



# PERIYAR UNIVERSITY

PERIYAR PALKALAI NAGAR

SALEM - 636011

**DEGREE OF BACHELOR OF SCIENCE**  
*CHOICE BASED CREDIT SYSTEM*

*Syllabus for*

## **B.SC. BIOCHEMISTRY**

( SEMESTER PATTERN )

( For Candidates admitted in the Colleges affiliated to  
Periyar University from 2017 - 2018 onwards )



## REGULATIONS

### 1. Preamble and objectives of the Course :

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

The major objectives of B.Sc., Biochemistry course are,

- To study the structures and functions of biomolecules.
- To understand the principles, instrumentation and applications of bioanalytical techniques.
- To study the enzyme catalysis, bioenergetics and major metabolic pathways.
- To study the techniques to understand molecular and gene expression.
- To understand human physiology and nutritional requirements.
- To study molecular concepts of body defenses and its mechanisms.
- To impart knowledge in principles and applications of clinical Biochemistry.
- To obtain knowledge in Pharmaceutical, Microbial and Industrial Biochemistry.
- To acquire skills for laboratory experiments.
- To prepare candidates for a career in Pharmaceutical industries, food industries etc.

### 2. Eligibility

Refer this office circular No: PU/R/AD-1/UG/PG/Programmes Eligibility/2019 Dated: 16-04-2019.

### 3. Duration of the Course :

The course for the degree of Bachelor of Science shall consist of three academic years into six semesters

### 4. Course of study:

The course of study for the B.Sc. Degree in Biochemistry Branch shall comprise the following subjects according to the syllabus,

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

Non Major Elective Course subjects ) Major : Biochemistry

Allied I- Chemistry (Compulsory) Allied II- Chemistry (Compulsory) Allied III- Biostatistics (Compulsory)

Allied IV- Computer Applications in Biology (Compulsory)

Non major elective course subjects 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. Major- practical –I
11. Allied –I Practical
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. Major - Practical II
24. Allied - Practical
25. Skill Based Elective Course - II
26. Non Major Elective Course - II

#### **V - SEMESTER**

27. Core Paper -V
28. Core Paper –VI
29. Core Paper –VII
30. Elective Paper -I
31. Skill Based Elective Course III
32. Major Practical – III

#### **VI - SEMESTER**

33. Core Paper - VIII
34. Core Paper - IX
35. Core Paper - X
36. Elective Paper - II
37. Skill Based Elective Course IV
38. Major Practical – IV
39. **Nan Mudhalvan Skill Development Course - III**
40. Mini Project (Group project)

### **5. Examinations**

There shall be six examinations for three years – two examination each years, two in the first year, two in the second year and two in the third 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. Examinations for I, III and V semesters will be held in November/ December and for II, IV and VI semesters will be held in April / May. The practical examination I will be held at the end 3of I year (II-semester). II will be held at the end of II year (IV-semester). III will be held at the end of V-semester and IV will be held at the end of III year (VI-semester). The mini project group should contain a maximum of 5 students and their report should be submitted and presented before the examiners at the end of VI- semester.

### **6. Passing Minimum**

A candidate shall be declared to have passed the examination if he /she secure not less than 40% of the

marks in each paper / practical. Candidates who do not secure the required minimum marks for pass in a paper / practical shall be required to reappear for and pass the same at a subsequent appearance. For 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 prescribed for the 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 2017-2018 onwards for candidates admitted during the academic year 2017-2018 and thereafter.

### 11. **Transitory Provision**

Candidates who were admitted to the UG course of study before 2015-2016 shall be permitted to appear for the examinations under those regulations for a period of three years i.e. up to April / May 2020 examination.. Thereafter, they will be permitted to appear for the examination only under the regulations there in 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

