K. Sembulingam and Prema Sembulingam, 6<sup>th</sup> Edition, 2012
2. Principles of Anatomy and Physiology, Tortora and Grabowski, 2003, John Wiley & Sons, Inc.
3. Human Physiology, Chatterjee.C. 11<sup>th</sup> edition Medical agency allied, Calcutta.
4. Text book of medical physiology, A.C. Guyton 10<sup>th</sup> edition.
5. Human body, Atlas, Publication Garden cheers.
6. A Text Book of Human physiology, Sarada Subrahmanyam et al., 2010, S Chand & Company

## WEB RESOURCES

1. <https://mymedicallibrary.files.wordpress.com/2016/08/jaypee-essentials-of-medical-physiology-6th-edition.pdf>

**B.Sc. BIOCHEMISTRY**  
**SEMESTER – V**  
**ELECTIVE – I NUTRITIONAL BIOCHEMISTRY**  
**PAPER CODE – 21UBCE01**

**Objective:**

- To describe the general principles and nutritional aspects of various foods and its dietary requirements
- To learn and explore the biochemical, physiological and clinical impact of inadequate intakes of specific nutrients.

**Course outcome:**

**On successful completion of this course, students should be proficient to**

Course No	Course Outcome Details	Knowledge level
CO1	Describe energy content of various foods and nutritional significance of different biomolecules	K2
CO2	Understand nutritional requirements and techniques to measure energy expenditure	K3
CO3	Explain the effect protein energy malnutrition	K3
CO4	Describe nutritional requirement, significance and deficiency disorders of dietary minerals	K3
CO5	Obtain an insight about Regulation and standardization of foods in food industry	K3

**Mapping with Programme Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	S	S	M	S	S	S
CO2	S	M	S	S	S	S	M	S	S	S
CO3	S	M	M	S	S	S	S	S	S	S
CO4	S	M	M	S	S	S	S	S	S	S
CO5	S	M	M	S	S	S	S	S	S	S

S- Strong M-Medium L-Low

## UNIT – I

**Nutritional profile of principal foods:** Cereals, pulses, vegetables, fruits, nuts, oil seeds, animal foods, milk and milk products, egg, fish, meat, drinks and spices. Role of dietary carbohydrates, proteins, fats, fiber and antioxidants.

**Energy content of foods:** Determination of calorific value by Bomb calorimeter.

## UNIT – II

**Dietary Requirements:** Balanced diet, Recommended dietary allowances for infants, children, adolescent, pregnant, lactating women, athletes and geriatrics.

Measurement of energy expenditure, respiratory quotients of food stuffs, specific dynamic action. BMR:  
- Measurement of BMR and factors influencing BMR.

## UNIT-III

**Dietary Protein:** Biological value of proteins and nitrogen balance. Essential and non- essentials aminoacids. Protein energy malnutrition – etiology, management of kwashiorkor and marasmus.

## UNIT – IV

**Minerals:** Nutritional significance of dietary macro minerals (Ca, P, Mg, S, K, Na, Cl) and trace minerals (Iron, Iodine, Zinc and copper). Disorders related to the deficiency of minerals.

**Nutraceuticals:** Introduction and classification of nutraceuticals.

## UNIT- V

**Regulation and Standardization of Foods:** Laws governing the food industry in India – PFA, MFPO,

**Key Regulations of Food Safety and Standards Authority (FSSA)** – packaging and labeling, signage and customer notices, licensing registration and health and sanitary permits.

**Foreign direct investment in the food processing industry.**

## REFERENCES

1. Human nutrition by B. Srilakshmi, New age International Pvt Ltd, 2009
2. Human nutrition and dietetics, S. Davidson and J.R. Passmore.
3. Human nutrition and dietetics, IS Garraw, WPT James, 10th edition
4. Modern nutrition in health and diseases, Whol and Good hart.
5. Mechanism and theory in food chemistry, DWS Wong, CBS New Delhi, 1996.

## WEB RESOURCES

1. <http://nsdl.niscair.res.in/jspui/bitstream/123456789/586/1/NutritionDietary.pdf>

**B.Sc. BIOCHEMISTRY**  
**SEMESTER V**  
**SKILL BASED ELECTIVE COURSE - III**  
**SBEC – II -GENETIC ENGINEERING**  
**PAPER CODE – 21UBCS03**

**Objective:**

- To impart the practical knowledge on nucleic acid isolation, digestion and ligation.
- To familiarize the students with the basic concepts in genetic engineering and it also gives knowledge on transformation and recombinant selection.
- To acquaint the students to versatile tools and techniques employed in genetic engineering and recombinant DNA technology and its applications genetic engineering.

**Course outcome:**

**On successful completion of this course, students should be proficient to**

Course No	Course Outcome Details	Knowledge level
CO1	Get an idea about the role of DNA manipulative enzymes and restriction enzymes used in rDNA technology.	K2
CO2	Advance their knowledge about the vectors suitable for rDNA technology	K2
CO3	Understanding of various methods adapted for gene transfer and screening of recombinants	K3
CO4	Obtain knowledge about advance techniques in genetic engineering	K4
CO5	Understand applications of rDNA technology in various fields	K4

**Mapping with Programme Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	S	S	S	S	S	S
CO2	S	M	S	S	S	S	S	S	S	S
CO3	S	L	S	S	S	S	S	S	S	S
CO4	S	L	S	S	S	S	M	S	S	S
CO5	S	L	S	S	S	S	M	S	S	S

S- Strong; M-Medium; L-Low

## UNIT - I

**Introduction to Genetic Engineering:** Introduction to rDNA technology, DNA manipulative enzymes: - Nucleases, Ligases, Polymerases, DNA modifying enzymes, Topoisomerases. Restriction- modification system: Restriction endonucleases and its types.

## UNIT - II

**Vectors:** Characteristics of an ideal vector, cloning vectors for E.Coli:- pBR322, pUC8. Vectors based on M13 bacteriophage: - M13, Vectors based on  $\lambda$  phage: - insertion and replacement vectors, Cosmids, Phagemids, Vectors for eukaryotes: - vectors for yeast: - Yep, YAC, Vectors for higher plants: - Ti plasmid, Ri plasmid.

## UNIT - III

**Methods of Gene Transfer:** Vector mediated gene cloning, Direct/vectorless methods: - Electroporation, biolistics, microinjection, chemical mediated gene transfer, liposome mediated gene transfer, silicon carbide method. Vector mediated gene transfer: - Agrobacterium mediated gene transfer.

**Screening of Recombinants:** Reporter gene-based screening, selection by the use of antibiotic resistance, blue white screening, Immunological methods, screening through protein activity.

## UNIT - IV

**Techniques in Genetic Engineering:** Isolation and purification of genomic DNA, plasmid DNA and  $\lambda$  phage. Molecular probes: - Types and its uses. Methods of nucleic acid labeling. Blotting techniques: - southern, northern and western blotting. DNA sequencing methods. PCR: - Procedure, important considerations of PCR for primer designing, Applications of PCR.

## UNIT - V

**Genomic and cDNA Libraries:** Methods of generating genomic and cDNA library, comparison between two types of libraries, advantages and disadvantages of cDNA library.

**Applications of rDNA Technology:** Recombinant DNA products in medicine (insulin, GH), recombinant vaccines, gene therapy, DNA finger printing, transgenic plants and transgenic animals.

