MANGLORE UNIVERSITY

SEMESTER SCHEME SYLLABUS FOR B.Sc.

SUBJECT: BIOCHEMISTRY

Scheme of Instruction and Examination

First Semester

Paper Code	Title of Paper	Instruction/week Hrs.	Duration of Examination	Marks	Credits
BCI01	Bioinorganic & Biophysical Chemistry	4	3	80+20=100	2
BC102	Biochemistry practicals-I	3	3	40+10=50	1
Total				**150**	

Second Semester

BCI51	BC151. Bioorganic Chemistry- 1	4	3	80+20=100	2
BC152	Biochemistry practicals-II	3	3	40+10=50	1
Total				**150**	

Third Semester

BC201	. Bioorganic Chemistry- 2	2	3	80+20=100	2
BC202	Biochemistry practicals-III	3	3	40+10=50	1
Total				**150**	

Fourth Semester

BC251	Biomolecules & Biochemical Techniques	4	3	80+20=100	2
BC252	Biochemistry practicals-IV	3	3	40+10=50	1
Total				**150**	

Fifth Semester

BC301	Enzymology & Metabolism	4	3	80+20=100	2
BC302	Molecular Biology & Genetic Engineering	4	3	80+20=100	2

BC303	Biochemistry practicals-V	4	3	80+20=100	2
Total				**300**	

Sixth Semester

BC351	Human Physiology & Clinical Biochemisry	4	3	80+20=100	2
BC352	Nutrition, Microbiology & Immunology	4	3	80+20=100	2
BC353	Biochemistry practicals-VI	4	3	80+20=100	2
Total				300	
Total				**1200**	**24**

BASIS FOR INTERNAL ASSESSMENT, PATTERN OF THEORY QUESTION PAPERS AND PRACTICAL EXAMINATION IN SCIENCE SUBJECTS

1. Basis of internal Assessment in Theory and Practical's

The internal assessment marks in theory papers shall be based on two tests. The tests shall be of at least 1 hour duration each and to be conducted after 6 and 12 weeks after the start of a semester. The average of the two tests shall be taken as the internal assessment marks in theory papers.

The practical internal assessment marks shall be based on one test and continuous evaluation during the practicals. The practical test shall be conducted after 10 weeks after the start of a semester. The average of the test and continuous evaluation shall be taken as the internal assessment marks in practicals.

2. Theory Question Papers Pattern:

Theory Question Papers in Bio- Chemistry shall carry 80 marks. The syllabus of each paper is grouped into four (4) units of 12 teaching hours. The Question Paper shall consist of Parts A and B, as detailed below:

Part A: Part A shall contain 12 objective type questions/divisions (Q. No. 1) drawn from all the 4 units of the syllabus (3 divisions per unit) carrying 2 marks each (a, b, c, d, e, f, g, h, i, j, k& l.). 10 divisions are to be answered. 10x2=20 marks

Part B: Part B shall contain eight (8) brief and long answer questions (Q. Nos. 2 to 9) carrying 15 marks each drawn from all the four units of the syllabus (2 questions per units). There shall be three divisions per question. The students are required to answer 4 full questions, choosing one full question from each unit. **4x15=60 marks**

	Unit I		**Unit II**		**Unit III**		**Unit IV**	
Q. Nos. (Max. Marks 15)	2	3	4	5	6	7	8	9
Marks Splitting	4+4+7 (4+3)	3+5+7 (3+4)	4+4+7 (4+3)	3+5+7 (3+4)	4+4+7 (4+3)	3+5+7 (3+4)	4+4+7 (4+3)	3+5+7 (3+4)

BIOCHEMISTRY- SEMESTER SYLLABUS

I SEMESTER

BC-101: BIO-INORGANIC AND BIO-PHYSICAL CHEMISTRY

Unit-I

1. Acids, bases and buffers: 5Hrs

Lewis concept of acids and bases. Ionic product of water. pH scale, buffers. Deri vation of Henderson-Hesselbach equation, buffer capacity. Preparation of acidic and basic buffer solutions. Buffer of blood plasma, RBC, and tissue fluids. Theory of acid-base indicators. pH titration curve and isoelectric pH of aminoacids.