**COURSE OF STUDY AND SCHEME OF EXAMINATIONS**

SEM	PART	SUB CODE	COURSE	Hrs.		CRE DIT	MARKS		
				Lect.	T/P		CIA	EA	TOTAL
<b>SEMESTER – I</b>									
I	I	Language	Tamil I	6	T	3	25	75	100
	II	Language	English I	6	T	3	25	75	100
	III	Core I	Bio organic Chemistry	5	T	5	25	75	100
		Allied I	Chemistry I	5	T	3	25	75	100
	III	Core		3	P				
		Practical I							
	III	Allied		3	P				
		Practical I							
	IV	Value Education	Yoga	2	T	2	25	75	100
			<b>Total</b>	<b>30</b>		<b>16</b>			
<b>SEMESTER – II</b>									
II	I	Language	Tamil II	6	T	3	25	75	100
	II	Language	English II	6	T	3	25	75	100
	III	Core II	Tools of Biochemistry	5	T	5	25	75	100
		Allied II	Allied Chemistry II	5	T	3	25	75	100
		Core		3	P	4	40	60	100
		Practical I							
		Allied		3	P	4	40	60	100
		Practical I							
	IV		Environmental Studies	2	T	2	25	75	100
			<b>Total</b>	<b>30</b>		<b>24</b>			
<b>SEMESTER – III</b>									
III	I	Language	Tamil III	6	T	3	25	75	100
	II	Language	English III	6	T	3	25	75	100
	III	Core III	Enzymes	4	T	5	25	75	100
		Allied III	Biostatistics	4	T	3	25	75	100
		Core		3	P				
		Practical II							
		Allied		3	P				
		Practical II							
	IV	NMEC - I		2	T	2			
		SBEC - I	Cell Biology	2	T	3	25	75	100
			<b>Total</b>	<b>30</b>		<b>19</b>			

## B Sc BIOCHEMISTRY

SEM	PART	SUB CODE	COURSE	Hrs.		CRE DIT	MARKS		
				Lect.	T/P		CIA	EA	TOTAL
<b>SEMESTER – IV</b>									
IV	I	Language	Tamil IV	6	T	3	25	75	100
	II	Language	English IV	6	T	3	25	75	100
	III	Core IV	Intermediary Metabolism	4	T	5	25	75	100
		Allied IV	Computer applications in Biology	4	T	3	25	75	100
		Core	Practical II	3	P	4	40	60	100
	IV	Allied	Practical II	3	P	4	40	60	100
		NMEC - II		2	T	2	25	75	100
		SBEC- II	Plant Biochemistry	2	T	3	25	75	100
			<b>Total</b>	<b>30</b>		<b>27</b>			
<b>SEMESTER – V</b>									
V	III	Core V	Clinical Biochemistry	5	T	4	25	75	100
		Core VI	Molecular Biology	5	T	4	25	75	100
		Core VII	Human Physiology	5	T	4	25	75	100
		Core	Practical III	5	P	4	40	60	100
		Elective-I	Nutritional Biochemistry	5	T	5	25	75	100
			Mini Project (group)	2					
	IV	SBEC - III	Genetic Engineering	3	T	3	25	75	100
				<b>30</b>		<b>24</b>			
<b>SEMESTER – VI</b>									
VI	III	Core VIII	Immunology	5	T	4	25	75	100
		Core IX	Endocrinology	5	T	4	25	75	100
		Core X	Pharmaceutical Biochemistry	5	T	4	25	75	100
		Core	Practical IV	5	P	4	40	60	100
		Elective-II	Microbial and Industrial Biochemistry	4	T	4	25	75	100
			Mini Project (group)	2		5	40	60	100
	IV	SBEC- IV	Bioinformatics and Nanotechnology	2	T	2	25	75	100
			Nan Mudhalvan Skill Development Course - III	Employability Readiness	2	T	2	25	75



	V		Extension activity			1			
				<b>30</b>		<b>30</b>			

	Study Components	First Year		Second Year		Third Year		No. of papers (subject-wise)	Total Credits (subject-wise)
		I	II	III	IV	V	VI		
Part I	Tamil and other languages	3	3	3	3			4	12
Part II	English	3	3	3	3			4	12
Part III	Core subjects - Theory	5	5	5	5	12	12	10	44
	Core subjects - Practical		4		4	4	4	4	16
	Allied Subjects - Theory	3	3	3	3			4	12
	Allied Subjects - Practical		4		4			2	8
	Project/Electives					5	9	3	14
	Part IV	NMEC			2	2			2
	SBEC			3	3	3	2	4	11
	Environmental studies		2					1	2
	Value Education	2						1	2
	Nan Mudhalvan Skill Development Course - III							2	2
Part V	Extension activities						1	1	1
<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>24</b>	<b>19</b>	<b>27</b>	<b>24</b>	<b>30</b>		<b>140</b>

