



ST.PHILOMENA'S COLLEGE (AUTONOMOUS), MYSURU

(AFFILIATED TO UNIVERSITY OF MYSORE)

REACCREDITED BY NAAC WITH A GRADE

**Three-year six semesters Choice Based Credit System (CBCS) and
Continuous Assessment & Grading Pattern (CAGP) Under Graduate
Programme under Autonomous Structure**

Programme- B.Sc.

The academic year 2018-19 onwards

DEPARTMENT OF BIOCHEMISTRY

ST. PHILOMENA'S COLLEGE (Autonomous), MYSURU- 570015
Subject: BIOCHEMISTRY
SYLLABUS FOR B.Sc., UNDER CBCS SCHEME
From The Academic Year 2018-2019 Onwards

PREAMBLE

The syllabus is framed to give sound knowledge with an understanding of Biochemistry to undergraduate students of three Years of B.Sc degree course. The goal of the syllabus is to make the study of Biochemistry popular, interesting and encouraging to students for higher studies including research. The new updated syllabus includes/ incorporates recent concepts within different areas of each paper offered. The syllabus is designed based on a basic and applied approach with vigour and depth. The syllabus is prepared after discussion at length with several faculty members of the subject and experts from industries and research fields. The new CBCS syllabus includes an array of discipline specific electives (DSE) which are offered by the second year and final year B.Sc students. The students are given the choice to choose the elective of their interest. The syllabus of these electives is designed to impart additional Knowledge to students which will enable them to appreciate the vast application of Biochemistry, and various tools used.

Biochemistry being an experimental science, due importance is given to the development of laboratory and instrumentation. The major goals of practical work are to teach manual and observational skills, to improve the understanding of methods of scientific enquiry, to develop problem-solving skills and to nurture professional attitudes.

CBCS SYLLABUS FOR BSc IN BIOCHEMISTRY

FOR THE ACADEMIC YEAR 2018-19 ONWARDS
GENERAL SCHEME for TEACHING & EVALUATION

Semester	Title of the Paper	TYPE	Teaching Hours per Week Theory/ Practical	Credits Theory/ Practical	Exam Duration in Hours Theory/ Practical	Max. Marks Theory/Practical		
						Theory/Practical	IA Theory/Practical	Total Marks
I	Paper-I: Principles Biochemistry	DSC	03	03	03	50	20	100
	Practical Paper-I	DSC	03	1.5	03	20	10	
II	Paper-II: Biomolecules-I	DSC	03	03	03	50	20	100
	Practical Paper-II	DSC	03	1.5	03	20	10	
III	Paper-III: Biomolecules-II & Biochemical Techniques	DSC	03	03	03	50	20	100
	Practical Paper-III	DSC	03	1.5	03	20	10	
IV	Paper-IV: Enzymology & Metabolism-I	DSC	03	03	03	50	20	100
	Practical Paper- IV Colorimetric Estimations	DSC	03	1.5	03	20	10	
V	Paper-V: Metabolism II & Human Physiology	DSC	03	03	03	70	30	300
	Paper-VI : Molecular Biology & Genetic Engineering	DSC	03	03	03	70	30	
	Practical Paper-V Enzyme Assays	DSC	02	01	03	35	15	
	Practical Paper-VI Bio-Physical & Biochemical Experiments	DSC	02	01	03	35	15	

VI	Paper-VII: Nutrition	DSC	03	03	03	70	30	300
	Paper-VIII: Clinical Biochemistry & Immunology	DSC	03	03	03	70	30	
	Practical Paper-VII Nutrition	DSC	02	01	03	35	15	
	Practical Paper-VIII Clinical Biochemistry & Immunology	DSC	02	01	03	35	15	
		DSE 1	02	02	03	30	20	100
		DSE 2	02	02	03	30	20	
				38	-			1100

Discipline Specific Electives Offered

Sl no	Title of the Paper	TYPE	Semesters	Teaching Hours per Week Theory/Practical	Credits Theory/Practical	Exam Duration in Hours Theory/Practical	Max. Marks Theory/Practical		
							Theory/Practical	IA Theory/Practical	Total Marks
1	Basic Chemistry	DSE	II	2	2	02	30	20	50
2	Basic Concepts of Genetics			2	2	02	30	20	50
3	Lifestyle Disorders		IV	2	2	02	30	20	50
4	Plant Biochemistry and Medicinal Plants			2	2	02	30	20	50
1	Molecular Basis of Non-Communicable Human diseases	DSE	V	2	2	02	30	20	50
2	Concepts of Pharmaceutical Biochemistry			2	2	02	30	20	50
3	Molecular Endocrinology		VI	2	2	02	30	20	50
4	Introduction to Biostatistics			2	2	02	30	20	50
5	Basic Bioinformatics			2	2	02	30	20	50

Note

Sl.No	Type	Type
1.	DSC or HC	Discipline Specific Core (DSC) or Hard Core (HC)
2.	DSE or SC	Discipline Specific Elective (DSE or /Soft Core (SC)

3.	SEC or OE	Skill Enhancement Course (SEC) or Open Elective (OE)
----	-----------	--

FIRST SEMESTER

BIOCHEMISTRY PAPER-I

Title: PRINCIPLES OF BIOCHEMISTRY.

Class duration – 03 hours per week .48 Hours

Marks: Theory - 50 + Internal Assessment - 20= 70

SUBJECT DESCRIPTION: Bio-organic chemistry emphasizes the combined aspect of studying biological processes using chemical methods. Bio-inorganic chemistry emphasizes on the properties, biological role and importance of inorganic elements in biological systems. Biophysical chemistry combines the aspects of chemistry, biology and physics.

OBJECTIVE OF THE PAPER: To enable the students to learn the basic concept of bio-organic, bio-inorganic and biophysical chemistry.

LEARNING OUTCOME: On successful completion of the course the students should have the basic knowledge about the basic concepts of Bio-organic, Bio-inorganic and Bio-physical chemistry and their application in various fields.

Unit 1. BIO-ORGANIC CHEMISTRY	1 hr
1.1 Concept of Biochemistry: Definition and scope of biochemistry, Important discoveries in biochemistry, An outline of elements and major organic compounds in a living system.	
1.2 Hydroxy acids, dicarboxylic acids and ketoacids	3hrs
1.2.1 Hydroxy acids: Structure, properties & biological importance of Lactic acid (Action of heat, oxidation), Tartaric acid, Citric acid (Action of heat, salt formation) & Isocitric acid.	
1.2.2 Dicarboxylic acid: Structure, properties & biological importance of Succinic acid, Maleic acid & fumaric acid.	
1.2.3 Ketoacids: Structure, properties & biological importance of Pyruvic acid, α - ketoglutaric acid & oxaloacetic acid.	
1.3 Heterocyclic compounds: Occurrence, structural formula and biological importance of the following and their derivatives. Furan, Pyrrole, thiophene, thiazole and imidazole, pyridine, pyran, pyrimidine, purine, indole, quinoline and isoquinoline	4hrs
1.4 Steroids:	4 hrs
1.4.1 Basic ring system in steroids, structure & biological importance of cholesterol.	
1.4.2 Structure & biological importance: Ergosterol, Estradiol, testosterone, progesterone, cortisol, cortisone, Biological importance of bile acids [mono, di & tricholic acids] and ecdysone.	
1.5 Phytochemicals	
1.5.1 Terpenes	5hrs
Isoprene rule, classification, structure, occurrence and importance of: a) Monoterpenes- limonene and importance of menthol and camphor. b) Sesquiterpenes- Juvenile hormone-I and importance of abscisic acid-II, c) Diterpenes- phytol d) Triterpenes- lanosterol e) Tetraterpenes- lycopene,	

	f) Polyprenols- the importance of dolichol.	
1.5.2	Flavanoids Quercetin, capsaicin & curcumin: occurrence & biological importance.	2hrs
1.5.3	Alkaloids Definition, classification based on their composition with examples, structure & the physiological action of LSD, morphine, caffeine, nicotine, Biological importance of reserpine, piperine, quinine, cocaine, theobromine and atropine, Synthesis of Atropine and nicotine.	5hrs
Unit 2. BIO-PHYSICAL CHEMISTRY		
2.1	Concentration units: Mole, mole fraction, molarity, equivalent weight, normality, molality (problems to be worked out), dilution factors.	1 hrs
2.2	Water: Essentiality of water to life and Water as a biological fluid, Special properties of water, Hypo, hyper and isotonic solutions and effects of osmotic pressure on living cells.	2 hrs.
2.3	Acids, bases and buffers: Lewis concept of acids & bases, the Ionic product of water and pH scale, Henderson-Hasselbalch equation of weak acids, Buffers: Definition, Buffer capacity. Preparation of acidic and basic buffer solutions, Theory of acid-base indicators, Choice of indicators	3 hrs.
2.4	Electrochemistry: Electrodes (Hydrogen Electrode & calomel electrode), Quinhydrone electrode, Glass electrode. Conductometric titrations-Strong acid against the strong base, a weak acid (amino acid) against NaOH]. Determination of pKa values of weak Electrodes (Hydrogen electrode & calomel electrode), quinhydrone electrode, and glass electrode. Determination of pKa values of a weak acid by potentiometric titration.	3 hrs.
2.5	Photochemistry: Laws of photochemistry, quantum efficiency, light absorption, Beer-Lambert's law-applications and limitation, Spectrophotometer, colourimeter-principle and applications, Fluorescence, phosphorescence, chemiluminescence, bioluminescence (Elementary treatment).	3hrs
Unit 3. BIO-INORGANIC CHEMISTRY		
3.1	Phosphorous, Sulphur and Selenium: Importance of phosphorus & sulphur compounds in the biological system, the effect of sulphur compounds on environmental pollution, Role of selenium in a biological system.	2 hrs.
3.2	Biochemical Toxicology: Source, entry into the biological system and toxic effects of lead, Mercury, Cadmium, Flouride, Arsenic. Toxicity studies: LD ₅₀ & ED ₅₀	3 hrs.
3.3	Porphyryns: Porphyrin nucleus – structure. Structure and the biological role of metal ions in important metalloporphyryns-Haemoglobin, Cytochromes, Chlorophyll, Vit-B ₁₂ .	3 hrs

3.4 Radiation chemistry:**4 hrs.**

Introduction, Natural and artificial radioactivity, Characteristics of radioactive elements, units of radioactivity, disintegration constant, half-life, detection of radioactivity by scintillation counter and advantages, Uses of radioisotopes in the biological system – ^3H , ^{14}C , ^{131}I , ^{60}Co and ^{32}P , Biological effects of radiations. Radiation hazards, Safety measurements in handling radioisotopes.