2. Electrochemistry: 6Hrs

Specific, equivalent and molar conductance. Reference Electrodes- Hydrogen electrode, Calomel electrode, Quinhydrone electrode, Glass Electrode. Determination of Equivalent conductabce of a strong electrolyte. Conductance titration (strong acid against strong base, weak acid against NaOH), Determination of pKa values of weak acid by potentiometric titration. Determination of pH of a buffer by potentiometric method using quinhydrone electrode.

3. Viscosity: 1Hrs

Definition, Determination of viscosity of liquids and solutions by Ostwald's viscometer.

Unit-II

1. Photochemistry: 5Hrs

Laws of photochemistry, quantum efficiency, Light absorption, Luminescence- Fluorescence, Phosphorescence, Bioluminescence, Chemiluminescence. Beer-Lambert's law, Spectrophotometer, Colorimeter.

2. Metal ions In Biological System: 5Hrs

Examples of some naturally occurring complex compounds in living systems. Role of iron in Haemoglobin, myoglobin and cytochromes. Copper in Haemocyanin, magnesium in Chlorophyll, cobalt in Vitamin $B_{12,}$ and molybdenum in Nitrogenase. Metaloenzymes.

3. Stoichiometry: 2Hrs

Mole concept, equivalent weights of elements, acids, bases, oxidizing agents, reducing agents. Volumetric Analysis- Normality, Molarity, Molality.

Unit-III

1. Air Pollution: 5Hrs

Air pollution types and sources of air pollutants-(inorganic gases, oxides of carbon, nitrogen and sulphur, organic gases and particulate matter- lead fibrous silicate),their sources, effects and control. Determination of carbon monoxide and sulphur dioxide in air. Bhopal Gas Tragedy.

2. Water Pollution: 5Hrs

Types of water pollutants, sources of water pollution, domestic, industrial and agricultural soil. Biodegradation dissolved oxygen level of water, biochemical oxygen demand of water, chemical oxygen demand, industrial effluents and their effects. Treatment of polluted water and sewage treatment. Purification of water for drinking purpose. Acid rain. Taj Mahal incidence.

3. Biochemical Toxicology: 2Hrs

Toxicity of Lead, Mercury, Cadmium and Arsenic

Unit-IV

1. Radioactivity: 6Hrs

Natural and artificial radioactivity. Characteristics of radioactive elements, units of radioactivity, disintegration constant, Half-life period, α- and β- radiation. Detection of radioactivity by GM counter. Application of radioisotopes- ^{3}H,^{14}C,^{131}I, ^{60}Co and ^{32}P. Biological effects of radiations. Free radicals: generation, detection, scavenging and affects. Radioactive decay- uranium to lead.

2. Radiation safety aspects: 6Hrs

Sources of pollutants, effects on vegetation and health. Detection and monitoring of radioactive pollutants. Methods of safe disposal of radioactive wastes. Nuclear disaster. Safety measurements in handling radioisotopes. Dosimetry. Units- Rad, ram, film badge. Safety limits of exposure to radiation. Detection of radiation. Scintillation-solid and liquid.

I SEMESTER

BC-102: BIOCHEMISTRY PRACTICALS-I

1. Use of analytical balance and calibration of pipette.
2. Preparation of standard sodium carbonate solution, standardization of HCl and estimation of NaOH in the given solution.
3. Preparation of standard oxalic acid solution, standardization of NaOH and estimation of $H_2 SO_4$ in the given solution.

4. Preparation of standard potassium bipthlate solution, standardization of NaOH and estimation of HCl in the given solution.
5. Titration curve for aminoacids and determination of p^{Ka} value using p^{H} meter.
6. Verification of Beer-Lambert's law for copper-ammonia complex.
7. BOD
8. COD
9. Conductometric titration of strong acids against strong base.
10. Preparation of acidic and basic buffers and determination of p^{H} using p^{H} meter.