## REFERENCES

1. Genetic Engineering -Smitha Rastogi, Neelam Pathak, 2009, Oxford University press.
2. Principles of gene manipulation, Old and Primrose, Blackwell Science. Genetic engineering and its applications, P.Joshi, Botania Publishers & Distributors. Recombinant DNA: A short course, Watson et al, Scientific American Books.
3. Gene Cloning and DNA analysis, T.A Brown, Blackwell Science Publishers, 2001.
4. Biotechnology Fundamentals & Applications, S.S.Purohitt, Agrobios Publishers, 2001.
5. Text book of Biotechnology by R.C. Dubey, 2009, S.Chand & Co Ltd.

## WEB RESOURCES

1. <https://nptel.ac.in/courses/102103013/>

**B.Sc. BIOCHEMISTRY  
SEMESTER – VI  
CORE – VIII – IMMUNOLOGY  
PAPER CODE: 21UBC08**

**Objective:**

- To learn about the general concepts of immune system and immune organs
- To understand the properties of antigens and antibodies and the concept of antigen-antibody interactions
- To know about the mechanisms related to cell mediated immunity, complement system, hypersensitivity and transplantation immunology and immunological disorders

**Course outcome:**

**On successful completion of this course, students should be proficient to**

Course No	Course Outcome Details	Knowledge level
CO1	Understand basics of immune system and about the cells and organs of immune system.	K2
CO2	Describe the Antigen and Antibody structure and properties and obtain the knowledge about the hybridoma technology	K2
CO3	Comprehend the antigen and antibody reactions and immunological techniques.	K3
CO4	Get a clear idea about the immunization and hypersensitivity reactions.	K3
CO5	Familiarize with complement system, autoimmunity and immunodeficiency disorders	K4

**Mapping with Programme Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	S	S	S	M	S	S
CO2	S	M	S	S	S	S	S	M	S	S
CO3	S	M	S	S	S	S	M	M	S	S
CO4	S	M	S	S	S	S	M	M	S	S
CO5	S	M	S	S	S	S	M	M	S	S

S- Strong M-Medium L-Low

## UNIT-I

**Introduction to Immunology:** Immunity, types of immunity, mechanism of immunity, Hematopoiesis, cells and organs of the immune system. Humoral and cell mediated immune response, primary and secondary immune response.

## UNIT-II

**Immunogens and Antigens:** Immunogenicity, antigenicity, factors that influencing antigenicity, antigenic specificity, epitopes of an antigen, haptens, adjuvants. **Antibodies:** Structure, Classes, Subclasses, Properties of Immunoglobins, Antigenic determinants –isotypic, allotypic and idiotypic determinants. Production and applications of Monoclonal antibodies.

## UNIT-III

**Antigen - Antibody Interactions:** Antigen – antibody binding, strength of binding, Primary binding tests: - Radioimmunoassay, Immunofluorescence assays, Immunoenzyme assays- ELISA. Secondary binding tests: - Agglutination, Precipitation, Immunodiffusion, Immunoelectrophoresis. Complement fixation.

## UNIT-IV

**Immunization:** Vaccine and its types.

**Major Histocompatibility Complex:** Classification and role of MHC in immune response. **Hypersensitivity:** Types – I to V. **Transplantation Immunology:** mechanism of graft acceptance and rejection,

## UNIT-V

**Complement System:** Classical and Alternative pathway, **Auto immunity:** - History and types of auto immune disorders. Immunodeficiency disorders: - Causes, symptoms, mechanism of HIV infection, HIV replication, transcription and diagnostic methods.

## REFERENCES

1. Immunology and Immunotechnology - M. Rajasekara Pandian & B. Senthil Kumar, Panima Publishing Corp, New Delhi, 2007.
2. Immunology Roitt. Brostoff and David Mole, 4<sup>th</sup> edition, 1998 Mosby Times Mirror Int Pub Ltd.
3. Immunology, An introduction: Tizard K, Saunders college Publishing (1984).
4. Essential Immunology. Roitt. I.M. (1988). Blackwell Scientific Publishers.
5. Immunology, Kuby Richard. A. Goldsby, Thomas. J.Kint, Barbara. A. Osborne, 4<sup>th</sup> Edition, 2000, W.H. Freeman and Company, New York.

## WEB RESOURCES

1. [http://www.hss.gov.yk.ca/pdf/im\\_manual\\_section14.pdf](http://www.hss.gov.yk.ca/pdf/im_manual_section14.pdf)

**B.Sc. BIOCHEMISTRY**  
**SEMESTER – VI**  
**CORE – IX ENDOCRINOLOGY**  
**PAPER CODE: 21UBC09**

**Objective:**

- To explain the role of endocrine system in maintaining homeostasis, integrating growth and development.
- To discuss molecular, biochemical, and physiological effects of hormones on cells.
- To explain the consequences of under and overproduction of hormones.

**Course outcome:**

**On successful completion of this course, students should be proficient to**

Course No	Course Outcome Details	Knowledge level
CO1	Gain knowledge about the basic terminologies, classification and mechanism of action of hormones and to demonstrate various types of second messengers and their action.	K2
CO2	Understand hypothalamic and pituitary hormones.	K2
CO3	Learn various functions of thyroid, parathyroid and pancreatic hormones along with their mechanism of action.	K2
CO4	Demonstrate the biological functions and dysfunction of various GI tract hormones as well as adrenal gland hormones.	K2
CO5	Understand about the male and female reproductive hormones and also gain the knowledge about some local hormones.	K2

**Mapping with Programme Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	M	S	S	S	S	M	M
CO2	S	M	M	M	S	M	S	S	M	M
CO3	S	M	M	M	S	S	S	S	M	M
CO4	S	M	M	M	S	S	M	S	M	M
CO5	S	M	M	M	S	L	S	L	M	M

S- Strong M-Medium L-Low

## UNIT – I

**Introduction to Endocrine System:** Hormones as messengers, classification of hormones, circulating and local hormones, receptors of hormones, mechanism of action, hormone interactions: - Permissive effect, synergistic effect and antagonistic effect.

**Second messengers:** - Role of cAMP, cGMP, IP<sub>3</sub>, DAG, Ca<sup>2+</sup> ions and calmodulin in hormonal action.

## UNIT – II

**Hypothalamus and Pituitary Gland:** Hypothalamic hormones, hormones of pituitary gland: - chemical nature, secretion, circulation, biological functions, disorders of Adenohypophyseal and neurohypophyseal hormones.

## UNIT – III

**Thyroid and Parathyroid Glands:** Chemical nature, secretion, circulation, biological function, disorder of thyroid and parathyroid hormones.

**Pancreas:** Chemical nature, secretion, circulation, biological function, disorder of Insulin and Glucagon.

## UNIT – IV

**G.I. Tract Hormones:** Chemical nature, secretion, circulation, biological function, disorders of Gastrin, Secretin and Cholecystokinin.

**Adrenal gland:** – Chemical nature, secretion, circulation, biological function, disorders of adrenal medullary and Cortical hormones.

## UNIT – V

**Gonadotropic Hormones:** Chemical nature, secretion, circulation, biological function, disorders of male and female reproductive hormones.