**13. Pattern of Question Paper (For Major, Allied, SBEC and NMEC)**

Maximum marks – 75

Duration – 3 hours

**Section –A (10 x 1 = 10 marks)**

(2 questions from each unit)

(Multiple choice questions) Answer all the questions

**Section –B (5 x 2 = 10 marks)**

(1 question from each unit)

Answer all the questions

**Section –C (5 x 5 = 25 marks)**

(Internal choice from the same unit)

Answer all the questions



**B.Sc. BIOCHEMISTRY**

**SEMESTER – I**

**CORE I - BIO ORGANIC CHEMISTRY**

**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, mutarotation.

**Oligosaccharides :** Dissaccharides - structures, properties and functions.

**Polysaccharides :**

Classification, structures and functions.

**UNIT-II**

**Amino acids :**

Structure, classification, physical, chemical and electrochemical properties, Non standard aminoacids, Non protein aminoacids.

**Peptides :**

Peptide bond, biologically important peptides – Glutathione.

**Proteins :**

Classification, structural organization of proteins - Primary, secondary, tertiary and quaternary structures, forces stabilizing the structure, properties of proteins.

**UNIT-III**

**Fatty acids :**

Classification, structure and properties of fatty acids.

**Lipids :**

Classification, structure and properties of lipids.

**Lipoproteins :**

Types and functions.

#### **UNIT-IV**

##### **Nucleic acids :**

Introduction, structure of nitrogenous bases - purines and pyrimidines, nucleosides, nucleotides, formation of phosphodiester bonds. Structure, types, properties, functions of DNA and RNA. Nucleoproteins with example. Special base sequences of DNA.

#### **UNIT-V**

##### **Vitamins :**

Introduction, structures, sources, RDA, functions, deficiency diseases of fat soluble and water soluble vitamins.

#### **REFERENCE**

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

**B.Sc. BIOCHEMISTRY**

**SEMESTER – II**

**CORE II - TOOLS OF BIOCHEMISTRY**

**UNIT - I**

**Acids and bases :**

Basis of acidity and basicity, pH and buffers.

**General principles of Biochemical investigation:**

*In vivo* and *in vitro* studies - organ and tissue slice techniques, tissue homogenization. Methods of cell disruption, basic principles of cell sorting and counting. Maintenance and preservation of cells.

**UNIT - II**

**Chromatography:**

Principles, sample preparation, methods and applications of paper chromatography, thin layer chromatography, column chromatography - ion exchange chromatography, gel filtration chromatography, affinity chromatography. GLC, HPLC and HPTLC.

**UNIT - III**

**Centrifugation :**

Basic principles of sedimentation, 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**

**Electrophoresis :**

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

**Colorimetry and spectroscopy :**

Basic principles - the laws of absorption (Beer - Lambert's law). Principles, instrumentations and applications of colorimetry, spectrophotometry, spectrofluorimetry and flame photometry.

**UNIT - V****Radioisotopic techniques :**

Radioisotopes commonly used in biochemical studies –  $^{32}\text{P}$ ,  $^{35}\text{S}$ ,  $^3\text{H}$ ,  $^{131}\text{I}$ , etc. Radioactive decay - rate of radioactive decay and units of radioactivity. Detection and measurement of radioactivity based on ionization, excitation properties. Autoradiography and its applications. Advantages, disadvantages and safety aspects of radioisotopic techniques.

**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.

**B.Sc. BIOCHEMISTRY**

**SEMESTER - II**

**CORE PRACTICAL – I**

**I. Preparation of Buffers and determination of pH. II. Qualitative Analysis**

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

**III. Quantitative Analysis**

1. Determination of reducing sugar- Benedict's method - Titremetry.
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.

**IV. Biochemical Preparations**

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

**REFERENECE**

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.



**B,Sc. BIOCHEMISTRY**  
**SEMESTER – III**  
**CORE III - ENZYMES**

**UNIT - I**

**Enzyme:**

History and terminology, nomenclature and classification of enzymes. Holoenzymes, metalloenzymes, metal activated enzymes, monomeric enzymes, oligomeric enzymes, ribozymes. Enzyme specificity, units of enzyme activity.