Books recommended:

Sl no	Book	Author	Publication
1	Textbook of Inorganic chemistry	J.D Lee	B Block well Science Ltd
2	Textbook of Inorganic chemistry	Puri& Sharma	ShobhanlalNagin Chand co
3	Textbook of physical chemistry	Puri& Sharma	Vishal Publishing Company
4	Textbook of physical chemistry	S.Glasstone	Read books
5	Textbook of Physical Biochemistry-	David Friefelder	Freeman and company W.H
6	Textbook of Organic Chemistry	Puri& Sharma	ShobhanlalNagin Chand co

PRACTICAL-I
Title: Principles of Biochemistry

Practical Duration -03 Hours per week Examination-03 Hours
MARKS=30

Practical Proper-20. Internal Assessment - Record-05+ Class Test-05=10

Note: Analytical/electronic balance for weighing can be used.

- 1 Calculation and preparation of molar solutions.
- 2 Calculation and preparation of normal solutions.
- 3 Calibration of volumetric glassware (Burette and Pipette).
- 4 Preparation of standard Oxalic acid solution. Standardization of NaOH solution and estimation of H₂SO₄ in the given solution. (Phenolphthalein).
- 5 Preparation of standard Sodium carbonate solution, standardization of HCl (Methyl orange) and estimation of NaOH in the given solution (methyl orange or phenolphthalein).
- 6 Preparation of ZnSO₄ solution. Standardization of EDTA solution and estimation of total hardness of water using Eriochrome black-T indicator.
- 7 Preparation of standard oxalic acid solution. Standardization of NaOH solution and estimation of acidity in vinegar.
- 8 Preparation of standard potassium biphthalate solution, standardization of NaOH solution and estimation of free and total acidity in gastric juice.
- 9 Preparation of standard Potassium dichromate and estimation of ferrous/ferric mixture using diphenylamine indicator (Demonstration).
- 10 Preparation of standard Oxalic acid solution. Standardization of KMnO₄ solution and estimation of calcium in milk.
- 11 Preparation of standard potassium biphthalate solution, standardization of sodium hydroxide solution and estimation of hydrochloric acid present in the given solution.
- 12 Preparation of standard potassium biphthalate solution, standardization of sodium hydroxide solution and estimation of alkalinity of antacids.

SECOND SEMESTER
Biochemistry Paper-II
Title: BIOMOLECULES –I
Class duration – 03 hours per week

SUBJECT DESCRIPTION: This course involves the study of bio-molecules their structure, properties and biological importance

OBJECTIVE OF THE PAPER: To enable the students to learn the basic concept in biomolecules.

LEARNING OUTCOME: On successful completion of the course the students should have the basic knowledge about biomolecules, their classification, structure and brief knowledge on qualitative analysis of bio-molecules.

Unit 1. CARBOHYDRATES

- 1.1 **Carbohydrates:** 8hrs
Classification, biological importance of carbohydrates, Monosaccharides: Configuration relationship of D-aldoses, D-ketoses. Reactions of glucose and fructose-oxidation, reduction, reducing properties formation of glycosides, acylation, methylation, condensation – phenylhydrazine, addition – HCN. Interconversion of aldoses and ketoses by chemical method. Ascending and descending the series by chemical methods. Stereochemistry of monosaccharides, (+) and (-), D and L, epimers, anomers, enantiomers and diastereomers.
- 1.2 **Glucose:** 8hrs
Elucidation of open chain structure configuration and ring structure of glucose and mutarotation. Open and Haworth structures of galactose, mannose, ribose and fructose. Structure and biological importance of amino sugars, deoxy sugars, sugar acids, neuraminic and muramic acid.
- 1.3 **Disaccharides:** 8hrs
Establishment of structures of - sucrose and lactose. Structure of isomaltose, cellobiose, trehalose and maltose and importance of trehalose.
- 1.4 **Polysaccharides:**
Classification with examples. Partial structure, occurrence and importance of starch, glycogen, inulin, cellulose, chitin, and pectin. Glycosaminoglycans: Occurrence, importance and the structure of the repeating units of heparin, hyaluronic acid, and chondroitin sulphate. Bacterial cell wall polysaccharides- Teichoic acid and peptidoglycans. Blood group oligosaccharides. Chemical basis of the qualitative tests: Molisch, iodine, Benedicts, Fehling's, picric acid, Barfoed's, Bial's, Seliwanoff's, osazone tests.

Unit 2. LIPIDS

- 2.1 **Lipids:** Definition, classification and biological role, 8 hrs
Fatty acids –Saturated [C4-C24] and unsaturated fatty acids: Nomenclature, structure & occurrence.
Physical properties and chemical reactions: esterification and rancidity.
Essential fatty acids (ω -3 & ω -6 fatty acids): structure, occurrence & biological importance.
- 2.2 **Tri-acylglycerols:** simple and mixed glycerides with examples, 8 hrs
Saponification, hydrolysis, Definition & significance of saponification value, iodine value, acid value and peroxide value.

Waxes: Composition, importance with examples

Phosphoglycerides: Structure of lecithin, cephalins, phosphatidyl inositol, plasmalogens, and cardiolipins. the biological role of phosphoglycerides.

2.3 **Spingolipids:** Ceramides, structure and importance of sphingomyelin. **8 hrs**

Glycosphingolipids: Structure and importance of cerebrosides (galactocerebroside and glucocerebroside), gangliosides (GM₁, GM₂, GM₃).

Eicosanoids: Structure of PGE₁, PGE₂, PGF_{1α} and PGF_{2α}. Biological roles of thromboxanes, leukotrienes and prostaglandins.

Plasma lipoproteins: Types and functions, composition and structure of lipoprotein

Biological Membrane: Amphipathic lipids, membrane bilayers, micelles, liposomes and its uses. Fluid Mosaic model – structure, composition & functions of the plasma membrane.

Books recommended

Sl no	Book	Author	Publication
1	Textbook of Biochemistry	West & Todd	Todd publications
2	Textbook of Biochemistry	A. Lehninger	Freeman, W.H and company
3	Chemistry of natural products	Chatwal	Himalaya Publishing House
4	Textbook of Biochemistry	O.P. Agarwal	Krishna Prakashan Media p Ltd
5	Textbook of Biochemistry	Jain	S Chand publishing
6	Handbook of Biochemistry	Satyanarayana	Elsevier India
7	Illustrated Biochemistry	Harper	Lange Medical Publication

PRACTICAL-II

Bio-molecules-I

Practical Duration -03 Hours per week Examination-03 Hours

MARKS=30.

Practical Proper-20.

Internal Assessment - Record-05+ Class Test-05=10

- 1 Qualitative analysis of monosaccharides (glucose, fructose).
- 2 Qualitative analysis of disaccharides & polysaccharides (lactose, maltose, sucrose & starch).
- 3 Acid hydrolysis of starch.
- 4 Determination of acid value of oil or fat.
- 5 Determination of saponification value of oil or fat.
- 6 Determination of iodine value of oil or fat.
- 7 Determination of peroxide value of oil or fat.
- 8 Extraction and confirmation of caffeine from tea leaves.
- 9 Extraction and estimation of lactose from milk.
- 10 Extraction of starch from potatoes.
- 11 Demonstration of extraction of Lycopene from Biological source.
- 12 Demonstration of extraction of oil from oilseeds.

THIRD SEMESTER-BIOCHEMISTRY

Biochemistry Paper-III

Title: BIOMOLECULES-II AND BIOCHEMICAL TECHNIQUES

Class duration – 03 hours per week

Marks: Theory - 50 + Internal Assessment - 20= 70

48 Hours

SUBJECT DESCRIPTION: This course emphasizes various bio-molecules and significance, principles, instrumentation, working and application of the instruments commonly used in the laboratories.

OBJECTIVES: To enable the students to learn the basic functions, structures and biological importance of lifeless chemical compounds along with functioning components of the various instruments.

LEARNING OUTCOME: On successful completion of the course the students should have understood the significance of the complex bio-molecules, polysaccharides, lipids, proteins, nucleic acids, vitamins and minerals and also would have learnt the principles and applications of the instruments.

Unit 1. BIOMOLECULES- II

1.1 Amino acids & Peptides:

8 hrs.

Structure and classification of amino acids based on polarity. D and L notation of amino acids Zwitterionic properties, pKa values of amino acids. Reactions of the amino groups with HNO_2 , LiAlH_4 , phenylisothiocyanate, dansyl chloride, 1-Fluoro 2,4-dinitrobenzene. The reaction of the carboxyl group with hydrazine. Any one method (Gabriel's) of chemical synthesis of amino acids. Peptide bond-formation and characteristics. Structure and biological importance of glutathione. Biological importance of Valinomycin, leu-enkephalin and endorphins. Chemical synthesis of dipeptides by carbobenzoxy method.