**Others:** Local hormones in tissues – Prostaglandins and Thromboxanes, Local hormones in blood – Kinins.

## REFERENCES

1. Essentials of Medical Physiology K. Sembulingam and Prema Sembulingam, 6<sup>th</sup> Edition, 2012
2. Fundamentals of Biochemistry, J.L. Jain, S. Chand publications, 2004.
3. Textbook of Biochemistry, Edward Staunton West, Wilbert R. Todd, Howard S. Mason, John T. Van Bruggen, 4th edition, Oxford & IBH publishing Co.Pvt.Ltd., 1996.
4. Principles of Biochemistry, David L. Nelson, Michael M.Cox, Lehninger, 4th edn, W.H. Freeman and Company.
5. Principles of Biochemistry: Mammalian Biochemistry -Emil Smith, Robert Hill, Robert Legman, Robert Lefkowitz, Philip Handler, Abraham white, 7 th Edition, McGraw Hill & Co.

## WEB RESOURCES

1. <http://en.bookfi.net/s/?q=biochemistry&e=1&t=0>

**B.Sc. BIOCHEMISTRY**  
**SEMESTER – VI**  
**CORE – X - PHARMACEUTICAL BIOCHEMISTRY**  
**PAPER CODE: 21UBC10**

**Objective:**

- To provide an in-depth knowledge about sources of drugs, pharmacokinetics and pharmacodynamics.
- To learn adequate scientific knowledge about pharmaceutical manufacturing process.
- To gain a better understanding of drug discovery, design and its development.

**Course outcome:**

**On successful completion of this course, students should be proficient to**

Course No	Course Outcome Details	Knowledge level
CO1	Understand drug dosage, routes of administration and about bioavailability of drugs	K2
CO2	Understand about basic principles involved in pharmacokinetics.	K3
CO3	Understand about the drug receptor interactions and gain knowledge on metabolism.	K3
CO4	Describe the general principles of adverse drug reactions and acute poisoning.	K3
CO5	Advance the knowledge on drug discovery process and ethical issues in drug discovery process and in preclinical toxicological studies.	K3

**Mapping with Programme Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	S	M	S	S	S	S	S
CO2	S	M	S	S	M	S	S	S	S	S
CO3	S	M	S	S	M	S	S	S	S	S
CO4	S	M	S	M	M	S	S	S	S	S
CO5	S	M	M	M	M	S	S	S	S	S

S- Strong M-Medium L-Low

## UNIT I

**Introduction:** Sources of drugs, routes of drug administration, dosage forms, drug dosage.

**Bioavailability:** - Bioavailability of drugs, Factors affecting bioavailability, Bioequivalence. Combined effect of drugs: - Synergism, antagonism.

## UNIT II

**Pharmacokinetics:** Absorption, distribution of drugs, half-life,  $c_{max}$ ,  $t_{max}$ , factors influencing drug absorption and distribution. Drug elimination: - Renal excretion, fecal excretion, biliary excretion, pulmonary excretion and other routes of excretion.

## UNIT III

**Pharmacodynamics:** Drug receptors: - Concept and theory, Drug - receptor interactions, Receptor mediated and non-receptor mediated drug action, Mechanism of phase I and Phase II metabolic reactions, factors affecting drug metabolism, significance of drug metabolism. Placebo effects, Factors modifying drug action.

## UNIT IV

**Adverse Drug Reactions and Toxicology:** Pharmacologic ADRs, Non-pharmacological ADRs, disease-related ADRs, multiple drug reactions. Acute poisoning: - General principles and management. Drug dependence, drug tolerance and intolerance.

## UNIT V

**Drug Discovery and Development:** Random screening, serendipity, molecular modification of a known drug, rational approaches in drug designing. Preclinical research, clinical research, overview of DCGI, NPPA, CDSCO, FDA, ICMR and FSSAI.

## REFERENCES

1. Pharmaceutical Pharmacology - S C Metha and Ashutosh Kar, 2011, New age International publishers.
2. Text book of Medical Pharmacology - Padmaja Udayakumar, 2<sup>nd</sup> Edition, CBS Publishers & Distributors, New Delhi, Bangalore.
3. Oxford Text book of Clinical Pharmacology and Drug Therapy, D. G Grahme Smith and K.Aronson.
4. Pharmacology and Pharmatherapeutics – R.S.Satoskar, S.D.Bhandhakarand.
5. Lippincotts Illustrated review Pharmacology, Mary.J.Mycek, Richards, Pamela.

## WEB RESOURCES

1. <http://en.bookfi.net/s/?q=biochemistry&e=1&t=0>

**B.Sc. BIOCHEMISTRY**  
**SEMESTER – VI**  
**ELECTIVE – II - INDUSTRIAL BIOCHEMISTRY**  
**PAPER CODE: 20UBCE02**

**Objective:**

- To learn the wide use of fermentation technology and microbial production techniques.
- To update the latest scientific developments on microbes and its industrial application
- To gain adequate knowledge on use of microbes in the environment.

**Course outcome:**

**On successful completion of this course, students should be proficient to**

Course No	Course Outcome Details	Knowledge level
CO1	Learn about the culture techniques for isolation of microbes from various sources and preserve the isolates.	K3
CO2	Gain basic knowledge about basic principles of fermentation and types of fermenters.	K3
CO3	Describe the microbial production of bioactive compounds such as organic acids, bacterial and fungal polysaccharides, antibiotics and vitamins.	K3
CO4	Learn about Industrial production of alcohol, alcoholic beverages, production of Single Cell Protein, bioethanol and biogas production.	K3
CO5	Provide fundamental insights to exploit microbes for protecting environment.	K3

**Mapping with Programme Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	S	S	M	S	S	S	S	S
CO2	S	L	S	S	M	S	S	S	S	S
CO3	S	M	S	S	M	S	S	S	S	S
CO4	S	M	S	S	M	S	S	S	S	S
CO5	S	M	S	S	M	S	S	S	S	S

S- Strong M-Medium L-Low

## UNIT – I

**Introduction to Fermentation Technology:** Isolation and screening of industrially important microbes, Various methods of achieving isolation: - Inoculum preparation, strain improvement for better yield; primary and secondary detection of microorganisms. Primary and secondary screening; Biological assay of fermentation products, limitations of Bioassay, Diffusion Assay, Turbidometric assay, metabolic Response Assay, Enzymatic Assay.

## UNIT – II

**Fermentation-** Principles of fermentation. Surface, Submerged and solid-state fermentation, Design and operation of Fermenter, Agitation and aeration, Downstream processing.

**Types of Fermenters:** Air-Lift fermenter, Fluidized Bed Bioreactor, Packed bed Bioreactor, Continuous culture; fed batch culture, fixed volume bed fed-batch, variable volume fed – batch, advantages and disadvantages of the Fed-batch reactors, continuous-Flow stirred-tank reactor.

## UNIT III

**Microbial Production of Bioactive Compounds:** Production of organic acids - Citric acid, lactic acid, acetic acid. Production of bacterial and fungal polysaccharides, Production of Antibiotics -Penicillin and streptomycin. Production of vitamins - B12 and B2.

## UNIT – IV

**Industrial Applications of Microbes:** Industrial production of alcohol, alcoholic beverages – Wine and Beer by yeast

**Production of Single Cell Protein (SCP) – Production of Edible Mushrooms**

**Bioethanol production, production of biogas from agricultural waste.**

## UNIT – V

**Microbes and Environment:** Microbes in mineral recovery: - Bioleaching – mechanism, advantages and disadvantages of bioleaching, Biosorption – Biosorbent material, Biosorption mechanisms. Microbial recovery of petroleum – process and advantages. Microbial degradation of xenobiotics – Properties of xenobiotic compounds, Hazards post by xenobiotics and mechanism involved in xenobiotic metabolism.