**UNIT - II**

**Active site :**

Characteristics, theories of ES complex - Lock and key, induced fit and substrate strain theory.

**Catalytic mechanisms :**

Acid - base catalysis, Covalent catalysis, Metal ion catalysis, Electrostatic catalysis. Mechanism of action of lysozyme.

**UNIT - III**

**Enzyme Kinetics :**

MM Equation, LB Plot, Eadie Hofstee Plot, Hanes Plot, Factors affecting enzyme activity.

**Enzyme inhibition :**

Types of inhibition - Reversible inhibition - Competitive, Non competitive and Uncompetitive inhibition. Irreversible inhibition, Feedback inhibition, Allosteric inhibition, covalent modification.

**UNIT - IV**

**Coenzymes :**

Structure and functions of TPP, NAD, NADP, FMN, FAD, Coenzyme A, Lipoate, Folate and biotin (Mechanism not required).

**Isoenzymes - LDH,**

**Allosteric enzymes - ATCase, multienzymes complex - PDC**

**UNIT - V**

**Immobilised Enzymes-** Principles, methods and applications. **Isolation and purification of enzymes –** localization and extraction of free enzymes and membrane bound enzymes, methods of purification of enzymes, criteria of purity.

### REFERENCE

1. Enzymes By Dixon, E.C Webb, CJR Thorne and K.F. Tipton, Longmans, London.
2. Fundamentals of Enzymology 2 ed., (1998) By 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.

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

**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.

**REFERENCE**

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.

**B.Sc. BIOCHEMISTRY**

**SEMESTER – IV**

**CORE IV - INTERMEDIARY METABOLISM**

**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**

**Lipid metabolism:**

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

**UNIT - IV**

**Protein metabolism:**

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

**Nucleic acid metabolism:**

Biosynthesis and degradation of purine and pyrimidine nucleotides.

**UNIT - V**

**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.

## REFERENCE

1. Fundamentals of Biochemistry, J.L. Jain, S.Chand publications, 2004.
2. Lehninger's Principles of Biochemistry (2000) by 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) by Donald Voet, Judith G.Voet and Charlotte W Pratt, John Wiley & Sons, NY.

**B.Sc. BIOCHEMISTRY**

**SEMESTER – IV**

**SKILL BASED ELECTIVE COURSE**

**SBEC II - PLANT BIOCHEMISTRY**

**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, distribution, mode of action and physiological effects of Auxins, Gibberellins, Cytokinins, ABA and Ethylene.

**Phytochemicals :**

Classification and medicinal value of phytochemicals.

**REFERENCE**

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 Jheea, 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.

**B.Sc. BIOCHEMISTRY**

**SEMESTER -IV**

**CORE PRACTICAL – II**

**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
4. Separation of serum proteins by paper electrophoresis

**II. COLORIMETRIC ANALYSIS**

1. Estimation of glucose – O T method
2. Estimation of fructose – Seliwanoff's method
3. Estimation of Ribose- Bial's method
4. Estimation of Protein - Biuret method
5. Estimation of Cholesterol- Zak's method
6. Estimation of Phosphorus – Fiske Subbarow method
7. Estimation of Iron – Wang's method.

**III. ENZYME ASSAY**

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

**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



**B.Sc. BIOCHEMISTRY****SEMESTER – V****CORE V - CLINICAL BIOCHEMISTRY****UNIT – I****Approaches to clinical Biochemistry:**

Automation and quality control, collection, processing, preservation and transport of clinical specimens, 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 Hb, PCV and ESR. Hemoglobinopathies, Thalassemias.

**UNIT – III****Disorders in carbohydrate metabolism :**

Diabetes mellitus:- Types, Clinical features, complications, GTT, galactosaemia, fructosuria, and glycogen storage diseases.

**Disorders in lipid metabolism:**

Atherosclerosis – aetiology, clinical features and its complications. Lipid storage diseases and fatty liver.

**UNIT – IV****Disorders in protein metabolism:**

Phenylketonuria, alkaptonuria, cystinuria, albinism and tyrosinemia.