1.2 Proteins:

8 hrs

Classification of proteins based on solubility, structure and functions with examples. Colour reactions of proteins- Biuret, xanthoproteic, Millon's, Hopkins-Cole, Sakaguchi and lead acetate tests.

Structural organization of proteins: Primary Structure of proteins, steps involved in protein sequencing, amino acid composition, methods of determining N and C-terminal amino acids, sequencing by Edman's degradation method.

Secondary Structure - α -Helix. β -sheets, β -bends. Tertiary structure: forces stabilizing the structure, structure of myoglobin. Quaternary structure: 3D structure of haemoglobin. Denaturation and renaturation of proteins, Anfinsen's experiment.

1.3 Nucleic acids:

8 hrs.

Isolation of DNA and RNA from plant and animal sources. Structure of purines and pyrimidines; nucleosides and nucleotides. Biological importance of nucleotides that are not found in nucleic acids.

DNA: Chargaff's rule, Watson and Crick model of DNA. Types of DNA -A, B and Z forms. Melting of DNA (T_m).

RNA: Composition, types (mRNA, tRNA and rRNA), Secondary structures of tRNA - cloverleaf model, Chemical reactions of RNA and DNA with acid and alkali, colour reactions of DNA and RNA.

Unit 2. BIO-CHEMICAL TECHNIQUES

- 2.1 **Isolation of proteins:** methods of purification – dialysis, salting in & salting out, pH precipitation and solvent precipitation. Criteria of purity of proteins. **2 hrs.**
- 2.2 **Chromatography:** Principles, procedures and applications of **12 hrs**
Paper chromatography-Ascending and descending paper chromatography, Circular paper chromatography, 2D chromatography.
Column chromatography-Adsorption Chromatography, Gel-filtration Chromatography, Ion-exchange Chromatography, Affinity chromatography, HPLC GLC.
 Thin-layer chromatography.
- 2.3 **Electrophoresis** **4 hrs.**
Principles, procedures and applications of Electrophoresis -Paper electrophoresis Gel electrophoresis (agarose, SDS – PAGE).
- 2.4 **Centrifugation:** **4 hrs.**
Principle and procedure of Centrifugation-Differential and density gradient centrifugation. Ultracentrifuge- construction and applications.
- 2.5 **Spectroscopy:** **2 hrs.**
 Principles & applications of Spectroscopy- UV-visible, IR, Fluorescence, NMR, CD spectra

Books recommended

Sl no	Book	Author	Publication
1	Textbook of Biochemistry	West & Todd	Todd publications
2	Textbook of Biochemistry	A. Lehninger	Freeman, W.H and company
3	Textbook of Biochemistry	O.P. Agarwal	Krishna Prakashan Media p Ltd
4	Textbook of Biochemistry	Jain	S Chand publishing
5	Handbook of Biochemistry	Sathynarayana	Elsevier India
6	Illustrated biochemistry	Harper	Lange Medical Publication
7	A biochemical guide to principles and techniques of practical biochemistry	K. Wilson&K.Goulding	Cambridge University Press
8	Principles and techniques of practical	Bryan L. Williams and Keith Wilson	Cambridge University Press

	biochemistry		
9	Textbook of Practical Biochemistry	Shawney	Narosa Publishing House

PRACTICAL-III

Biomolecules –II & Biochemical Techniques

Practical Duration -02 Hours per week Examination-03 Hours

MARKS=30.

Practical Proper-20.

Internal Assessment - Record-05+ Class Test-05=10

PART – A

PROTEINS

- 1 Precipitation reactions of proteins (albumin).
- 2 Colour reactions of proteins (albumin, casein, gelatin).
- 3 Qualitative analysis of amino acids (arginine, tryptophan, tyrosine, cysteine & phenylalanine).
- 4 Extraction of casein from milk.
- 5 Determination of the activity of urease from horse gram.
- 6 Demonstration of the activity of phosphatase from potatoes.

PART-B

BIOCHEMICAL TECHNIQUES

- 1 Identification of amino acid by circular paper chromatography.
- 2 Ascending paper chromatography of amino acids.
- 3 Separation of plant pigments by column chromatography using silica gel-G.
- 4 Demonstration on polyacrylamide gel electrophoresis [PAGE] of proteins.
- 5 Demonstration of separation of lipids by TLC.
- 6 Demonstration of two-dimensional chromatography of amino acids.

FOURTH SEMESTER- BIOCHEMISTRY
Biochemistry Paper-IV
Title: ENZYMOLOGY & METABOLISM-I
Class duration – 03 hours per week
Marks: Theory - 50 + Internal Assessment - 20= 70

48 Hours

SUBJECT DESCRIPTION: Enzymes are protein catalyst that regulates the rates at which physiological process takes place. Consequently, defects in enzyme function frequently cause diseases. Hence, sound knowledge about enzymes is essential for life science students.

OBJECTIVES: To enable the students to learn about the different types of enzymes and its isolation and purification which will pave how the students can enter in the research field. And also to learn about the basic functions, principles and concepts of metabolism.

LEARNING OUTCOME: On successful completion of the course the students will acquire knowledge about Techniques of isolation & purification of the enzyme and Provides much information related to carbohydrate and fat metabolism that takes place in our body.

Unit1. ENZYMOLOGY

- 1.1 **Enzymes:** **6hrs**
General characteristics, Definition with examples of the holoenzyme, apoenzyme, co-factors coenzymes, metalloenzymes, abzymes and RNA as an enzyme. Isolation and purification of enzymes.
Classification of enzymes based on IUB with examples, units of enzyme activity, Specific activity, enzyme specificity, Concept of the active site.
Theories of enzyme catalysis: Lock and key model, Koshland's induced fit theory.
Mechanism of enzyme action: General acid-base catalysis, covalent catalysis.
- 1.2 **Enzyme kinetics:** **4 hrs**
Factors affecting the rate of enzyme-catalyzed reactions. Effect of substrate concentration, pH, temperature. Michaelis - Menten equation (derivation not required). Lineweaver- Burk (L-B) plot. Determination of Km & Vmax from L-B plot and their significance. Turn over number.
- 1.3 **Enzyme inhibition:** Competitive, Non- competitive, uncompetitive **4 hrs**
inhibition with suitable examples, Graphical representation by L-B plot, Effect of inhibitor on Km & Vmax using LB plot, Irreversible inhibition- suicide inhibition.
- 1.4 **Allosteric enzymes** –Characteristics with ATCase as an example. **4hrs**
Iso enzymes – Properties –LDH as an example.
Multienzyme complex- Pyruvate dehydrogenase complex,
Multi-functional enzymes - Definition, characteristics with an example.
Applications of enzymes: Industrial & medical applications.

Unit 2 METABOLISM – I

- 2.1 **Bioenergetics:** **2 hrs.**
Concept of free energy. Endergonic and exergonic reactions. Coupled reactions. High energy compounds – Structure of ATP and its free energy change during hydrolysis, Examples of other high energy compounds.

- 2.2 **Biological oxidation:** Electron transport chain: electron transport complexes (Complex I, II, III and IV). Oxidative & substrate-level phosphorylation with examples, uncouplers and inhibitors of respiration: Rotenone, antimycin-A, cyanide and DNP, P/O ratio. Formation of ATP (Outlines of Mitchell's hypothesis) binding change mechanism (Boyer model). Photophosphorylation, **3 hrs**
- 2.3 **Metabolism:** Anabolism and catabolism compartmentalization of metabolic pathways. **1 hr.**
- 2.4 **Metabolism of Carbohydrates:**
- 2.4.1 Reactions and energetics of glycolysis, Fermentation, Entry of -fructose, galactose, mannose and lactose into glycolytic pathway. Fates of pyruvate - conversion of pyruvate to lactate, alcohol and acetyl CoA. Reactions and energetics of the TCA cycle. Cori cycle. **4 hrs**
- 2.4.2 Gluconeogenesis. Regulatory steps of glycolysis and TCA cycle, Futile cycle. Amphibolic and integrating roles of TCA cycle. Anaplerotic reactions. **4 hrs**
- 2.4.3 Pentose phosphate pathway and its significance. Glycogen metabolism: Glycogenolysis, glycogenesis & regulation. Synthesis of starch and lactose. Regulation of blood glucose. **4 hrs**
- 2.5 **Metabolism of Lipids:** **6 hrs**
Outlines of α , β & ω modes of oxidation. Beta oxidation of even number saturated fatty acid and carnitine shuttle. Energetics of β -oxidation. Biosynthesis of even number of saturated fatty acids. Metabolism of ketone bodies- formation, utilization and ketosis.
- 2.6 **Cholesterol Metabolism:** **6 hrs**
Biosynthesis and degradation of cholesterol. Production of primary and secondary bile acids, bile salts and its importance. Regulation of cholesterol biosynthesis. Outline of the metabolism of lipoproteins: Chylomicrons, VLDL, LDL & HDL, Reverse transport of cholesterol.

Books recommended

SLNO	BOOK	Author	Publisher
1	Principles of Biochemistry	Lehninger	Freeman, W.H and company
2	Textbook of Biochemistry	Voet and Voet.	John Wiley and Sons
3	Textbook of Biochemistry	Garrett and Grisham	Cengage Learning
4.	Essentials of Biochemistry	Sathyanarayan	Elsevier India
5.	Textbook of Biochemistry	Strayer.	W.H Freeman and Co Ltd
6.	Textbook of Biochemistry of	Harper	Lange Medical

	Physiological chemistry		publications
7.	Textbook of Biochemistry	Suttie	Holt, Rinehart and Winston of Canada Ltd
8.	Outline of biochemistry	Conn & Stumpf.	John Wiley and Sons Inc
9.	3 rd edition Understanding enzymes.	Trevor Palmer	Ellis-Horwood Limited.
10.	Enzymes in 1964. Digitized	Dixon and Webb	Publisher Academic Press,
11.	Enzyme Technology Publisher	Chaplin & Bucke.	Cambridge University Press
12.	2 nd edition, Handbook of enzyme biotechnology.	Alan Welshman	

PRACTICAL-IV

Colourimetric estimations

Practical Duration -03 Hours per week Examination-03 Hours

MARKS=30.