**Sewage Biodegradation;** - Sewage treatment, Biodegradation and Bioremediation.

## REFERENCES

1. Pelczar MJ, Chan ECS, Kleig NR, 1993, Microbiology, Tata McGraw Hill.
2. B. Tom Betsy, & Jim Keogh, 2005, Microbiology Demystified, McGraw Hill.
3. C. R C Tilton, 2002, Microbiology, 10th ed, McGraw Hill.
4. D. Stuart Hogg, 2005, Essential Microbiology, Wiley.

## WEB RESOURCES

1. [http://www.water.me.vccs.edu/courses/env108/Lesson3\\_print.htm](http://www.water.me.vccs.edu/courses/env108/Lesson3_print.htm)
2. [http://www.google.co.in/?gws\\_rd=cr&ei=Nx9uUrn0GMA4rgeB44CgCA#q=isolation+of+microorganisms](http://www.google.co.in/?gws_rd=cr&ei=Nx9uUrn0GMA4rgeB44CgCA#q=isolation+of+microorganisms)
3. [http://www.google.co.in/?gws\\_rd=cr&ei=Nx9uUrn0GMA4rgeB44CgCA#q=fermentation](http://www.google.co.in/?gws_rd=cr&ei=Nx9uUrn0GMA4rgeB44CgCA#q=fermentation)
4. <http://en.wikipedia.org/wiki/Biochemist>

## **WEB RESOURCES**

1. <http://en.bookfi.net/s/?q=biochemistry&e=1&t=0>

**B.Sc. BIOCHEMISTRY**  
**SEMESTER – VI**  
**SKILL BASED ELECTIVE COURSE**  
**SBEC - IV - BIOINFORMATICS AND NANOTECHNOLOGY**  
**PAPER CODE: 21UBCS04**

**Objective:**

- To acquire basic knowledge in Bioinformatics/Nanotechnology
- To provide scope for databank and sequence analysis
- To understand the novel concepts in Nanotechnology and Bioinformatics.

**course outcome:**

**On successful completion of this course, students should be proficient to**

Course No	Course Outcome Details	Knowledge level
CO1	Understand basic principles and applications of bioinformatics in lifescience and get trained in database searching.	K2
CO2	Acquire knowledge of biological databases for the sequence alignments and predicting the structures of biomolecules such as nucleic acids and proteins.	K2
CO3	Describe the different tools available for sequence alignment and and predicting the structures	K3
CO4	Describe the different tools available for sequence alignment and and predicting the structures.	K3
CO5	Describe history of nanotechnology, Properties of nanoparticles, types, synthesis of nanoparticles and the characterization of nanoparticles using Microscopy techniques such as SEM, TEM, AFM, STM.	K3

**Mapping with Programme Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	S	S	S	S	S	S	S
CO2	S	M	M	S	S	S	S	S	S	S
CO3	S	M	M	S	S	S	M	M	S	S
CO4	S	M	M	S	S	S	M	M	S	S
CO5	S	M	M	S	S	S	M	M	S	S

S- Strong M-Medium L-Low

## UNIT I

**Introduction to Bioinformatics:** Definition, History, Scope and Applications. Opportunities in Bioinformatics. Emerging areas of Bioinformatics. Databanks – Gen Bank, PDB. Literature Databanks - PubMed, Med line. Human Genome Project.

## UNIT II

**Biological Databases:** Uses of sequence databases-Nucleic acid - NCBI, EMBL, DDBJ, Proteins-SWISSPROT, PIR, Structural databases- CATH, SCOP, Specialized databases – KEGG, OMIM.

## UNIT III

**Sequence Alignment Based on Matrices:** BLOSUM and PAM, Algorithm - Needleman Wunsch & Smith Waterman. Tools for sequence alignment – BLAST, FASTA, ClustalW. Phylogenetic analysis.

## UNIT IV:

**Introduction to Nanotechnology:** Basics of nanotechnology-types of nanoparticles, nanocomposites, nanorods, nanotubes, and dendrimers, Fabrication methods- Top down, Bottom up approach – Properties of nanoparticles – mechanical testing, elasticity, toughness, effect of fabrication on strength. Biosensors – classification - potential based biosensors, bio membrane-based sensors - Principle, instrumentation, applications and biochips.

## UNIT V:

**Applications of Nanotechnology:** Nanotechnology in food industry, textile industry and agriculture - nanomaterial in waste water treatment, Nanotechnology in medicine, cancer therapy and research – Tissue regeneration (Tissue engineering) – Drug delivery system, polymer therapeutics – Polymer drug conjugates – Risks involved in nanotechnology – nanotoxicity, consumer health and environmental concern.

## REFERENCES

1. Leibler DC. 2002. Introduction to proteomics, tools for the new biology. Humana press.
2. Introduction to Bioinformatics - S.Sundararajan and Balaji.
3. Instant notes – Bioinformatics – Westhead, Howard parish and Twyman. Viva books Pvt. Limited. Chennai.
4. Bioinformatics basic skills and applications – Rastogi.
5. Basic Bioinformatics – S. Ignacimuthu (2005). Narosa Publishing House.
6. Bioinformatics for Beginner – K. Mani and Vijayaraj (2002). Kalaikathir Achagam.
7. Bioinformatics: Databases and Algorithms – N. Gautham (2009). Narosa Publishing House.
8. Bionanotechnology: Lessons from Nature, David. S. Goodsell. Jhonwiley 2006.
9. Biomaterials Sciences: An Introduction to Materials in Medicine 2nd Edition, Buddy D. Ratner, Allan S. Hoffman, Frederick J. Schoen and Jack E. Lemons.

## WEB RESOURCES

1. <http://en.bookfi.net/s/?q=biochemistry&e=1&t=0>

**B.Sc. BIOCHEMISTRY  
SEMESTER – VI  
CORE PRACTICAL – III  
PAPER CODE: 21UBCP03**

**Objective:**

- To have hands on experience on laboratory diagnostic tests.
- To learn and understand the biochemical analysis and estimation of various biomarkers.
- **On successful completion of this course, students should be proficient to**

Course No	Course Outcome Details	Knowledge level
CO1	Estimate and identify the hematological parameters	K4
CO2	Experiment the assay of serum marker enzymes	K4
CO3	Analyse the blood parameters like urea, bilirubin cholesterol etc	K4
CO4	Experiment urine samples	K4

**Mapping with Programme Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	S	S	S	L	S	S
CO2	S	M	S	S	S	S	M	L	S	S
CO3	S	M	S	S	S	S	M	L	S	S
CO4	S	M	S	S	S	S	S	L	S	S

S- Strong M-Medium L-Low

## **I. HEMATOLOGY**

1. Estimation of Hemoglobin – Sahli's method
2. Enumeration of RBC & WBC
3. Differential Smear – Blood cells count
4. Bleeding time & Clotting time
5. Identification of blood grouping & typing
6. Evaluate ESR & PCV

## **II. ASSAY OF SERUM MARKER ENZYMES**

- a. Determination of activity of SGOT and SGPT
- b. Determination of activity Acid Phosphatase and Alkaline Phosphatase

## **III. 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.

## **IV. 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.

## **REFERENCES**

1. Practical Clinical Biochemistry, 1988, Harold Varley 2<sup>nd</sup> to 4<sup>th</sup> Edition, CBS publishers, New Delhi.
2. Introductory practical Biochemistry, 1999 Editors: S.K. Sawhney and Randhir Singh, Narosa Publishing House, Mumbai
3. Biochemical Methods 1992, S.Sadasivam and A. Manickam, Second Edition, New Age International Publishers, New Delhi
4. Laboratory Manual in Biochemistry, 1981. J.Jayaraman, New Age International Publishers, New Delhi
5. A Manual of Laboratory Techniques, 2003. N. Raguhuramulu, K. Madhavan Nair, S. Kalayanasundaram, National Institute of Nutrition.