**Disorders in nucleic acid metabolism:**

Gout:- Types, aetiology and clinical features.

**Disorders in bilirubin metabolism:**

Jaundice:- classification, clinical features.

**UNIT – V****Liver function tests:**

Detoxification and excretory function.

**Renal function test:**

Glomerular filtration tests, tests for renal blood flow and tests of tubular function.

**Enzymology :**

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

### REFERENCE

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

**B.Sc. BIOCHEMISTRY****SEMESTER – V****CORE – VI MOLECULAR BIOLOGY**

**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**

**Regulation of gene expression:** General aspects, operon model in prokaryotes – 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, phoreactivation, direct demethylation, double strand break repair. Regulation of DNA repair:- SOS repair.

**REFERENCE**

1. Text Book of Cell and Molecular Biology by 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

**B.Sc. BIOCHEMISTRY**

**SEMESTER – V**

**CORE VII - HUMAN PHYSIOLOGY**

**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, pressure changes during pulmonary ventilation, lung volumes and capacities, transport and exchange 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.

**UNIT – IV**

**Renal 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.

**REFERENCE**

1. Essentials of Medical Physiology by K. Sembulingam and Prema Sembulingam, 6<sup>th</sup> Edition, 2012
2. Principles of Anatomy and Physiology by 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. Review of medical physiology, William. F. Ganong, 14<sup>th</sup> edition, A Lange Medical book.

**B.Sc. BIOCHEMISTRY****SEMESTER – V****ELECTIVE – I NUTRITIONAL BIOCHEMISTRY****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 – aetiology, 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**

**Nutrition and body defenses:** Drug - nutrient interaction, nutritional therapy for inborn errors of metabolism, role of diet and nutrition in the prevention and treatment of diseases:- Diabetes mellitus, Jaundice, Peptic ulcer, Gout, blood pressure, cardiovascular diseases, nephritis.

**REFERENCE**

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.

**B.Sc. BIOCHEMISTRY**  
**SEMESTER V**  
**SKILL BASED ELECTIVE COURSE**  
**SBEC III - GENETIC ENGINEERING**

**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,GGH), recombinant vaccines, gene therapy, DNA finger printing, transgenic plants and transgenic animals.

**REFERENCE**

1. Genetic Engineering by 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.

**B.Sc. BIOCHEMISTRY**  
**SEMESTER - V**  
**CORE PRACTICAL – III**

**I. HEMATOLOGY**

1. Estimation of Hemoglobin – colorimetric 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**

1. Determination of activity of SGOT and SGPT
2. Determination of activity Acid Phosphatase and Alkaline Phosphatase

**III. BLOOD ANALYSIS**

1. Estimation of blood glucose by Asatoor and King method.
2. Estimation of serum creatine and creatinine by – Alkali-Picrate method.
3. Estimation of Determination of Total proteins in whole blood – Biuret method
4. Determination of urea in serum- DAM –TSC method
5. Estimation of Cholesterol in serum- Zak's method
6. Determination of Bilirubin [ Conjugated & Unconjugated] in serum.

**IV. URINE ANALYSIS**

1. Estimation of Urea in urine by DAM –TSC method
2. Determination of Creatine and Creatinine in urine – Alkali-Picrate method
3. Estimation of Uric acid – Caraway's method
4. Determination Chloride by VanSlyke's method
5. Physical properties of urine : Microscopic and visual observation for normal and abnormal constituents, color, density, crystals and pH etc

### REFERENCE

1. Practical Clinical Biochemistry , 1988,by Harold Varley 2<sup>nd</sup> to 4<sup>th</sup> Edition, CBS publishers, NewDelhi.
2. Introductory practical Biochemistry, 1999 Editors: S.K. Sawhney and Randhir Singh, Narosa Publishing House, Mumbai
3. Biochemical Methods 1992, by 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.



**B.Sc. BIOCHEMISTRY**  
**SEMESTER – VI**  
**CORE – VIII    IMMUNOLOGY**

**UNIT-I**

**Introduction to immunology:** Immunity, types of immunity, mechanism of immunity, cells of the immune system, lymphoid organs. Humoral and cell mediated immune response, primary and secondary immune response, Antigen processing and presentation.