Practical Proper-20.

Internal Assessment - Record-05+ Class Test-05=10

Colourimetric estimation of

- 1 Glucose by DNS method.
- 2 Protein by Biuret method.
- 3 Protein by Lowry's method.
- 4 Keto acid by DNPH method.
- 5 Urea by DAMO method.
- 6 Creatinine by Jaffe's method.
- 7 Inorganic Phosphorous by Fiske and Subbrao/Ascorbic molybdate method.
- 8 Iron by Wong's method.
- 9 Cholesterol by Zak's method.
- 10 Glucose by Folin-Wu's method.
- 11 Glucose by anthrone method.
- 12 Aminoacid by ninhydrin method.

FIFTH SEMESTER-BIOCHEMISTRY

Biochemistry Paper-V

Title: METABOLISM-II AND HUMAN PHYSIOLOGY

Class duration – 03 hours per week

MARKS-Theory - 70 + Internal Assessment -30= 100

48 Hours

SUBJECT DESCRIPTION: This course emphasizes the students to understand the metabolism of amino acids, proteins and nucleic acids and also to study of the functioning of the normal body, and is responsible for describing how various systems of the human bodywork

OBJECTIVES: This course Provides knowledge base and understanding of the physiological processes underlying health and disease in the major organ systems of the body, i.e., cardiovascular, respiratory, renal, gastrointestinal and endocrine systems.

LEARNING OUTCOME: This course would have made the student's ability to explain physiological processes in detail and understanding of the metabolic fates of amino acids, proteins and nucleic acids.

Unit 1. METABOLISM –II

1.1 Metabolism of Amino acids:

6 hrs.

General mechanism of amino acid metabolism: Deamination-oxidative and non – oxidative deamination, Transamination, Decarboxylation (biologically important amines) Desulphuration. Catabolism of carbon skeleton of amino acids, glycogenic and ketogenic amino acids. Urea cycle and its significance.

Synthesis and catabolism of alanine, phenylalanine and cysteine.

1.2 Metabolism of peptides and porphyrins

8hrs.

Biosynthesis of creatine, polyamines and glutathione

Heme –synthesis and degradation.

- 1.3 **Metabolism of proteins:**
Protein turnover, Structural features influencing the protein degradation: PEST sequence, N-end rule. ATP dependent and ATP independent mechanism of protein degradation, Synthesis of glycoproteins: N-linked and O-linked glycoproteins.
- 1.4 **Metabolism of Nucleic acids:** **10hrs**
Pathways of degradation of nucleic acids in cells, Action of nucleases-DNase I and II, RNase and phosphodiesterases. Catabolism of purines and pyrimidines, uric acid formation and inhibition, Salvage pathways. De novo biosynthetic pathways of purine and pyrimidine nucleotides. Conversion of ribonucleotides to deoxyribonucleotides. Inhibitors of nucleotide biosynthesis-methotrexate, and 5-fluorouracil.
- Unit 2. HUMAN PHYSIOLOGY**
- 2.1 **Nervous system:** **4 hrs.**
Neurons -Types, the generalized structure of a multipolar neuron. Neuromuscular junction. Resting membrane potential, action potential transmission of a nerve impulse along an axon and across the synapse. Neurotransmitters-Excitatory and Inhibitory with examples. Inhibitors of neurotransmission and their importance.
- 2.2 **Muscle:** Types of muscles and their structure. Ultrastructure of skeletal muscle. **3 hrs.**
Contractile and regulatory proteins of skeletal muscle. Sliding filament model of skeletal muscle contraction.
- 2.3 **Bone:** Composition and structure of long bone (internal and external structure), **3 hrs.**
growth (mechanism of growth) and remodelling of a long bone. Factors affecting growth.
- 2.4 **Renal system:** **2 hrs.**
Structure of the nephron, formation of urine – Glomerular filtration, tubular reabsorption (sodium, urea, water and glucose) and Tubular secretions.
- 2.5 **Endocrine system:** **10 hrs.**
Endocrine organs, classification of hormones. Hierarchy, interplay and dynamic balance and regulation of hormone secretions. Functions of the hormones of hypothalamus, pituitary (GH, ACTH, TSH, FSH, LH, oxytocin and ADH) adrenal (aldosterone, cortisol & cortisone), thyroid (T₃ & T₄) pancreas (insulin and glucagon) and gonads (testosterone, estradiol and progesterone). General mechanism of peptide and steroid hormone action. Concept of second messengers. Eg: CAMP, DAG and IP₃. Endocrine disorders-Diabetes Mellitus.
- 2.6 **Liver:** Structure of the liver lobule, Functions – metabolic & storage, role in the **2 hrs.**
removal of following substances: ethanol, ammonia, bilirubin and drugs.

Books recommended:

SLNO	Book	Author	Publisher
1	Textbook of Biochemistry	West & Todd	Todd publications
2	Textbook of Biochemistry	A. Lehninger	Freeman, W.H and company
3	Textbook of Biochemistry	O.P. Agarwal	Krishna Prakashan Media p Ltd
4	Textbook of Biochemistry	Jain	S Chand publishing
5	Handbook of Biochemistry	Sathynarayana	Elsevier India

6	Illustrated biochemistry	Harper	Lange Medical publications
---	--------------------------	--------	----------------------------

PRACTICAL -V
Enzyme Assays

Practical Duration -02Hours per week Examination-03 Hours

MARKS=50.

Practical Proper-35.

Internal Assessment - Record-05+ Class Test-10=15

I. Salivary amylase/Acid phosphatase/Invertase:

- 1 Determination of specific activity by DNS method.
- 2 Determination of optimum pH.
- 3 Determination of Km and Vmax.
- 4 Determination of optimum time.
- 5 Determination of optimum temperature.
- 6 Effect of activators/inhibitors on enzyme activity

II. Report:

- 1 Visit to scientific/research institute – Tour report.

Education tour V or VI Visit

1. Bangalore: IISE, JNCASR, NIMHANS, UAS-NCBS, Biocon.
2. Bombay: TIFR, cancer research institute, BARC, IIT
3. Hyderabad:CCMB,NIN,Reddy'slab,Indian Drug Research Lab
 - Internal crop research institute for semi and crops (ICRISAC)University of Poona
 - National Institute of virology
 - National chemical laboratory
 - National centre for the cell science
4. Goa: National Institute of Oceanography(NIO)
5. Cochin: Sree Chitra Tirunal Institute of medical science
6. Kasaragod: coconut research institute
7. Trivandrum: Rajiv Gandhi institute of biological science
8. Mangalore: fisheries college
 - Manipalcentre of higher education
 - Plant biotechnology lab- St. Aloysius college
 - Mangalore Chemical Fertilizers(MCF)
9. Hassan: coffee Estate,
10. Ooty: potato research station
11. Kannur: TATA tea process Centre, vaccine institute
12. Madras: IIT
 - Centre for Leather and Resin Institute
 - RSIC-Regional Sophisticated Instrumentation Centre
13. Other research institutes in other parts of the country may also be included in the visit.

FIFTH SEMESTER- BIOCHEMISTRY
Biochemistry Paper-VI
Title: MOLECULAR BIOLOGY & GENETIC ENGINEERING
Class duration – 02 hours per week
Marks: Theory - 70 + Internal Assessment - 30= 100

48 Hours

SUBJECT DESCRIPTION: This course emphasise the mechanism of synthesis of DNA, RNA and proteins, gene regulation and gene mutation. Techniques used in molecular biology Along with the basis of gene cloning, vectors, genetic engineering techniques.

OBJECTIVES: This course enables the students to learn about the synthesis and functions of molecules that make up living organisms, their mutation and identification of mutants with sound knowledge on cloning methods, techniques and applications of genetic engineering.

LEARNING OUTCOME: On successful completion of the course the student should have understood the synthesis of genetic material, RNA and proteins along with gene repair mechanism & gene mutation in molecular biology; basics, vectors, methods of gene cloning Techniques and application of gene technology.

Unit 1. MOLECULAR BIOLOGY

- | | | |
|-----|---|---------------|
| 1.1 | Introduction: Nucleic acids as genetic information carriers, Experimental evidences ex: bacterial genetic transformation, Hershey Chase experiment. The central dogma of molecular biology and its modification. | 3 hrs. |
| 1.2 | Replication of DNA:
DNA replication in prokaryotes- conservative, semi-conservative and dispersive types. Mechanism of semi-conservative replication. DNA polymerases, other enzymes and protein factors involved in the replication. Meselson and Stahl experiment. Mechanism of replication in prokaryotes. | 5 hrs. |
| 1.3 | Prokaryotic RNA Synthesis:
Role of RNA polymerase. Initiation, elongation and termination, reverse transcription-replication of HIV. | 5 hrs. |
| 1.4 | Genetic code:
General features, wobble hypothesis. | 1 hr. |
| 1.5 | Prokaryotic Protein biosynthesis:
Activation of Amino acids, aminoacyl tRNA synthesis. Initiation, elongation and termination of protein synthesis. Inhibitors of protein synthesis. Post-translational modifications. | 5 hrs. |
| 1.6 | Mutations:
Concept of mutation and mutagens – effect of HNO ₂ , alkylating agents, intercalating agents and UV-radiation. Concept of missense, nonsense, point mutation and frameshift mutation. | 4 hrs. |
| 1.7 | Repair of DNA:
DNA damage and their repair. Types of damages repair by direct reversal of damage, excision repair, recombination repair, SOS repair. | 3 hrs. |
| 1.8 | Concept of gene:
Gene expression in prokaryotes - the concept of Lac operon and trp operon. | 4 hrs. |

Functional units in a typical eukaryotic gene-promoter, introns and exons.