## **WEB RESOURCES**

1. [https://biolympiads.com/wp-content/uploads/2014/08/metodich\\_1.pdf](https://biolympiads.com/wp-content/uploads/2014/08/metodich_1.pdf)

**B.Sc. BIOCHEMISTRY**  
**SEMESTER – VI**  
**CORE PRACTICAL – IV**  
**PAPER CODE: 21UBCP04**

**Objective:**

- To have hands on experience on tissue culture techniques and immunological assays.
- To learn and understand the identification and characterization of microbes.

**On successful completion of this course, students should be proficient to**

Course No	Course Outcome Details	Knowledge level
CO1	Demonstration on PTC media preparation ,and callus induction	K4
CO2	Experiment the genetic engineering protocols	K4
CO3	Investigate on immunological experiments	K4
CO4	Experiment and interpret the microbiological experiments	K4

**Mapping with Programme Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	S	S	S	L	S	S
CO2	S	M	S	S	S	S	M	L	S	S
CO3	S	M	S	S	S	S	M	L	S	S
CO4	S	M	S	S	S	S	S	L	S	S

S- Strong M-Medium L-Low

## **I. PLANT TISSUE CULTURE**

1. Media preparation
2. Callus induction
3. Micropropagation

## **I. GENETIC ENGINEERING**

1. Restriction Digestive Enzymes identification
2. Isolation of Plasmid DNA and Separation in Electrophoresis
3. Isolation of genomic DNA

## **II. IMMUNOLOGY**

1. Single [Radial] Immunodiffusion
2. Double [Ouchterlony] immunodiffusion
3. Immunoelectrophoresis

## **III. MICROBIOLOGY**

1. Sterilization: Wet and Dry methods
2. Preparation of Agar and broth media [Slant and plate]
3. Culture Techniques: Streak, Pour and Spread plate
4. Enumeration of microbes from soil, air and water
5. Staining techniques: Simple and Gram's staining
6. Identification of microbes by Biochemical tests [IMViC tests]

## **REFERENCES**

1. Biochemical Methods (1992), by S. Sadasivam and A. Manickam, Second Edition, New Age International Publishers, New Delhi.
2. Introductory practical Biochemistry (2005), by S. K. Sawhney and Radhir Singh, Alpha Science International publishers, 2<sup>nd</sup> Edition.
3. Kannan N (1996) Laboratory Manual in General Microbiology. 1st Edition, Palani Paramount Publications, Palani, Tamilnadu.
4. Sundararaj T. Microbiology – Laboratory Manual. Revised and Published by Aswathy Sundararaj, No.5. 1st Cross Street, Thirumalai Nagar, Perungudi, Chennai.
5. Aneja KR (2005). Experiments in Microbiology, Plant pathology and Biotechnology. 4th Edition, New Age International Publishers, Chennai.
6. James G Cappuccino & Natalie Sherman (2008) Microbiology: A Laboratory manual. 8th Edition, Published by Pearson Education.

## **WEB RESOURCES**

1. [https://biolympiads.com/wp-content/uploads/2014/08/metodich\\_1.pdf](https://biolympiads.com/wp-content/uploads/2014/08/metodich_1.pdf)

**B.Sc. BIOCHEMISTRY**  
**SEMESTER – I**  
**ALLIED - I - BIOCHEMISTRY – I**  
**PAPER CODE: 21UBCA01**

**Objective:**

- To understand the simple and molecular structure of the different types of biomolecules, enzymes and vitamins.
- To gain knowledge the physicochemical properties and biological importance of biomolecules.

**Course outcome:**

**On successful completion of this course, students should be proficient to**

Course No	Course Outcome Details	Knowledge level
CO1	Describe structures, properties and functions of carbohydrates.	K2
CO2	Understand the structures, properties and role of amino acids and proteins.	K2
CO3	Describe the nomenclature and identify the classes of enzymes and factors affecting their action with kinetics.	K2
CO4	Demonstrate about the structure and properties of lipids and Nucleic acids with their importance.	K2
CO5	Describe about source, importance and deficiency disorders of vitamins and minerals	K2

**Mapping with Programme Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	S	M	S	M	M	M	S	S
CO2	S	L	S	M	S	M	M	M	S	S
CO3	S	L	S	M	S	M	M	M	S	S
CO4	S	L	S	M	S	M	M	M	S	S
CO5	S	L	S	M	S	M	M	M	S	S

S- Strong M-Medium L-Low

## UNIT - I

**Carbohydrates:** Classification of carbohydrates, Monosaccharides: - Structures, Stereoisomers and structural isomers, mutarotation, and chemical properties. Oligosaccharides: - Disaccharides-structure and importance of sucrose, Lactose, maltose, Polysaccharides: - Structure and significance of homopolysaccharides and heteropolysaccharides.

## UNIT - II

**Amino Acids:** Structures and Classifications of amino acids, Essential and Non-essential amino acids, properties of amino acids.

**Protein:** Classification and functions of proteins, bonds involved in protein structure, structural levels of organization: - primary, secondary, tertiary and quaternary structures with examples.

## UNIT - III

**Enzymes:** Holoenzyme, Apoenzyme, coenzymes, cofactors/prosthetic groups, IUB classification of enzymes with example. Active site: - characteristic features and theories of ES complex, enzyme units, Enzyme kinetics: - MM equation and LB plot, factors affecting enzyme activity.

## UNIT - IV

**Lipids:** Classifications of lipids, physical and chemical properties of fats, structure and functions of saturated and unsaturated fatty acids.

**Nucleic Acids:** Nitrogenous bases, structures of Ribonucleotides and deoxyribonucleotides, structure and functions of DNA and RNA.

## UNIT - V

**Vitamins:** Sources, RDA, biochemical functions, deficiency disorders of fat soluble and water-soluble Vitamins.

**Minerals:** Sources, Biological importance and disorders of Phosphorus, Calcium, Magnesium and Iron.

## REFERENCES

1. Lehninger's Principles of Biochemistry (2000) by Nelson, David L. and Cox, M.M. Macmillan/ worth, NY.
2. Fundamentals Of Biochemistry (1999) by Donald Voet, Judith G.Voet and Charlotte W Pratt, John Wiley & Sons, NY.
3. Biochemistry 4th edition (1988) by Zubay G L, W M C Brown Publishers.
4. Principles of Biochemistry (1994) Garrette & Grisham, Saunders college publishing.
5. Text book of biochemistry (1997) 4th edition Thomas M devlin, A John Wiley, Inc publication, New York.
6. Biochemistry (2013) by U.Satyanarayana and U. Chakrapani, 4th edition, Elsevier.

## WEB RESOURCES

1. <http://en.bookfi.net/s/?q=biochemistry&e=1&t=0>

**B.Sc. BIOCHEMISTRY**  
**SEMESTER – II**  
**ALLIED II - BIOCHEMISTRY – II**  
**PAPERCODE: 21UBCA02**

**Objective:**

- To learn biochemical techniques, metabolism of biomolecules and energy production.
- To gain knowledge the physicochemical properties and biological importance of hormones.