References:

1. Principles of physical chemistry- Puri ,Sharma
2. Text book of inorganic chemistry- P.L Sony(2000) Sulthan Chand & Sons
3. Biophysical chemistry, principles and techniques- Upadhyaya, Upadyaya and Nath(2005) Himalya publishing house.
4. Biophysics- G.R.Chatwal(2003) Himalya publishing house

II SEMESTER

BC-151: BIO-ORGANIC CHEMISTRY-1

Unit-I

1. **Introduction to Organic Chemistry: 2Hrs**

Classification of organic compounds, unique charecteristics.IUPAC nomenclature of organic compounds

2. Bonding: 2Hrs

Covalent bond, non-covalent bonds, ester bond, phosphodiester bond, N-C bond. Bonding in water. Significance of water in biological system.

3. Stereochemistry of organic compounds: 8Hrs.

Optical isomerism, elements of symmetry, molecular chirality, enantiomers stereogenic center,optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic center- example-lactic acid and tartaric acid, diastereomers, threo and erythro diastereomers, meso compounds, resolution of enantiomers. Inversion and racemisation, relative and absolute configuration sequences. D an L, R and S systems of nomenclature.

Geometrical isomerism, determination of configuration of geometric isomers, E and Z system of nomenclature, geometric isomerism in oximes and alicyclic compounds.

Unit-II

1. Aliphatic Hydrocarbons: 6Hrs

Diens: Types with examples. 1,3-butadiene- preparation from n-butane and 1,4-dihaloalkanes. Mechanism of addition of HBr. Diels-Alder reaction. Mechanism of Markownikoff's rule-addition of HBr to propene.Mechanism of Antimarkownikoff's addition of HBr to propene . Conformational analysis of ethane and butane.

2. Arenes: 6Hrs

Structure of benzene- Resonance and molecular orbital theories. Aromaticity. Electronic interpretation of the orienting influence of substituents in the electrophilic substitution of toluene, chlorobenzene, nitrobenzene and phenol.

Polynuclear hydrocarbons: Naphthalene and Anthracene, Reactions- oxidation, nitration, sulphonation of naphthalene and oxidation of Anthracene.

Unit-III

1. Reaction Mechanisms: 8Hrs

Concept of inductive effect ,hyper conjugation and resonance. Classification of organic reactions with one example each. Concepts of the following- carbanions, carbocations, free radicals and nitrenes–their formation and stability. Nucleophiles and electophiles.Mechanism of substitution reaction- S_N1 and S_N2 reactions.Mechanism of elimination reactions -E1 and E2

2. Polymers: 4Hrs.

Classification, polymerization process, number average and weight average molecular weights. Manufacture and applications of polythene, PVC, Nylon and terylene.Biomedical polymers and polymer drugs

Unit-IV

1. Hydroxy Acids: 3Hrs

Structure , preparation and properties of lactic, tartaric and citric acids. Biological importance of hydroxyl acids.

2. Dicarboxylic acids: 4Hrs

Structure preparation and properties of Succinic , maleic and fumaric acids. Ketoacids-preparation and properties of pyruvic acid

3. Pharmaceutical chemistry: 5Hrs

Analgesic, antipyretic, antibiotics, antiseptics, disinfectants, antivirals, antifungals, tranquilizers,antimalerialswithexample.Preparation of aspirin,paracetomol,chloroxyleneol ,chloremphenicol ,sulphanilide and barbituric acid. Structure, chemistry and uses of aspirin, paracetamol, penicillin, chloroxylenol, barbituric acid and chloroquin.