Unit 2.GENETIC ENGINEERING

- 2.1 Historical development, aim and scope of genetic engineering. **1 hr.**
- 2.2 **Outline of techniques of genetic engineering.** **10hrs.**
 Isolation of DNA, cutting of DNA by restriction endonucleases –Types, staggered cut and blunt end. Separation of fragments by agarose gel electrophoresis.
 Vectors- plasmid (pBR322), bacteriophage, viruses, cosmids, phagemid and plant vectors. Insertion of foreign DNA into vectors- Use of linkers and adapters. Homopolymer tailing. Transfection of vectors into host cells. cDNA. Principle of polymerase chain reaction and applications.
- 2.3 **Blotting techniques:** **4 hrs.**
 Principle and procedure of Southern, northern and western blotting. Dot blot. DNA fingerprinting.
- 2.4 **Applications of Genetic engineering** **3 hrs.**
 Transgenic plants, transgenic animals and gene therapy. Human genome project.

Books recommended:

SLNO	Book	Author	Publisher
1	Biochemistry of Nucleic acids	Adam et al	Springer Netherlands
2	Textbook of Molecular Biology	David Friefelder	Narosa
3	Text book Molecular Biology of gene	James and Watson	Pearson Education

PRACTICAL-VI

Biophysical and Biochemical Experiments

Practical Duration -02Hours per week Examination-02 Hours

MARKS=50.

Practical Proper- 35. Internal Assessment - Record-05+ Class Test-10=15

1. Conductometric titration of strong acid against a strong base.
2. Conductometric titration of amino acid against the strong base.
3. Preparation of acidic and basic buffers and determination of pH using pH meter.
4. Determination of pKa value of amino acid by using pH meter.
5. Determination of pKa value of acetic acid by using a potentiometer.
6. Determination of molar extinction coefficient.
7. Determination of UV spectra of proteins and nucleic acid.
8. Extraction of DNA from a natural source.
9. Estimation of DNA by diphenylamine method.
10. Demonstration of estimation of RNA by orcinol method.

SIXTH SEMESTER- BIOCHEMISTRY
Biochemistry Paper-VII
Title: NUTRITION
MARKS-Theory - 70 + Internal Assessment -30= 100

48 Hours

SUBJECT DESCRIPTION: This course emphasizes the students to know about the nutritional requirement of cell and organisms that are necessary to support life and privilege of a healthy diet in preventing common health problems.

OBJECTIVES: This course enables the students to improve their health status by understanding the strong relationship between nutrition and health and also improve their food choices and eating habits to prevent nutrition-related health problems.

LEARNING OUTCOME: This course would have made the students to increase their knowledge on healthy food choices using safe food handling practices, preparation and storage practices and to improve their skill in the selection of healthy foods.

Unit1- NUTRITION

- | | | |
|-----|---|---------------|
| 1.1 | Introduction:
Concept of Nutrition, the calorific value of foods and its determination (Bomb calorimeter), Different components of energy expenditure, measurement of energy expenditure by the direct and indirect calorimetric method.
Energy expenditure at rest and work, respiratory quotient, basal metabolic rate (BMR), determination of BMR by indirect calorimetric method, factors affecting BMR. The specific dynamic action of foods.
Proximate analysis of food samples: Moisture, fibre, ash, proteins, carbohydrates, fats and their importance. | 8 hrs |
| 1.2 | Carbohydrates:
Dietary sources of carbohydrates, dietary fibres (types, beneficial & adverse effects) and protein-sparing action.
Glycemic index, importance with examples, lactose intolerance. | 8hrs. |
| 1.3 | Proteins: Dietary sources of proteins, nutritional classification, Nutritive value of proteins-PER and biological value (BV). Essential amino acids.
Nitrogen balance, Mutual Supplementation of proteins.
Malnutrition-kwashiorkor and marasmus. | |
| 1.4 | Fats:
Dietary sources of fats, visible and invisible fat, trans fats, omega fatty acids and their biological importance, Role of DHA and EPA.
Effects of fried foods. | |
| 1.5 | Vitamins:
Dietary sources, requirements, deficiency symptoms and biological role of water-soluble vitamins-thiamine, riboflavin, niacin, pantothenic acid, pyridoxine, biotin, folic acid, vitamin-B ₁₂ and vitamin-C.
Fat-soluble vitamins-A, D, E and K, hypo and hypervitaminosis. | 8 hrs. |
| 1.6 | Minerals:
Dietary sources, physiological functions, deficiency disorders, absorption and excretion.
Macronutrients-Ca, P, Na, Cl, Mg and K
Micronutrients-Fe, Zn, Cu, I ₂ , F, Se, Cr, Mn. | 8 hrs. |

- 1.7 **Balanced diet:** **8 hrs.**
Composition of a balanced diet for infants, children, pregnancy and lactating women, old age.
- 1.8 **Water Metabolism:**
Absorption, requirement, distribution of water in body fluid compartments. Factors influencing water metabolism, functions of water, deficiency and water intoxication in the human body.
- 1.9 **Antinutritional Factors:**
Sources and harmful effects of anti vitamins (example:- avidin, dicoumarol), Natural toxicants (example:- Lathyrussativus) and adulterants (Butter yellow, lead chromate & malachite green)
- 1.10 **Digestion and absorption:** **8 hrs.**
GIT: secretion, composition and functions of saliva, gastric, bile, pancreatic and intestinal juices. Gastrointestinal hormones and its effects. Absorption and transport of carbohydrates, proteins and fats.
- 1.11 **Nutraceuticals:** Introduction, functional foods and pre and pro-biotics in health and disease prevention.

Books recommended:

SLNO	Book	Author	Publisher
1	Textbook of nutrition	Swaminathan	The Bangalore printing And
2	Fundamentals of Foods, Nutrition and Diet Therapy	Sumati R. Mudambi & M.V. Rajagopal	New age international P Ltd

**PRACTICAL-VII
Nutrition**

Practical Duration -02 Hours per week

Examination-03 Hours MARKS=50.

Practical Proper-35. Internal Assessment - Record-05+ Class Test-10=15

- 1 Determination of moisture content of foods and detection of adulterants in food.
- 2 Extraction and estimation of calcium in ragi.
- 3 Proximate analysis of food samples- Moisture, fibre, protein fat and carbohydrate (by difference)
- 4 Estimation of reducing sugars (From jams and jellies) by Fehling's method.
- 5 Extraction and estimation of vitamin – C in the biological sample.
- 6 Extraction and estimation of iron from mustard.
- 7 Determination of saponification value of oil.
- 8 Determination of iodine/acid/peroxide value of oil or fat.
- 9 Estimation of amino acid by Sorensen's formal titration.
- 10 Determination of pH of the given sample of fruit juice. (Eg: lemon, papaya, apple, sugar cane, bejois juice etc).
- 11 Estimation of lactic acid in milk.

SIXTH SEMESTER-BIOCHEMISTRY
Biochemistry Paper-VIII
Title:-CLINICAL BIOCHEMISTRY AND IMMUNOLOGY
Class duration – 03 hours per week
MARKS-Theory - 70 + Internal Assessment -30= 100

48 Hours

SUBJECT DESCRIPTION: This course emphasizes the students to study the diagnostic importance of various metabolic disorders. Immunology presents a wide knowledge of all the aspects of the immune system concerning biomedical applications.

OBJECTIVES: This course Provides knowledge base and understanding of the clinical aspects of various metabolic disorders along with principles based on antigen and antibody interactions which help in the field of medicine and detection of diseases.

LEARNING OUTCOME: This course would have made the student's ability to explain physiological processes in detail and on an appropriate level (knowledge, comprehension, application and analysis) with sound knowledge about the significance of diagnostic biochemistry. And also should have understood the detail aspects of immune cells, organs and their role in hypersensitivity reactions.

Unit 1. CLINICAL BIOCHEMISTRY

- | | | |
|-------------------------------|--|---------------|
| 1.1 Introduction: | Clinical biochemistry: Definition, scope, collection & preservation of biological fluids. | 1 hr. |
| 1.2 Urine: | Normal composition of urine – Volume, pH, colour and specific gravity. Chemical analysis and normal values of the constituents- urea, uric acid, creatinine, pigments and their clinical significance.
Abnormal constituents - glucose, albumin, ketone bodies and bile pigments and their pathological significance. | 3 hrs. |
| 1.3 Body fluids: | Blood- volume, composition and functions. RBC, WBC and platelets: structure and functions. Total WBC count, differential count, erythrocyte count, platelet count. Hb%, blood grouping & ESR. C-reactive protein and subpopulation of blood cells. Mechanism of blood coagulation (outline) - intrinsic and extrinsic pathway. Blood-brain barrier.Cerebrospinal fluids and lymph – composition and functions.
Normal constituents of blood and their variation in pathological conditions- urea, uric acid, creatinine, glucose, bilirubin, total protein, albumin/globulin ratio. Lipid profile: cholesterol, triglycerides, lipoproteins: chylomicrons, VLDL, LDL and HDL. | 7 hrs. |
| 1.4 Clinical enzymes: | Alkaline phosphatase, serum transaminases (SGPT & SGOT) and lactate dehydrogenase (LDH). Cardiac injury profile- CPK and LDH. | 2 hrs. |
| 1.5 Acid-base balance: | Maintenance of normal pH of the body fluids. Role of blood buffers. Biochemical events in the transport of CO ₂ and O ₂ in blood. Role of lungs and kidney in acid-base balance. Acidosis and alkalosis. | 4 hrs. |

1.6 **Liver disorders:** 4 hrs.
Cirrhosis, hepatitis, fatty liver and jaundice (pre, post and hepatic). Estimation of conjugated and total bilirubin in serum (Diazo method). Detection of bilirubin and bile salts in urine (Fouchet's test and Hay's test).