**UNIT-II**

**Immunogens and Antigens:** Immunogenicity, essential features of antigens, antigenic determinants, antigenicity, factors that influencing antigenicity, haptens, adjuvants. **Antibodies:** Structure, Classes, Subclasses, Properties of Immunoglobins, 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:-** auto immune disorders, immune deficiency disorders with special reference to AIDS.

**REFERENCE**

1. Immunology and Immunotechnology by 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.
6. Basic and Clinical Immunology. Stites D.P. Stobo, J.D. Fundanberg. H.A and Wells. J.V. (1990) 6th edition Los Atlas Lange.

**B.Sc. BIOCHEMISTRY**  
**SEMESTER – VI**  
**CORE – IX ENDOCRINOLOGY**

**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.

**REFERENCE**

1. Essentials of Medical Physiology by 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, 4<sup>th</sup> edition, Oxford & IBH publishing Co.Pvt.Ltd., 1996.
4. Principles of Biochemistry, David L. Nelson, Michael M.Cox, Lehninger, 4<sup>th</sup> edn, W.H. Freeman and Company.
5. Principles of Biochemistry: *Mammalian Biochemistry* by Emil Smith, Robert Hill, Robert Legman, Robert Lefkowitz, Philip Handler, Abraham white, 7<sup>th</sup> Edition, McGraw Hill & Co.

**B.Sc. BIOCHEMISTRY**  
**SEMESTER – VI**  
**CORE – X PHARMACEUTICAL BIOCHEMISTRY**

**UNIT I**

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

**Bioavailability:-** Bioavailability of drugs, determination and its importance, Bioequivalence. Combined effect of drugs:- Synergism, antagonism.

**UNIT II**

**Pharmacokinetics:** Absorption, distribution of drugs, factors influencing drug absorption and distribution.

Drug elimination:- Renal excretion, fecal excretion, biliary excretion, pulmonary excretion and other routes of excretion.

**UNIT III**

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

**UNIT IV**

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

**UNIT V**

**Drug discovery:** Random screening, serendipity, molecular modification of a known drug, rational approaches in drug designing

**Drug development:** Preclinical research, clinical research, FDA review and FDA post- market safety monitoring.

**REFERENCE**

1. Pharmaceutical Pharmacology by S C Metha and Ashutosh Kar, 2011, New age International publishers.
2. Text book of Medical Pharmacology by 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.

**B.Sc. BIOCHEMISTRY**

**SEMESTER – VI**

**ELECTIVE – II MICROBIAL and INDUSTRIAL BIOCHEMISTRY**

**UNIT – I**

**Microscopy:** Simple, Light, Dark, Phase Contrast, Fluorescence, SEM and TEM. Sterilization and disinfection, Bacterial Growth curve, Continuous growth, Diauxic growth. Staining principles and techniques:- Gram +ve and Gram -ve staining. Structure and biosynthesis of cell wall components, Phosphotransferases, Porins and Iron uptake.

**UNIT II**

**Microbial metabolism:** Entner Doudoroff pathway, Bacterial photosynthesis, pectin and aldo hexuronate pathway, cellulose degradation, fermentative diversity- clostridium and propionic acid fermentation-stickland reaction and bioenergetics of methanotrophy, methanogenesis, Biochemistry of sulphur reaction.

**UNIT III**

**Introduction to fermentation technology:** Isolation and screening of industrially important microbes, Inoculum preparation, strain improvement for better yield. Fermentation-Submerged and solid state fermentation, Fermentor design, Downstream processing.

**UNIT IV**

**Industrial applications of microbes:** Industrial production of alcohol, alcoholic beverages – Wine and Beer. Microbes in mineral recovery - Bioleaching and Biosorption, Production of Biomass, Production of Single cell protein and Mushrooms.

**UNIT V**

**Microbial production of bioactive compounds:** Production of bacterial and fungal polysaccharide, Industrial Production of Penicillin and streptomycin. Vitamins - B12 and riboflavin.