II SEMESTER

BC152: BIOCHEMISTRY PRACTICALS-II

Qualitative analysis of following organic compounds:

Urea, Benzamide, Benzaldehyde, Aniline, Acetophenone, O-Cresol, Nitrobenzene, Chlorobenzene, Bromobenzene, Toluidine, Benzoic acid, Resorcinol, Oxalic acid

References:

1. Advances in organic chemistry- Arun Bhal and B.SBhal.(2000), Sulthan Chand & Sons.
2. Organic chemistry- P.Y.Bruice(2002) Pearson Publishers.
3. Text book of organic chemistry- P.L Sony(2000) Sulthan Chand & Sons.
4. Chemistry of Natural products- O.P.Agarwal(1998) Goel Publishing House

SEMESTER-III

BC-201: BIO-ORGANIC CHEMISTRY-2

Unit-I

1. Amines: 4Hrs

Classification, Basicity of amines. Effect of substituents on basicity of amines,Reaction of amines- Alkylation ,Acylation, reaction with HNO_2 and Schiff base formation.Diazotisation and aromatic substitution,Separation of primary,secondary and tertiary amines from a mixture, Distinguishing reactions of primary, secondary and tertiary amines.

2. Water soluble vitamins: 8Hrs

Structural formula, co-enzyme forms,dietary sources, deficiency symptoms and biological role of B1,B2,B6,Niacin,Folic acid, biotin, pantothenic acid and vitaminB_{12}. Synthesis ,sources,deficiency symptons and biological role of Vitamin C .Vitamin C as redox reagent.

Unit-II

1. Heterocyclic compounds: 6Hrs

Biological occurrence, structural formula and importance of Furan, Pyrrole, Thiopene, Pyridine, Pyran, Thiazole, Pyrimidine, Purine, Indole, Imidozole, Quinoline and Isoquinoline.

2. Fat soluble vitamins: 6Hrs

A,D,E and K- structural formula, dietary sources, requirements, deficiency symptoms and biological role.synthesis of vitamin-A

Unit-III

1. Steroids: 4Hrs

Basic ring system in steroids, structure,occurrence,properties and physiological activity of of Cholesterol,structure and biological importance of Ergosterol, Bileacids and Ecdysone.

2. Terpenoids: 4Hrs

Isoprene rule, Classification, structure, occurrence and importance of Monoterpene- limonene, menthol and camphor and α-pinene. Sesquiterpenes- Santonin, Juvenile hormone-I and Abscisin-II. Diterpenes- Phytol. Triterpenes- Lanosterol. Tetraterpenes- Lycopine,β-carotene. Polyprenols-Dolichols.

3. Natural Pigments: 4Hrs

Structure, occurrence,functions and applications of Heme, Chlorophyll, flavones and anthocyanin.

Unit-IV

4. Alkaloids: 6Hrs

Definition, occurrence, general properties,Classification with examples, structure and physiological action of LSD, Morphine, Aristolochic acid, Nicotine Atropine,cocaine and quinine.

5. Spectroscopy: 6Hrs

Electromagnetic radiation, Principle of spectroscopy, IR spectroscopy, UV spectroscopy, NMR spectroscopy, Mass spectroscopy-Principle, instrumentation and applications in the elucidation of structure of organic molecules.

III SEMESTER PRACTICALS

BC 202: BIOCHEMISTRY PRACTICALS- III

1. Organic Preparations:

Preparation of a) Benzoic acid from Benzaldehyde or Toluene

b) Acetanilide from aniline

c) Aspirin from salicylic acid

d) p-bromo acetanilide from acetanilide.

2. Quantitative analysis of Biomolecules:

i) Estimation of Vitamin C from lemon and gooseberries.

ii) Estimation of keto acid by DNPH method.

3. Extraction of Biomolecules:

a) Caffeine from tea leaves.

b) Starch from potato.

c) Casein from milk.

d) Oil from oil seeds.