**Course outcome:**

**On successful completion of this course, students should be proficient to**

Course No	Course Outcome Details	Knowledge level
CO1	Understand the basics of acid - base balance of human body and gain Develop competence in handling various chromatographic techniques.	K2
CO2	Describe carbohydrate metabolism and gain knowledge about Diabetes mellitus.	K2
CO3	Learn basic concepts of Bioenergetics, mechanisms of oxidative phosphorylation.	K2
CO4	Describe the concepts of lipid metabolism and amino acid metabolism.	K2
CO5	Gain knowledge about the basic terminologies, classification and mechanism of action of hormones and to demonstrate various types of second messengers.	K2

**Mapping with Programme Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	S	M	S	M	M	M	S	S
CO2	S	L	S	M	S	M	M	M	S	S
CO3	S	L	S	M	S	M	M	M	S	S
CO4	S	L	S	M	S	M	M	M	S	S
CO5	S	L	S	M	S	M	M	M	S	S

S- Strong M-Medium L-Low

## UNIT I

**pH and Buffers:** Definitions for Acids and bases, pH: - Definition and determination of pH, Henderson - Hasselbalch equation, Buffer systems of human body.

**Biochemical Techniques:** Principles and Applications of paper and thin layer.

## UNIT II

**Carbohydrate Metabolism:** Glycolysis, Citric acid cycle, gluconeogenesis, glycogen metabolism and HMP shunt.

## UNIT III

**Bioenergetics:** Redox potential, Electron transport chain, Oxidative phosphorylation, inhibitors of ETC, uncouplers of oxidative phosphoryation, High energy compounds.

## UNIT IV

**Lipid Metabolism:** Beta and omega oxidation, Biosynthesis of Saturated fatty acids. Interrelationship between carbohydrates, proteins and fat metabolism.

**Protein Metabolism:** Transamination, oxidative and non-oxidative deamination, decarboxylation, urea cycle.

## UNIT V

**Introduction to Hormones:** Definition, Classification and Biological significance of hormones, mechanism of hormone action.

**Second Messengers:** - Role of cAMP, cGMP, IP<sub>3</sub>, DAG and Ca<sup>2+</sup>.

## REFERENCES

1. Principles and techniques of practical Biochemistry, Keith Wilson and John Walker, 1995. Cambridge University Press.
2. Biophysical chemistry Principles and Techniques- Avinash Upadhyaye and Nirmalendhe Nath, Himalaya Publishers.
3. A Biologist Guide to Principles and Techniques of Biochemistry, Keith Wilson and Kenneth Goulding, Edward Arnold publishers.
4. Fundamentals of Biochemistry (1999) by Donald Voet, Judith G.Voet and Charlotte W Pratt, John Wiley & Sons, NY.
5. Outlines of Biochemistry (1987) by Eric E.Conn, P.K. Stumpf, G.Brueins and Ray H.Do, JohnWiley & Sons, NY.
6. Biochemistry 3rd (1994) by Lubert stryer, W H freeman and co, Sanfrancisco.
7. Text book of biochemistry (1997) 4th edition, Thomas M devlin, A John Wiley, In.
8. Biochemistry (2013) by U.Satyanarayana and U. Chakrapani, 4th edition, Elsevier

## WEB RESOURCES

1. <http://en.bookfi.net/s/?q=biochemistry&e=1&t=0>

**B.Sc. BIOCHEMISTRY**  
**SEMESTER – II**  
**ALLIED PRACTICAL – I - BIOCHEMISTRY PRACTICAL**  
**PAPER CODE: 21UBCAP01**

**Objective:**

- To have hands on experience on qualitative analysis of biomolecules.
- To learn and understand the separation techniques.

**On successful completion of this course, students should be proficient to**

Course No	Course Outcome Details	Knowledge level
CO1	Analyse biomolecules for qualitative study	K4
CO2	Learn about biochemical preparation carbohydrates, proteins and lipids	K4
CO3	Quantify the biomolecules	K4
CO4	Experiment chromatography techniques	K4

**Mapping with Programme Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	S	S	S	S	S	L	S	S
CO2	S	L	S	S	S	S	M	L	S	S
CO3	S	L	S	S	S	S	M	L	S	S
CO4	S	L	S	S	S	S	S	L	S	S

S- Strong M-Medium L-Low

## **I. Qualitative Analysis**

- a. Analysis of carbohydrates
- b. Analysis of Amino acids
- c. Test for proteins
- d. Test for lipids – cholesterol

## **II. Biochemical preparation**

- a. Starch from Potato
- b. Casein from milk
- c. Lecithin from egg yolk

## **III. Quantitative Analysis**

- a. Reducing Sugar – Benedict's method
- b. Amino acid – formal titration
- c. Ascorbic acid – using 2, 6 Dichloro phenol Indophenol method.

## **IV. Techniques**

- a. Separation of sugar & amino acid by paper chromatography
- b. Separation of lipid by thin layer chromatography

## **REFERENCENCES**

1. Biochemical Methods 1992, by S.Sadasivam and A. Manickam, Second Edition, New Age International Publishers, New Delhi.
2. Laboratory Manual in Biochemistry, 1981. J.Jayaraman, New Age International publishers, New Delhi.
3. Introductory practical Biochemistry (2005), by S. K. Sawhney and Radhir singh, Alpha Science International publishers, 2nd Edition.

## **WEB RESOURCES**

1. [https://biolympiads.com/wp-content/uploads/2014/08/metodich\\_1.pdf](https://biolympiads.com/wp-content/uploads/2014/08/metodich_1.pdf)

**B.Sc. BIOCHEMISTRY**  
**SEMESTER – III**  
**NON-MAJOR ELECTIVE COURSE – I**  
**PAPER I – FUNDAMENTALS OF HUMAN PHYSIOLOGY**  
**PAPER CODE: 21UBCN01**

**Objective**

- To educate non-bioscience students about human system
- To emphasize fundamentals of physiology of human anatomy
- To provide knowledge on neuronal network.

**Course outcome:**

**On successful completion of this course, students should be proficient to**

Course No	Course Outcome Details	Knowledge level
CO1	Describe about digestion and absorption process of biomolecules	K2
CO2	Grasp the respiratory system and mechanism of exchange of gaseous.	K2
CO3	Gain awareness on cardiovascular system, structure and functioning of heart.	K2
CO4	Understand the urine formation and excretion through kidney.	K2
CO5	Obtain an imminent knowledge about nervous system.	K2

**Mapping with Programme Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	M	M	S	S	M	S
CO2	S	M	S	S	M	M	S	S	M	S
CO3	S	M	S	S	M	M	S	S	M	S
CO4	S	M	S	S	M	M	S	S	M	S
CO5	S	M	S	S	M	M	S	S	M	S

S- Strong M-Medium L-Low

## **UNIT – I**

**Digestive System:** Overview of the digestive system, process of digestion, absorption of carbohydrates, proteins and fats.

## **UNIT – II**

**Respiratory System:** Overview of the respiratory system, transport and exchange of gases.

## **UNIT – III**

**Cardiovascular System:** overview of cardiovascular system, structure and function of heart,

## **UNIT – IV**

**Renal System:** Kidney and nephron structure, mechanism of glomerular filtration, tubular reabsorption and secretion.

## **UNIT – V**

**Nervous System:** Classification of nervous system, Structure of neuron, Action potential, signal transmission at synapse, neurotransmitters.