**REFERENCE**

1. Microbiology, Pelczar. Jr.M.J.Chan, McGraw- Hill Inc. NY.
2. Fundamental Principles of bacteriology, Salle.A.J 7 th edition, 1992. Mc.Graw.
3. Textbook of Microbiology, Ananthanarayanan.R. and Jayaram Panicker.C.K.Orient Longaman, 1994.
4. Textbook of medical parasitology, Parija.S.c, Orient Longmans, 1996
5. Medical Parasitology, Chatterjee, TATA McGraw Hill, 1986.
6. Mehrotra RS & KR Aneja (2006), An Introduction to Mycology. Reprinted and Published by New Age International (P) Limited, Publishers, New Delhi.
7. Jagadish Chander(1996). A Text book of Medical Mycology, Interprint, NewDelhi.
8. Brock Biology of Microorganisms 12thEdition - Michael T.Madigan, John M.Martinko, Paul V. Dunlap, David P.Clark.
9. Microbial Physiology –Albert G.Moat, John.W.Foster, Michael.P.Spector.

**B.SC. BIOCHEMISTRY**  
**SEMESTER – VI**  
**SKILL BASED ELECTIVE COURSE**

**SBEC      IV      -      BIOINFORMATICS AND NANOTECHNOLOGY**

**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, Specialised 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**

**Protein digestion techniques:** 2D Electrophoresis, Isoelectric focusing (IEF), High Performance Liquid Chromatography- Mass Spectroscopy (HPLC-MS). Microarrays, ISH, FISH.

**UNIT V**

**Introduction to Nanotechnology:** Nano-definitions, biosystems, biological networks, biological neurons, neurotransmitters. Bionanoparticles – nanocomposites, nanoparticles. Biosensors – Types: Potential, Electrochemical & Biomembrane based sensors. Imaging techniques - digital & molecular.

**REFERENCE**

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.

**B.Sc. BIOCHEMISTRY**  
**SEMESTER - VI**  
**CORE PRACTICAL – IV**

**I. PLANT TISSUE CULTURE**

1. Media preparation
2. Callus induction
3. Micropropagation

**II. GENETIC ENGINEERING**

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

**III. IMMUNOLOGY**

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

**IV. 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 [all tests]

**REFERENCE**

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, Perundgudi, 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.

**B.Sc. BIOCHEMISTRY****SEMESTER – I****ALLIED I - BIOCHEMISTRY – I****UNIT - I**

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

**UNIT - II**

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

**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.

**REFERENCE**

1. Lehninger's Principles of Biochemistry (2000) by Nelson, David I. 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.

**B.Sc. BIOCHEMISTRY**

**SEMESTER – II**

**ALLIED II - BIOCHEMISTRY – II**

**UNIT I**

**Acids and bases:** Basis of acidity and basicity, pH, determination of pH, Henderson - Hasselbalch equation, buffer system of human body.

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

**UNIT II**

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

**UNIT III**

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

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

**UNIT IV**

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

**UNIT V**

**Introduction to Endocrine system:** Classification of hormones, mechanism of hormone action, hormone interactions:- Permissive effect, synergistic effect and antagonistic effect.

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



**REFERENCE**

1. Principles and techniques of practical Biochemistry, Keith Wilson and John Walker, 1995. Cambridge University Press.
2. Biophysical chemistry Principles and Techniques- Avinash Upadhyay 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. Doi, John Wiley & Sons, NY.
6. Biochemistry 3rd (1994) by Lubert Stryer, W H Freeman and Co, San Francisco.
7. Text book of biochemistry (1997) 4th edition, Thomas M Devlin, A John Wiley, Inc.
8. Biochemistry (2013) by U. Satyanarayana and U. Chakrapani, 4th edition, Elsevier

**B.Sc. BIOCHEMISTRY**  
**SEMESTER – II**  
**ALLIED PRACTICAL – I**  
**BIOCHEMISTRY PRACTICAL**

**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

**REFERENECE**

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.

**B.Sc. BIOCHEMISTRY**

**SEMESTER – III**

**NON MAJOR ELECTION COURSE - I**

**PAPER I - FUNDAMENTALS OF HUMAN PHYSIOLOGY**

**UNIT – I**

41 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.

**REFERENCE**

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.

**B.Sc. BIOCHEMISTRY**

**SEMESTER – III**

**NON MAJOR ELECTIVE COURSE - I**

**PAPER II - BIOCHEMISTRY IN NUTRITION**

**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.

**REFERENCE**

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.