1.7 **Inborn errors of Metabolism:** 3hrs.
Glycogen storage disease (Von-Gierke's disease), fructosuria, galactosemia, 7.2 phenylketonuria, alkaptonuria, albinism, Lesch-Nyhan syndrome, Niemann-Pick disease.

Unit 2. IMMUNOLOGY

2.1 **Overview of the Immune system:** 7 hrs.
Role of immunologically important organs and cells - bone marrow, thymus, spleen and lymphocytes. Innate and adaptive immunity. Passive and active immunity. Cellular and humoral immunity: formation and functions of T & B Lymphocytes. Helper T-cells and killer T-cells. Macrophages and dendritic cells.

2.2 **Antigens:** 2 hrs.
Definition, Types, chemical nature and antigenicity. Epitopes, paratopes, haptens and adjuvants.

2.3 **Antibodies:** Definition, Types and structure of a typical immunoglobulin (IgG – Light chain, heavy chain, hypervariable region, constant domains, Fab and Fc). Polyclonal and monoclonal antibodies. Production and applications of monoclonal antibodies. 4 hrs.

2.4 **Antigen-antibody reaction *in-vitro*:**
Formation of an antigen-antibody complex. Agglutination and precipitation Principle, procedure and applications of immunodiffusion, RIA, ELISA. 4 hrs.

2.5 **Immunization:** 2 hrs.
Vaccines and their preparations, primary and secondary immune response.

2.6 **Hypersensitivity:** 2hrs.
Different types in brief, Immediate and delayed type of hypersensitivity.

2.7 **Immunological disorders:** 3 hrs.
Autoimmune disorder- systemic lupus erythematosus and rheumatoid arthritis
Immunodeficiency diseases- AIDS.

Books recommended:

SLNO	Book	Author	Publisher
1	Textbook of clinical biochemistry	Ranasinghe	Jaypee Brothers, Medical Publishers Pvt Limited
2	Textbook of biochemistry	<u>Denise R. Ferrier,</u> <u>Richard A. Harvey</u>	Lippincott Williams and Wilkins
3	Textbook of biochemistry with clinical correlations	<u>Thomas M. Devlin</u>	Wiley, John and Sons Incorporated
4	Clinical Chemistry in diagnosis and treatment	Philip.D.Mayne	CRC Press
5	Textbook of Immunology	Kuby	W.H Freeman and

			Company
6	Textbook of Immunology	Tortora	Pearson Education India

PRACTICAL-VIII

Clinical Biochemistry and Immunology

Practical Duration -02Hours per week Examination-03 Hours

MARKS=50.

Practical Proper-35. Internal Assessment - Record-05+ Class Test-10=15

- 1 **Qualitative analysis of urine:**
Organic: urea, uric acid, creatinine and amino acid. Inorganic constituents: chlorides, sulfates, phosphates and ammonia
Abnormal constituents -glucose, albumin, bile pigments, bile salts and ketone bodies.
- 2 **Quantitative estimations:**
- 3 Titrable acidity and ammonia in urine.
- 4 Creatinine in the urine.
- 5 Urea in blood.
- 6 Blood glucose
- 7 SGPT/SGOT.
- 8 Alkaline phosphatase.
- 9 Haemoglobin.
- 10 Determination of antigen-antibody reaction by immunodiffusion technique.
- 11 Assay of antigen concentration by radial immunodiffusion technique.
- 12 Photographic demonstration of immunological important cells

BIOCHEMISTRY DISCIPLINE SPECIFIC ELECTIVES (DSE)

BIOCHEMISTRY DSE(For 2nd, 3rd&4th Semesters)

Title:-BASIC CHEMISTRY

CLASS DURATION – 03 HOURS PER WEEK

MARKS-Theory - 30 + Internal Assessment -20= 50

30 Hours

SUBJECT DESCRIPTION: The course emphasizes on teaching the students the basic concepts of Chemistry.

LEARNING OUTCOME: On successful completion of the student will be able to appreciate the different types of organic reactions, procedures employed in the determination of important elements, basics of stereochemistry. The above paper provides a strong foundation to the concepts of organic chemistry which will enable a better understanding of metabolic pathways.

Unit 1. Chemical Bonding 8 hrs

1.1 Definition, Types of chemical bonding Ionic bond, covalent bond, Coordinate bond, Metallic bond, Vander wall's bond, Hydrogen bond.

1.2 Theories of bonding –Valence bond Theory, Molecular orbital theory.

Unit 2. Study of Organic Compounds 7 hrs

2.1 Empirical, structural & Molecular formula

2.2 Nomenclature & classification of organic compounds,

2.3 Determination & estimation of C, H, N & Halogens

Unit 3. Mechanism of Organic Reactions

3.1 Types of reagents – Electrophiles, Nucleophiles 7 hrs

3.2 Electron Mobility : Inductive effect, Resonance, Hyper conjugation (Without example each)

3.3 Reactive intermediates – carbocation, carbanion, free radicals, carbenes, Arynes & nitrenes.

3.4 Types of Reactions: Substitution, Addition, Elimination, Rearrangement, Redox Reaction.

Unit 4. Stereochemistry

4.1 Isomerism, Types of isomerism, representation of organic molecules 8 hrs

4.2 Optical isomerism. Plane polarized light, optical activity. Working of Polarimeter angle of rotation, specific rotation d_l . Cause of optical activity symmetry, elements and chirality.

4.3 Enantiomers, diastereomers and geometrical isomerism with suitable examples.

4.4 R S nomenclature, Methods of Racemisation Resolutions of Racemic mixture

Reference Books:-

1. Textbook of Inorganic chemistry - Puri & Sharma.
2. Concise inorganic chemistry - J.D. Lee
3. Textbook of inorganic chemistry - Gurdeep Raj & Chatwal
4. Advanced organic chemistry - Bhal & Bhal
5. Advanced organic chemistry - P.L. Soni

BIOCHEMISTRYDSE (For 2nd, 3rd & 4th Semesters)

Title:-BASIC CONCEPTS OF GENETICS
CLASS DURATION – 03 HOURS PER WEEK
MARKS-Theory - 30 + Internal Assessment -20= 50

30 Hours

SUBJECT DESCRIPTION: The course emphasizes on teaching the students the basic concepts of genetics.

LEARNING OUTCOME: On successful completion of the student will be able to understand the concept of genetics and molecular basis of mutations and the conditions caused due to abnormality in chromosome number.

Unit 1 Introduction

6 hrs

- 1.1 Introduction: A brief overview of the modern history of genetics;
- 1.2 Mendel's experiments, segregation, dominance, independent assortment; Epistasis; Multiple alleles; one gene-one enzyme hypothesis.

Unit-2 Linkage and Inheritance

8 hrs

- 2.1 Linkage And Recombination Of Genes In A Chromosome.
- 2.2 X-Linked Inheritance. Polygenic Inheritance, Mitochondrial Inheritance,

Unit-3 Chromosome Numbering

2 hrs

- 3.1 Ploidy, Karyotyping, Sex Chromosome And Dosage Compensation. Mobile Genetic Elements.

Unit-4 Mutations

8hrs

- 4.1 Mutations; Nature Of Mutations, Spontaneous And Induced Mutation, Conditional, Lethal (Temperature Sensitive) Mutation. Chemical Mutagens, Radiation-Induced Mutation, Reverse Mutations And Suppressor Mutations - Intergenic And Intragenic Suppression,
- 4.2 Reversion As A Means Of Detecting Mutagens - Ames Test.
- 4.3 **Chromosomal Basis Of Human Diseases:** Extra Or Missing Chromosome, Abnormality In Chromosome Structure; Deletion, Duplication, Inversion, Translocation.

Unit-5 Population genetics:

6hrs

- 5.1 Gene pool, allele frequency, genotype frequency, and Hardy-Weinberg equation;
- 5.2 Variation, Mutation, Mechanisms of speciation, factors producing changes in populations.

Suggested Reading:

1. A textbook of Genetics essentials by Benjamin. Pierce
2. Biotechnology –2 (Cell Biology, Genetics, Microbiology), Rajeshwari S. Setty and V. Sreekrishna. New Age International Publishers, 2002.
3. Basic Genetics. G. S. Miglani. Narosa Publishing House. New Delhi, 2000.
5. Principles of Genetics. VIII edition, J. Gardner. John Wiley and Sons, New York. 2003.
6. Gene VII. Lewin, B. Oxford Univ. Press. Oxford. 2003

BIOCHEMISTRY DSE(For 2nd, 3rd&4th Semesters)

Title: LIFESTYLE DISORDERS

CLASS DURATION – 03 HOURS PER WEEK

MARKS-Theory - 30 + Internal Assessment -20= 50

30 Hours

SUBJECT DESCRIPTION: This course is designed to impart knowledge about the importance of a healthy lifestyle for a better healthy living.

LEARNING OUTCOME: The student would have understood the need to maintain a healthy lifestyle and the complications associated with the unhealthy /poor lifestyle which causes many lifestyle-related disorders. They will also have learnt about practices which enable them to have a lifestyle which can prevent the occurrence of various disorders

Unit-1 Introduction to lifestyle disorders **5 hrs**

- 1.1 Introduction: Definition of health, lifestyle disorders
- 1.2 Types and contributory factors of lifestyle disorders
- 1.3 Impact of lifestyle factors on physical & mental health of the people.