## **REFERENCES**

1. Essentials of Medical Physiology by K. Sembulingam and Prema Sembulingam, 6th Edition, 2012
2. Principles of Anatomy and Physiology by Tortora and Grabowski, 2003, John Wiley & Sons, Inc.
3. Human Physiology, Chatterjee.C. 11th edition Medical agency allied, Calcutta.
4. Text book of medical physiology, A.C. Guyton 10th edition.
5. Human body, Atlas, Publication Garden cheers.
6. Review of medical physiology, William. F. Ganong, 14th edition, A Lange Medical book.

## **WEB RESOURCES**

1. <http://en.bookfi.net/s/?q=biochemistry&e=1&t=0>

**B.Sc. BIOCHEMISTRY**  
**SEMESTER – III**  
**NON-MAJOR ELECTIVE COURSE - I**  
**PAPER – II - BIOCHEMISTRY IN NUTRITION**  
**PAPER CODE: 21UBCN02**

**Objective:**

- To create awareness on various nutrient content in food/food regulation act / food safety
- The significance of nutrients in metabolic process
- To study the importance of nutrients during physiological changes and in sports

**Course outcome:**

**On successful completion of this course, students should be proficient to**

Course No	Course Outcome Details	Knowledge level
CO1	Describe the nutritional profile of various foods and the role of biomolecules, fiber and antioxidants.	K2
CO2	Describe the techniques to measure energy expenditure and BMR; RDA for various disorders.	K3
CO3	Understand the recommended dietary allowances for different age group people.	K3
CO4	Gain awareness on drug – nutrient interactions, food allergy and importance of nutraceuticals.	K3
CO5	Obtain an impending knowledge about nutritional therapy for various metabolic disorders.	K3

**Mapping with Programme Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	S	S	M	S	S	S
CO2	S	M	S	S	S	S	M	S	S	S
CO3	S	M	M	S	S	S	S	S	S	S
CO4	S	M	M	S	S	S	S	S	S	S
CO5	S	M	M	S	S	S	S	S	S	S

S- Strong M-Medium L-Low

## **UNIT – I**

**Nutritional Profile of Foods:** - Cereals, pulses, vegetables, fruits, nuts, oil seeds, animal foods, milk and milk products, egg, fish, meat, drinks and spices. Role of dietary carbohydrates, proteins, fats, fiber and antioxidants.

## **UNIT -II**

Determination of calorific value of foods by Bomb calorimeter. Measurement of energy expenditure, respiratory quotients of food stuffs, specific dynamic action. BMR: - Measurement of BMR and factors influencing BMR. RDA for patients: - Anemic, Diabetic, Blood pressure and obese.

## **UNIT – III**

Recommended dietary allowances for infants, children, adolescent, pregnant, lactating women, athletes and geriatrics.

## **UNIT- IV**

Drug - nutrient Interactions, food toxins, food allergy, adverse effects of alcohol, tobacco, tea, Acidic and alkaline foods. Nutraceuticals: - Introduction and classification of nutraceuticals.

## **UNIT- V**

Nutritional therapy for inborn errors of metabolism, role of diet and nutrition in the prevention and treatment of diseases: - Diabetes mellitus, peptic ulcer, jaundice, hypertension and cardiovascular diseases.

## **REFERENCES**

1. Human nutrition by B. Srilakshmi, New age International Pvt Ltd, 2009
2. Human nutrition and dietetics, S. Davidson and J.R. Passmore.
3. Human nutrition and dietetics, IS Garraw, WPT James, 10th edition.
4. Mechanism and theory in food chemistry, DWS Wong, CBS New Delhi, 1996.
5. Modern nutrition in health and diseases, Whol and Good hart.

## **WEB RESOURCES**

1. <http://en.bookfi.net/s/?q=biochemistry&e=1&t=0>

**B.Sc. BIOCHEMISTRY**  
**SEMESTER – IV**  
**NON-MAJOR ELECTIVE COURSE - II**  
**PAPER I - BIOCHEMISTRY AND HEALTH**  
**PAPER CODE: 21UBCN03**

**Objective:**

- To understand the different types of biomolecules.
- To learn the common disorders of nutritional deficiency.
- To gain knowledge on the biological importance of micro nutrients.

**Course outcome:**

**On successful completion of this course, students should be proficient to**

Course No	Course Outcome Details	Knowledge level
CO1	Summarize the sources, importance of carbohydrates and gain awareness about Diabetes mellitus.	K2
CO2	Understand the importance of proteins in living organism with their deficiency disorders.	K2
CO3	Describe the sources and importance of lipids along with the disorders of lipid metabolism.	K2
CO4	Explain the sources, RDA, importance and deficiency disorders of vitamins.	K2
CO5	Describe about sources and biological importance of minerals.	K2

**Mapping with Programme Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	M	M	S	S	M	S	S
CO2	S	M	S	M	M	S	S	M	S	S
CO3	S	M	S	M	M	S	S	M	S	S
CO4	S	M	S	M	M	S	S	M	S	S
CO5	S	M	S	M	M	S	S	M	S	S

S- Strong M-Medium L-Low

## **UNIT – I**

**Carbohydrate:** Sources of carbohydrates, importance of carbohydrates in living organisms, Normal level of sugar in blood, factors influencing blood glucose, renal threshold value, Diabetes mellitus: - Types, Complications, management-monitoring methods of blood glucose level and GTT.

## **UNIT – II**

**Proteins:** Sources of proteins and amino acids, essential and non-essential aminoacids, Importance of proteins in living organisms, normal level of serum proteins, protein deficiency disorders: -Kwashiorkor and Marasmus.

## **UNIT – III**

**Lipids:** Sources of lipids, essential and non-essential fatty acids, importance of fats and lipids in living organism, role of lipoproteins in human body. Normal levels of cholesterol and TG. Disorders: - Hypertension and Atherosclerosis.

## **UNIT – IV**

**Vitamins:** Sources, RDA, importance, deficiency disorders of water-soluble and fat-soluble vitamins in humans.

## **UNIT – V**

**Minerals:** - Sources, Biological importance and deficiency disorders of Na, K, Ca, Mg, P, Fe, Zn, Se and Iodine in humans.

## **REFERENCES**

1. Textbook of medical physiology by C. Guyton, John E. Hall. 12<sup>th</sup> ed, 2011, Saunders, an imprint of Elsevier Inc.
2. Medical Biochemistry by MN Chatterjee, Rana Shinde, 8th edition, 2013, Jaypee publications.
3. Deb. A.C., Fundamentals of Biochemistry, 10<sup>th</sup> edition, 2011, New central book agency Pvt Ltd.
4. Biochemistry (2013) by U. Satyanarayana and U. Chakrapani, 4th edition, Elsevier.
5. Ambika Shanmugam's Biochemistry for Medical Students by K. Ramadevi, 8th Edition, Wolters kluvel

## **WEB RESOURCES**

1. <http://en.bookfi.net/s/?q=biochemistry&e=1&t=0>

**B.Sc. BIOCHEMISTRY**  
**SEMESTER – IV**  
**NON-MAJOR ELECTIVE COURSE - II**  
**PAPER II - BIOCHEMISTRY IN DIAGNOSIS**  
**PAPER CODE: 21UBCN04**

**Objective:**

- To understand the different types of diagnostic tests in biochemistry.
- To learn the common techniques to collect, preserve and processing the biological samples.
- To gain knowledge on the enzyme assays.