References:

1. Advances in organic chemistry- Arun Bhal and B.SBhal.(2000), Sulthan Chand & Sons.
2. Organic chemistry- P.Y.Bruice(2002) Pearson Publishers.
3. Text book of organic chemistry- P.L Sony(2000) Sulthan Chand & Sons.
4. Chemistry of Natural products- O.P.Agarwal(1998) Goel Publishing House

SEMESTER-IV

BC-251: BIOMOLECULES AND BIOCHEMICAL TECHNIQUES

Unit-I

6. Carbohydrates: 12Hrs

Classification, Biological importance. Monosaccharides: Configuration relationship of D-aldoses, D-ketoses. General properties of aldoses and ketoses- oxidation, reduction, reducing property, formation of glycosides, acylation, methylation, condensation-phenyl hydrazine, addition- HCN. Interconversion of aldoses and ketoses by chemical method. Ascending and descending series by chemical methods. Stereochemistry of monosaccharides(+) and (-), D and L, Epimers, anomers and diastereomers.

Glucose: Elucidation of open chain structure and ring structure of glucose. Conformation of glucose(only structures), mutaration. Structure of galactose, mannose, ribose and fructose. Structure and biological importance of amino sugars, deoxy sugars, sugar acids, neuraminic and muramic acids.

Disaccharides: sucrose, maltose and lactose.,

Polysaccharides: Partial structure, occurrence and importance of starch, Seliwanoff's and osazone test.

Unit-II

Lipids and Biomembranes: 12Hrs

Classification and biological role. Fatty acids: Nomenclature of saturated and unsaturated fatty acids. Physical properties and chemical reactions- esterification, rancidity. Essential fatty acids.

Acyglycerols:, saponification, saponification value, Iodine value, Acid value and significance.

Phoshoglycerides: Structure of lecithin, Cephalins, Phosphotidyl inositol, Plasmalogens and Cardiolipin. Biological role of phosophogllycerides. Sphingolipids: Structure and importance of Sphingomyelin. Glycerosphingo lipids: Structure and importance of Gangliosides an Cerebrosides.

Prostaglandins: Structure of PGE2 and PGF2. Biological role of Thromboxane, leudotrienes and Prostaglandins.

Plasma lipoproteins: Types and functions.

Biological Membrane: Composition of membrane. Fluid Mosaic Model, functions of plasma membrane- endocytosis, phagocytosis. Membrane receptors and their functions.

Unit-III

7. Aminoacids and peptides: 5Hrs

Structure and classification of aminoacids based on polarity, structure. Reactions of the amino group with HNO_2 , Ninhydrin, phenyl isothiocyanate , dansyl chloride, Fluoro dinitrobenzene. Zwitter ionic properties, pKa value. Reaction of carboxyl group- hydrazine. Any method for chemical synthesis of aminoacids- Gabrielsynthesis and Strecker synthesis. D and L notations. R and S notations.

Peptide bond, structure and biological importance of Glutathione, Valinomycin, Leu-enkaphalin. Syntetic peptides- poluglutamate, polylysine. Chemical synthesis of dipeptides.

8. Proteins: 7Hrs

Isolation, methods of purification- dialysis, salting out, pH precipitation and solvent precipitation. Classification of proteins based on solubility, structure and functions with examples. Primary structure of proteins, methods of determining N- and C- terminal aminoacids, aminoacid composition, sequencing by Edman's method. Colour reactions of proteins- Biuret, Millons, Xanthoproteic tests. Secondary structure- α-helix, β-pleated sheet, β-bend. Tertiary and quaternary structure. 3D structure of haemoglobin. Denaturation and renaturation of proteins. Anfinsen's experiment.

Unit-IV

9. Nucleic Acids: 5Hrs

Isolation and purification of DNA and RNA. Composition of DNA. Nucleotides and Nucleosides. Chargoff's rule. Watson and Crick model of DNA. Melting of DNA.RNA- Composition, types(mRNA, tRNA and rRNA), Secondary structures of tRNA- Clover-leaf model. Chemical reactions of RNA and DNA with acid and alkali. Colour reactions of DNA and RNA. Circular and linear chromosomes. Structure of eukaryotic chromosome and nucleosome.

10. Chromatographic Techniques: 4Hrs

General principles of chromatography- Adsorption and Partition techniques, Paper chromatography- ascending, descending and circular, 1D, 2D-chromatography.Rf values. TLC, GC, IEC, Affinity chromatography and their applications.