Unit-2 Lifestyle disorders **7hrs**

- 2.1 Eating, physical, mental and occupational lifestyle disorders;
- 2.2 Causes -food, physical & mental habits and its consequences
- 2.3 Symptoms and Prevention of lifestyle disorders in children, adult and old age diseases.

Unit-3 Lifestyle disorders in India **9hrs**

- 3.1 Cardiovascular disease –hypertension, heart attack and stroke
- 3.2 Asthma, chronic liver disease, chronic obstructive pulmonary diseases (COPD), nephritis diabetes and osteoporosis;
- 3.3 Cancer, Alzheimer's disease and Obesity.

Unit-4 Growth monitoring and promotion: **9 hrs**

- 4.1 Growth & factors affecting growth and development;
- 4.2 Importance of Nutrition for ensuring adequate development, management of diet-related to lifestyle disorders.
- 4.3 Strategies and approaches in lifestyle disorders: Prevention of the disease using diet and lifestyle changes;
- 4.4 Lifestyle choices and personal wellness.

Textbooks and References

1. Guide to Prevention of Lifestyle Diseases by M. Kumar and R. Kumar,2003, DEER & DEEP publications, New Delhi.
2. Dietetics by Srilakshmi, 2014, 7th Edition, Publisher: New Age International Private Limited.
3. Principles of Nutrition & Dietetics by Swaminathan M, ISBN-13: 5551234022792,2001

BIOCHEMISTRY DSE (For 2nd, 3rd & 4th Semesters)
CLASS DURATION – 03 HOURS PER WEEK
MARKS-Theory - 30 + Internal Assessment -20= 50

Hours-28

SUBJECT DESCRIPTION: To acquire a good working knowledge of the chemistry of important biological processes in plants and to understand the biochemistry of phytochemicals and metabolites and their use as alternate medicines

LEARNING OUTCOME: On successful completion of the course the student will have a better understanding of Biochemical processes in plants and applied knowledge for the development of herbal drugs.

Unit- 1Introduction

6 hrs

- 1.1 Plant cell – structure and functions of subcellular organelles, plant cell wall
- 1.2 Mechanism of water absorption, Ascent of sap.
- 1.3 Transpiration - types, stomatal opening, Mechanism and factors affecting transpiration.

Unit-2Photosynthesis and Carbon assimilation:

8 hrs

- 2.1 Structure of PSI and PSII complexes, Light reaction, Cyclic and non cyclic photophosphorylation
- 2.2 Calvin cycle and regulation
- 2.3 C₄ cycle and Crassulacean acid metabolism (CAM), Photorespiration.

Unit-3Nitrogen Metabolism:

6 hrs

- 3.1 Importance Of Nitrogen In Biological Systems, Nitrogen Cycle.
- 3.2 Nitrogen Fixation; Symbiotic And Non-Symbiotic, Nitrogenase Complex, Energetics And Regulation. Formation Of Root Nodules In Legumes.
- 3.3 Assimilation Of Nitrate And Ammonium Ion.

Unit-4Plant Hormones

5 hrs

- 4.1 Introduction to plant hormones and their effect on plant growth and development- Auxins, Gibberellins, cytokinins, Ethylene, Abscisic acid.
- 4.2 Biochemistry of seed dormancy, Seed germination, Fruit ripening and Senescence.

Unit-5Plants in alternative medicines

5 hrs

- 5.1 Medicinal value of different parts of plants.
- 5.2 Basic methods to identify the secondary metabolites
- 5.3 Role of secondary metabolites in Ayurvedha and Sidha treatment.
- 5.4 Medicinal value of Amla, Stevia, Aswagandha and Turmeric.

Suggested Readings

1. Plant physiology, Verma, 7th Revised edition, Emkay Publications 2001.
2. Plant Physiology, S. N. Pandey and B.K. Sinha, Vikas Publishing House Pvt. Ltd, 3rd 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, 3rd edition
5. A Handbook of Medicinal Plants –Prajapathi, Purohit, Sharma, Kumar
6. Medicinal Plants –a compendium of 500 species.

8. Medicinal Plants –Chopra, Khana, Prasad, Malik, Bhutiani

BIOCHEMISTRY DSE(For 5th and 6th Semesters)

Title: BIOCHEMISTRY OF NON COMMUNICABLE DISORDERS

CLASS DURATION – 03 HOURS PER WEEK

MARKS-Theory - 30 + Internal Assessment -20= 50

Hours-30

SUBJECT DESCRIPTION: The course emphasizes teaching students a molecular basis for non-communicable diseases which are a major concern of the modern world. The syllabus is outlined with a view of increasing awareness about having a healthy lifestyle.

LEARNING OUTCOME: On successful completion of the course the student should have gained knowledge regarding non-communicable diseases and the molecular basis for their appearance.

The knowledge gained will enrich and help the students in understanding the importance of a healthy lifestyle.

Unit-1Metabolic and Lifestyle disorders

10 hrs

- 1.1 Obesity and eating disorders like Anorexia nervosa and Bullemia.
- 1.2 Diabetes mellitus A metabolic syndrome and the relationship with hypertension, obesity, hypothyroidism and stress.
- 1.3 Cardiovascular disorders and Atherosclerosis- understanding the factors that contribute to the syndrome, stages of disorder and the management of the condition.
- 1.4 Irritable bowel syndrome- biochemistry behind the disorder and the influence of diet, stress and environment on the condition.

Unit-2Cancer

6 hrs

- 2.1 Cancer: characteristics of a transformed cell, causes and stages of Cancer, molecular basis for neoplastic growth and metastasis, Proto-oncogenes and tumour suppressor genes; Cancer-causing mutations
- 2.2 Tumour viruses; Biochemical analysis of cancer; Molecular approaches to cancer treatment.

Unit-3Other Complex disorders

6 hrs

- 3.1 Disorders of mood: Schizophrenia, dementia and anxiety disorders.
- 3.2 Polycystic ovarian syndrome, Parkinson's disease, ALS.

Unit-4Protein Folding disorders:

8 hrs

Introduction to protein folding and proteosome removal of misfolded proteins; etiology and molecular basis for Alzheimer's, Prion diseases, Huntington's Chorea, sickle cell anaemia, Thalassemia.

SUGGESTED READINGS

- 1 Textbook of Biochemistry with Clinical Correlations (2011) Devlin, T.M. John Wiley & Sons, Inc. (New York),
- 2 Introduction to Human Physiology (2012) 8th edition; Lauralee Sherwood.

- Brooks/Cole, Cengage Learning.
- 3 The World of the cell, 7th edition (2009). Lewis J. Kleinsmith, Jeff Hardin, Gr Wayne M.Becker.
 - 4 Genetics (2012) 6th ed., Snustad, D.P. and Simmons, M.J., John Wiley & Sons
 - 5 The Cell: A Molecular Approach (2009) 5th ed., Cooper, G.M. and Hausman, R.E., ASM Press & Sunderland (Washington DC), Sinauer Associates, MA,

BIOCHEMISTRY DSE(For 5th and 6th Semesters)
Title:-CONCEPTS OF PHARMACEUTICAL BIOCHEMISTRY
CLASS DURATION – 03 HOURS PER WEEK
MARKS-Theory - 30 + Internal Assessment -20= 50

Hours-30

SUBJECT DESCRIPTION: The course emphasizes on teaching the students to identify some general drugs used in medicine, their mode of action, clinical application, side effects and toxicity.

LEARNING OUTCOME: On successful completion of the student will be able to identify a range of drugs used in medicine and discuss their mechanisms of action. The student will be able to report the clinical applications, side effects and toxicities of drugs used in medicine. The student will be able to explain the mechanisms of action and pathology of ethanol and drugs of abuse.

Unit 1 General Pharmacology

- | | |
|---|--------------|
| 1.1 Importance of Biochemistry and pharmacy: Metabolites and anti-metabolites; | 6 hrs |
| 1.2 Drugs -Classification of drugs, routes of drug administration, absorption and distribution of drugs, factors influencing drug absorption. | |

Unit 2 Pharmacokinetics

- | | |
|---|-------------|
| 2.1 Drugs: Receptor interaction, the involvement of binding forces in drug-receptor interaction, drug action not mediated by receptors; | 6hrs |
| 2.2 Drug metabolism, the role of cytochrome P450. | |

Unit 3 Adverse responses

- | | |
|--|-------------|
| 3.1 Adverse responses and side effects of drugs: Allergy, drug intolerance, drug addiction, drug abuses and their biological effects. | 8hrs |
| 3.2 Drugs and pharmaceuticals from marine organisms: Marine lipids, marine flavourants and flavonoids. | |
| 3.3 Natural products: Alkaloids -coinine, nicotine, quinine, atropine; Terpenoids - terpenoil, menthol, ditentene; Flavonoids –anthoxynene | |

Unit 4 Drug action

Mechanism of action of

- | | |
|--|--|
| 1. CNS stimulants- (strychnine, amphetamine). | |
| 2. Beta-blockers | |
| 3. Opioids- Morphine | |
| 4. NSAID – Aspirin, Paracetamol and ibuprofen | |
| 5. Anti-Hypertensive drugs | |
| 6. Diuretics and antidiuretics | |
| 7. Allopurinol | |
| 8. Anti-diabetic drugs- Oral drugs (Metformin and gliclazide) and | |

- hormonal (Insulin and glucagon)
9. Oral contraceptives
 10. Alcohol

Suggested Readings

1. Essentials of Medical Pharmacology, 7th edition (2010), K.D. Tripathi, Jaypee Brothers,
2. Pharmacology, 7th edition (2011), H.P. Rang, M.M. Dale, J.M. Ritter and P.K. Moore, Churchill Livingstone.
3. Handbook of Experimental Pharmacology, 4th edition (2012), S.K. Kulkarni, VallabhPrakashan, 2012.
4. Textbook of pharmacology and pharmacotherapeutics by R.S. Satoskar, S.D. BandarkarAinapure.
5. The Pharmacology volume I and II –Goodman and Gillman
6. Basic Pharmacology –Foxter Cox
7. Oxford textbook of Clinical Pharmacology and Drug Therapy, D.GGrahmeSmithandJ.K.Aronson
8. Pharmacology and Pharmacotherapeutics – R.S.Satoskar, S.D.Bhandhakarand.