**Course outcome:**

**On successful completion of this course, students should be proficient to**

Course No	Course Outcome Details	Knowledge level
CO1	Summarize the use of standard precautions applied in clinical laboratory and during the collection, processing, preservation and transportation of biological specimens for analysis.	K3
CO2	Gain knowledge of the normal composition of blood and their analysis along with their significance in maintaining good health.	K3
CO3	Become skilled at performing clinical urine tests for diagnostic purposes and Identify abnormal constituents of urine.	K3
CO4	Describe physical, chemical and microscopic examination of stool and analysis of its constituents using standard procedures.	K3
CO5	Become aware with the variations in the levels of biochemical components of blood and their relationship with various diseases and also get acquainted with the role of enzymes in diagnosis of a variety of diseases.	K3

**Mapping with Programme Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	S	S	M	S	M	M	S	S
CO2	S	L	S	S	M	S	M	M	S	S
CO3	S	L	S	S	M	S	M	M	S	S
CO4	S	L	S	S	M	S	M	M	S	S
CO5	S	L	S	S	M	S	M	M	S	S

S- Strong M-Medium; L-Low

## **UNIT - I**

**Approaches to Clinical Biochemistry:** Collection of clinical specimens, preservatives for blood and urine, transport of biological samples.

**Quality Control:** Concepts of accuracy, precision, sensitivity and reproducibility,

## **UNIT - II**

**Hematology:** Composition and functions of blood, Haemoglobin, PCV, ESR, RBC count, WBC count, Platelet count, Differential count, ESR and PCV.

## **UNIT - III**

**Physical Examination of Urine:** Volume, colour, odour, appearance, specific gravity and pH.

**Chemical examination of urine:** Qualitative tests for Reducing sugar, protein, ketone bodies, Bile pigment, bile salt, Urobilinogen, and mucin. Microscopic Examination of urine.

## **UNIT - IV**

**Stool Examination:** Collection of fecal specimens, preservation, **physical examination:** - volume, colour, odour and appearance. **Chemical examination:** - reducing sugar, occult blood test, detection of steatorrhea. Microscopic examination of stool.

## **UNIT - V**

**Estimation of Biochemical Components in Blood:** Glucose, GTT, Glycosylated hemoglobin, Protein, cholesterol, Urea, Uric acid and Creatinine.

**Determination of Enzyme Activity:** SGOT, SGPT and LDH.

## **REFERENCES**

1. Kanai L. Mukherjee, Medical Laboratory Technology Vol. I. Tata Mc Graw Hill 1996, New Delhi.
2. Sabitri Sanyal, Clinical pathology, B. I. Churchill Livingstone(P)Ltd, New Delhi.2000.
3. Text book of Biochemistry with clinical correlation, Thomas M. Devlin, 3rd edition, A. John Wiley-Liss Inc.Publication.
4. Practical Clinical Biochemistry, Harold Varley, 4th edition, CBS Publication and Distributors, New Delhi.
5. Tietz Fundamentals of Clinical Chemistry- (5th edition) C.A. Burtis, E.R. Ashwood (eds) Saunders WB Co.
6. Medical Biochemistry by MN Chatterjee, Rana Shinde, 8th edition, 2013, Jaypee publications.

## **WEB RESOURCES**

1. <http://en.bookfi.net/s/?q=biochemistry&e=1&t=0>

**B.Sc., BIOCHEMISTRY**

**SEMESTER- I**

**MAJOR – BASICS OF BIOCHEMISTRY**

**PAPER CODE: 21UBC01**

**Total. Marks: 75**

**Time: 3Hrs**

**SECTION – A (1×15=15)**

**Answer the following questions**

1. Mark the INCORRECT statement about sugar alcohol?
  - a) Addition of -itol as a suffix
  - b) A linear molecule that cannot cyclize
  - c) Carbonyl groups reduced to a hydroxyl group
  - d) Terminal -OH group oxidizes
2. Which class of carbohydrates is considered as non-sugar?
  - a) Monosaccharide
  - b) Polysaccharide
  - c) Oligosaccharide
  - d) Disaccharide
3. Which out of the following is a carbohydrate with no nutritional value?
  - a) Glycogen
  - b) Starch
  - c) Dextrin
  - d) Cellulose
4. The general structure of all amino acids is same except for -----
  - a) Lysine
  - b) Glycine
  - c) Proline
  - d) Alanine
5. How is the secondary structure of a protein stabilized?
  - a) Vander wall forces
  - b) Hydrogen bonding
  - b) Covalent bond
  - d) Hydrophobic bond
6. Which part of the amino acid gives it uniqueness?
  - a) Amino group
  - b) Carboxyl group
  - c) Side chain
  - d) None
7. Naturally occurring fats are
  - a) L types
  - b) D types
  - b) Symmetric
  - d) An equi – molar mixture of L and D types
8. Dietary fats are transported as
  - a) Chylomicrons
  - b) Liposomes
  - b) Lipid globules
  - d) Oil droplets sample
9. Which is a phospholipid
  - a) Lecithin
  - b) Cholesterol
  - b) Sterol
  - d) Steroid
10. Group of adjacent nucleotides are joined by
  - a) Phosphodiester bond
  - b) Peptide bond
  - b) Ionic bond
  - d) Covalent bond
11. Building blocks of the nucleic acids are
  - a) Nucleotides
  - b) Nucleosides
  - b) Amino acids
  - d) Histones
12. One of the following nucleic acid has a left-handed helix?
  - a) m- RNA
  - b) t - RNA
  - b) A – DNA
  - d) Z – DNA

13. Niacin is the chemical name of which vitamin?  
a) Vitamin B3                      b) Vitamin B1  
b) Vitamin B2                      d) Vitamin C
14. Name the vitamins which are essential for the health of the brain?  
a) Vitamin B6                      b) Vitamin B9  
b) Vitamin B12                     d) All of the Above
15. Which of the following Vitamin is also known as Cobalamine?  
a) Vitamin B1                      b) Vitamin B6  
c) Vitamin B12                     d) Vitamin B2

**SECTION – B (5×2=10)**

**Answer any two questions**

16. Explain the following  
i) Define isomerism and its types  
ii) Mutarotation with an example
17. What are the bonds involved in protein structure?
18. Write a detailed account on Lipoproteins and its types.
19. Discuss the differences between Nucleotides and Nucleosides.
20. Explain the structure, RDA, functions and deficiency status of Anti Xerophthalmic vitamin.

**SECTION – C (5×10=50)**

**Answer either or questions**

21. A) Explain the chemical properties of monosaccharides. **(Or)**  
B) Give a detailed account on Carbohydrates and its classifications.
22. Write a note on the classification of amino acids. **(Or)**  
B) Describe the structural organization of secondary structure of protein.
23. A) Describe the classification and properties of fatty acids. **(Or)**  
B) Discuss on compound lipids: structure and properties.
24. A) Explain the structure, types and functions of RNA. **(Or)**  
B) Describe the Watson and Crick model of double helical structure and properties of DNA.
25. A) Describe structure, sources, RDA, functions and deficiency of Vitamin D. **(Or)**  
B) Discuss the differences between water- and fat-soluble vitamins and its functions.

**All the best**

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