11. Electrophoresis : 1Hrs

Principle of electrophoresis, paper and gel electrophoresis.

12. Centrifugation: 2Hrs

Types of centrifuges, Principal of differential centrifugation. Ultra centrifugation-construction and application

IV SEMESTER PRACTICALS

BC- 252: BIOCHEMISTRY PRACTICALS- IV

1. Qualitative analysis of Biomolecules
   i) Carbohydrates: Glucose, Fructose, Lactose, Maltose and sucrose.
   ii) Proteins- Albumin, Casein.
2. Biochemical T echniques:
   a) Identification of aminoacids and carbohydrates by
   i) Circular paper chromatography
   ii) Ascending paper chromatography
   iii) Descending paper chromatography
   b) Separation of aminoacids by TLC
   c) Separation of plant pigments by column chromatography using silica gel G.

References:

1. Fundamentals of Biochemistry-JL Jain, S. Jain and N.Jain (2000), S. Chand.
2. Lenhingers biochemistry- Nelson and Cox(2005) CBS Publishers.
3. Biochemisry- U.Sathyanrayana and U.Chakrapani(2006) .
4. Biophysical chemistry, principles and techniques- Upadhyaya, Upadyaya and Nath(2005) Himalya publishing house.

V Semester

BC- 301: ENZYMOLOGY AND METABOLISM

Unit-I

13. Enzymes: **4Hrs**

Introductory aspects, General characteristics, co-factors, coenzyme and metal ions. Classification of enzymes based on IUB with examples. Unit of enzymes, activity- specific activity. Enzyme specificity. Concept of active site. Theories of enzyme catalysis- Lock and key model, Koshland's induced fit theory. Regulation of enzymes.

14. Enzyme Kinetics: 4Hrs

Factors affecting rate of enzyme catalyzed reaction. Effect of substrate, enzyme, product concentration, pH, temperature. Michalies-Menton equation (Derivation not required). Lineweaver-Burk plot. Determination of Vmax and Km from L-B plot and its significance.

3. Enzyme Inhibition: 2Hrs

Competitive, noncompetitive and uncompetitive inhibition. Graphical representation by L-B plot. Application of competitive inhibition in chemotherapy.

4.Allosteric enzymes: 2Hrs

Definition, ATCase as an allosteric enzyme. Isoenzymes- LDH, Multienzyme complex- pyruvate dehydrogenase complex. Ribozyme. Clinical and Biotechnological application of enzymes.

Unit-II

15. Metabilsm: 1Hr

Anabolism and catabolism- stages involved in it. Compartmentalization of metabolic pathway.

16. Metabolism of Carbohydrates: 7Hrs

Glycolysis- aerobic and anaerobic and energitics of Glycolysis, regulation of glycolysis. Entry of other carbohydrates into glycolytic pathway. Fate of pyruvate. Amphibolic integrating roles of TCA cycle. Anapleorosis. Gluconeogenesis and its importance. Outlines of HMP shunt pathway and its significance. Importance of Cori's cycle and 2,3- BPG. Glycogen metabolismglycogenolysis and glycogen synthesis.

17. Metabolism of Lipids: 4Hrs

Oxidation of fatty acids- alpha, beta and omega types. Beta- oxidation of even number saturated fatty acids. Energetics of beta oxidation. Biosynthesis of even number saturated fatty acids. Ketone bodies formation and ketosis. Outline of Cholesterol synthesis.

Unit-III

18. Metabolism of Aminoacids: 5Hrs

General reaction of aminoacid degradation- transamination and its mechanism of action. Deamination and decarboxylation. Ketogenic and Glucogenic aminoacids. Urea cycle and its

significance. Biosynthesis of biologically important amines –epinephrine, nor epinephrine , Histamine and ploy amines. Disorders of amino acid metabolism PKU and AKU.

2. Metabolism of Nucleic acids: 3Hrs

Schematic pathway of synthesis and degradation of purines and pyrimidines.