**B.Sc. BIOCHEMISTRY**

**SEMESTER – IV**

**NON MAJOR ELECTIVE COURSE - II**

**PAPER I - BIOCHEMISTRY AND HEALTH**

**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.

**REFERENCE**

1. Textbook of medical physiology by C. Guyton, John E. Hall.—12th 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 th 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

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

**UNIT - I**

Approaches to clinical biochemistry: Quality control: Concepts of accuracy, precision, sensitivity and reproducibility, Collection of clinical specimens, preservatives for blood and urine, transport of biological samples.

**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 specimen, 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 haemoglobin, Protein, cholesterol, Urea, Uric acid and Creatinine. Determination of enzyme activity: SGOT, SGPT and LDH.

**REFERENCE**

1. Kanai L.Mukherjee, Medical Laboratory Technology Vol. I.Tata McGrawHill 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.

**B.Sc. BIOCHEMISTRY****SEMESTER III****CORE - III ENZYMES****Time: 3 hours****Maximum Marks = 75****SECTION – C (10X1=10)****Answer ALL the questions**

- Who coined the term enzyme?  
a) Traube    b) Kuhne    c) Buchner    d) Sumner
- Complete enzyme including the prosthetic group is called  
a) Apoenzyme    b) Holoenzyme    c) Prosthetic group    d) All of the above
- Multiple forms of enzymes with the same catalytic activity but differ in structure are called  
a) Holoenzymes    b) Isoenzymes    c) Prosthetic groups    d) Apoenzymes
- The optimal pH for the enzyme pepsin is  
a) 1.0–2.0    b) 4.0–5.0    c) 5.2–6.0    d) 5.8–6.2
- The coenzyme not involved in hydrogen transfer a) FMN b) FAD c) NADP+ d)FH4
- The coenzyme directly concerned with the synthesis of biogenic amines  
a)TPP    b) Biotin    c) NADP+    d) Pyridoxal phosphate
- The Which of the following statements about Michaelis-Menten kinetics is correct?  
a)  $K_m$ , the Michaelis constant, is defined as the concentration of substrate required for the reaction to reach maximum velocity  
b)  $K_m$  the Michaelis constant, is defined as the dissociation constant of the enzyme-substrate complex.  
c)  $K_m$ , the Michaelis constant, is expressed in terms of the reaction velocity.  
d)  $K_m$ , the Michaelis constant, is a measure of the affinity the enzyme has for its substrate.
- A sigmoidal plot of substrate concentration ( $[S]$ ) verses reaction velocity ( $V$ ) may indicate  
a) Michaelis-Menten kinetics    b) Co-operative binding  
c) Competitive inhibition    d) Non-competitive inhibition
- Immobilized enzymes:  
a) Potentiation of activity    b) Presentation of activity    c) Preparation of activity    d) All of these
- The purity of an isolated protein can be tested by employing various methods.  
a) Solubility curve    b) Molecular weight    c) Ultra Centrifugation    d) All of these

**SECTION – B (5X2=10)**

**Answer ALL the questions**

11. Define: Apo enzymes
12. Write down the significance of Km.
13. Define metal ion catalysis.
14. What is an allosteric enzyme.
15. Give the principle of chromatography.46

**SECTION – C (5X5=25)**

**Answer ALL the questions**

16. Define active site and give its characteristic features (Or) explain Lock and Key theory.
17. Derive MM equation (Or) write down the diagnostic importance of isoenzymes.
18. Explain the mechanism of action of chymotrypsin (Or) Explain the mechanism of action of Lysozyme.
19. Explain feed back inhibition with an example (Or) Explain Covalent modification.
20. Differentiate the characteristic properties of ordinary enzyme with immobilized enzyme (Or) Explain the criteria of purity of enzymes.

**SECTION – D (3X10=30)**

**Answer any THREE of the questions**

21. Explain Multi enzyme complex with an example.
22. List out the various factors that affect enzyme activity.
23. Explain Covalent catalysis.
24. Differentiate Non competitive enzyme inhibition from un competitive enzyme inhibition.
25. Explain any four methods of immobilization of enzyme.