BIOCHEMISTRY DSE (For 5th and 6th Semesters)
Title: MOLECULAR ENDOCRINOLOGY
CLASS DURATION – 03 HOURS PER WEEK
MARKS-Theory - 30 + Internal Assessment -20= 50

Hours-30

SUBJECT DESCRIPTION: The course emphasizes on teaching the students to define and discuss the physiological actions of hormones relating them whenever possible to human disorders. To explain the consequences of under and overproduction of hormones and to learn techniques in endocrinology.

LEARNING OUTCOME: On successful completion of the student will be able to understand the mechanism of action of various hormones and conditions caused due to the variation in their secretion.

Unit-1 Introduction

6 hrs

- 1.1 Definition and scope of molecular endocrinology- steroid hormones- structure,
- 1.2 Biosynthesis and transport - dynamics of steroid hormone production and metabolism
- 1.3 Mechanisms of action of sex steroid hormones.

Unit- 2Peptide Hormones

6hrs

- 2.1 Peptide hormones- genetic control of peptide hormone formation- gonadotropins – cell surface receptors - mechanisms of action of peptide hormones.

Unit-3Endocrinopathies

10 hrs

- 3.1 Molecular basis of - Disorders of pituitary hormone axis- thyrotoxicosis- hypothyroidism- Hashimoto's thyroiditis- metabolic bone diseases- Cushing syndrome- Addison's diseases,
- 3.2 Androgen deficiency syndromes- testicular neoplasm- Klinefelter's syndrome and Turner's syndrome.

Unit-4 Laboratory techniques in molecular endocrinology

- 4.1 Principles of radioimmunoassay and enzyme-linked immunoassays- 8hrs
basic principles and measurement of steroid hormone receptors- analytic validation- quality assurance.

Text Books:

- 1 Henry M. Kronenberg, Shlomo Melmed, Kenneth S. Polonsky, P. Reed Larsen. Williams Textbook of Endocrinology, 11th ed. Saunders Elsevier 2008
- 2 Molecular Endocrinology, III ed, Bolander, F. F. Academic Press, 2004.
- 3 Knobil & Neill's Physiology of Reproduction III Edition, J.D. Neill (Ed in chief), Elsevier Academic Press, 2006.

BIOCHEMISTRY DSE (For 5th and 6th Semesters)

Title:-INTRODUCTION TO BIOSTATISTICS

CLASS DURATION – 03 HOURS PER WEEK

MARKS-Theory - 30 + Internal Assessment -20= 50

Hours-30

SUBJECT DESCRIPTION: The course emphasizes on introducing the students to the concepts of applied statistics –Biostatistics. The course encompasses methodology and theory of statistics as applied to the problems in the life and health sciences.

LEARNING OUTCOME: On the completion of the course the students are prepared to apply the skilled application statistical methods to solve problems encountered in various fields working with a huge amount of data

Unit 1 Introduction

10hrs

- 1.1 Nature and scope of statistical methods and their limitations:
- 1.2 Collection of sample –Classification, Types and methods of data collection-
- 1.3 Tabulation of data and representation of data, Diagrammatic representation (histogram, frequency, polygon and Ogives.

Unit 2 Measurements

8hrs

Measures of central tendency: Mean, Median, Mode, Harmonic mean, geometric mean -merits and demerits.

Unit 3 Statistical Measurements

6hrs

- 3.1 Measurements of dispersion: Range, Variance, Standard deviation, Quartile deviation, Lorenz curve, Coefficient of variation. Skewness: classification of skewness, Karl Pearson's coefficient of skewness; Kurtosis.
- 3.2 Correlation: Types and method of correlation, coefficient of correlation, scatter diagram, Regression, Regression analysis. Test of significance (student t-test), F-test, Chi-square, ANOVA (one way) **6hrs**

TEXTBOOKS:

1. Statistical Methods, Sultan chand& sons S, P. Gupta, V.K. Kapor, New Delhi 2002
2. Introduction to Biostatistics P.S.S. Sundaram.

BIOCHEMISTRY DSE(For 5th and 6th Semesters)

Title: BASIC BIOINFORMATICS

CLASS DURATION – 02 HOURS PER WEEK

MARKS-Theory - 30 + Internal Assessment -20= 50

Hours-30

SUBJECT DESCRIPTION: The course is designed to impart knowledge on the information stored in the structure of biologically important molecules. It also introduces them to the concepts of drug designing and basics of proteomics and its application in the current scenario.

LEARNING OUTCOME: The student on completion of the course will have understood the importance of Bioinformatics and will appreciate the use of the structural data in understanding the behaviour of biomolecules and how the information can be used to design a specific drug, to predict the structure of a molecule. The student will have learnt various

Unit-1 Introduction		6 hrs
	Introduction to Bioinformatics, History , Current Status of Bioinformatics, tasks of Bioinformatics, Problems and Scope of Bioinformatics	

tools and programmes used in Bioinformatics.

Unit 2	Biological Database, properties of Biological, Nature of biological Database- Diversity and variability, data source in life science, Data integration, Ontology, Bioinformatics Tools.	6hrs
Unit 3	Biological queries, searching and Mining, Browsing, the semantics of queries, Query processing, Biological resource, Query planning, Query optimization, Tools for a website, Data retrieval tool.	6hrs
Unit4	Proteomics and drug discovery	6hrs
4.1	Introduction to origin of proteomics, Types of proteomics, Applications and future perspectives of proteomics.	
4.2	Introduction to Drug Discovery and Drug designing. Importance parameters in drug discovery, Areas influencing drug discovery, Drug design Approaches.	
Unit5	Structure Predictions and data banks	6hrs
	DNA and RNA structure prediction, Limitations of prediction, DNA and cDNA sequencing, Genbank DNA sequencing entry, EMBL, SWISSPROT,FASTA, Sequence alignment and significance of sequence alignment	

RECOMMENDED BOOKS

- 1 Bioinformatics Sequence and Genome Analysis –David .W.Mount.
- 2 Complete practical Guide to bioinformatics for life science
- 3 Bioinformatics computing –Bryan Bergeron
- 4 Bioinformatics –Zeonacroix
- 5 Bioinformatics methods and applications –S.C.Rastogi, Mendiratta, P. Rastogi
- 6 A new handbook of bioinformatics –Punithmehrotra, Kumudserin, Swapna .K.Srivatsava

BIOCHEMISTRY DISCIPLINE SPECIFIC CORE

Blue Print of Question Paper I Semester

Time: 3 Hours		Max Marks: 60
PART-A		
Answer the following:		5x2=10
	1	
	2	
	3	
	4	
	5	
PART-B		
Answer any SIX questions:		6x5= 30
	6	

	7	
	8	
	9	
	10	
	11	
	12	
	13	
PART-C		
Answer any TWO questions:		2x5=10
	14	
	15	
	16	
	17	
PART-D		
Answer any TWO questions:		2x5=10
	18	
	19	
	20	
	21	

BIOCHEMISTRY
DISCIPLINE SPECIFIC CORE
Blue Print of Question Papers II & III Semester

St. Philomena's College (Autonomous), Mysore		
Time: 3 Hours		
Max Marks: 60		
PART-A		
Answer the following:		5x2=10
	1	
	2	
	3	
	4	
	5	

Answer any FIVE questions:			5x5=25
	6		
	7		
	8		
	9		
	10		
	11		
	12		
Answer any FIVE questions:			5x5=25
	13		
	14		
	15		
	16		
	17		
	18		
	19		

BIOCHEMISTRY
DISCIPLINE SPECIFIC CORE
Blue Print of Question Paper IV Semester

St. Philomena's College (Autonomous), Mysore			
Time: 3 Hours			Max Marks: 60
PART-A			
Answer the following:			5x2=10
	1		
	2		

	3	
	4	
	5	
Answer any FOUR questions:		4x5=20
	6	
	7	
	8	
	9	
	10	
	11	
Answer any SIX questions:		6x5=30
	12	
	13	
	14	
	15	
	16	
	17	
	18	
	19	

BIOCHEMISTRY

Blue Print of Question Papers V & VI Semesters

(Equal weightage to be given as per allotted hours for PART- A & B of the syllabus)

St. Philomena's College (Autonomous), Mysore		
Time: 3 Hours		Max Marks: 70
PART-A		
Answer the following:		10x1=10
	1	
	2	
	3	
	4	
	5	
	6	
	7	

	8	
	9	
	10	
PART-B		
Answer any SIX questions:		6x5= 30
	11	
	12	
	13	
	14	
	15	
	16	
	17	
	18	
PART-C		
Answer any SIX questions:		6x5=30
	19	
	20	
	21	
	22	
	23	
	24	
	25	
	26	

BIOCHEMISTRY
Blue Print of Question of DSE Papers

St. Philomena's College (Autonomous), Mysore		
Time: 03 Hours		Max Marks: 30
PART-A		
Answer any five of the following:		5x2=10
	1	
	2	
	3	
	4	
	5	
	6	

	7	
PART-B		
Answer any FOUR questions:		4 x5=20
8		
9		
10		
11		
12		
13		