3.Photosynthesis : 4Hrs

The photosynthesis apparatus and pigments. light harvesting antennae complex, Chemistry and structural components of photo systems I and II. Outlines of light dependant reactions . outlines of C_3 (Calvin cycle) and C_4 cycle in plants.

Unit-IV

19. Biological oxidation: 6Hrs

Ultrastructure of mitochondria, ETC and its complexes-I,II,III,IV. Uncouplers and inhibitors of respiration(Rotenone, Actinomycin D, Cyanide and 2,4-DNP). Oxidative phosphorylation, P/O ratio. Formation of ATP-Outline of Mitchell's hypothesis. Substrate level phosphorylation with examples. Biological importance of ETC.

20. Bioenergitics: 6Hrs

Laws of thermodynamics- First and second law.Concept of enthalpy, entropy, free energy. Endergonic and exergonic reactions. Coupled reactions. High energy compounds- structure of ATP and its free energy change during hydrolysis, other high energy compounds.

References:

1. Fundamentals of Biochemistry-JL Jain, S. Jain and N.Jain (2000), S. Chand.
2. Lenhingers biochemistry- Nelson and Cox(2005) CBS Publishers.
3. Biochemisry- U.Sathyanrayana and U.Chakrapani(2006) .
4. Enzymes:Biotechnology, Biochemistry and Clinical Chemistry- Trevor Palmer(2006).

V SEMESTER

BC302: Molecular Biology and Genetic Engineering.

Unit-I

1. Central dogma of molecular biology:
2Hrs

Historical perspective. Central dogma of molecular biology and its modification. DNA as genetic material- Griffith and Hershey Chase experiment.

2. Replication of DNA: **5Hrs**

Semiconservative mechanism, Messelson and Stahl experiment. Enzymes and regulatory proteins involved in replication, Mechansim of replication in prokaryotes. Fidelity of replication.

3.Transcription: **5Hrs**

Prokaryotic RNA synthesis, Role of RNA polymerase. Initiation, elongation and termination. Reverse transcription. Outlines of eukaryotic transcription, Post-transcriptional process- mRNA splicing,cap addition and poly A tail addition.RNA dependant RNA synthesis.

Unit-II

1.Genetic Code: **4Hrs**

Triplet codon ,universal features of genetic code, Wobble hypothesis. Variation in the codon usage

2.Protein biosynthesis: **8Hrs**

Activation of aminoacids, aminoacyl tRNA synthesis, Initiation, elongation and termination of protein synthesis in prokaryotes and Eukaryotes. Protein translation inhibitors (any three examples) Post translational modifications, Protein sorting and targeting.

Unit-III

21. Concept of gene: **6Hrs**

Functional units in prokaryotic and eukaryotic gene- promoter, introns and exons. Gene expression in prokaryotes, concept of operon, Lac-Operon, Tryptophan Operon, Galactose operon.

22. Mutation and DNA repair: **6Hrs**

Concept of mutation and mutagens- effect of HNO_2,Alkylating agents, Interchelating agents and UV- radiation. Concept of Point mutation and frameshift mutation. DNA repair.

Unit IV

23. Genetic Engineering: 12Hrs

Basic principles of recombinant DNA technolgy. Isolation of DNA, Cutting of DNA by restriction endonucleases- staggered cut and blunt cut. Separation of DNA fragments by agarose gel electrophoresis. Vectors, Plasmids- PBR322. Insertion of foreign DNA into vectors. Transfection of vectors into host cell. cDNA, cDNA library.Principle of polymerase chain reaction and its application. Blotting techniques- Principle of Southern, Western and Northern blotting. DNA fingerprinting. RFLPs. Transgenic plants, Transgenic animals. Gene Therapy, Human genome project. Application of Genetic Engineering.

BC-303: BIOCHEMISTRY PRACTICALS-V

Enzyme Assays (3Hrs per week)

1. Salivary Amylase
   a) Determination of activity of salivary amylase by DNS.
   b) Determination of specific activity of salivary amylase by DNS method.
   c) Determination of optimum pH for salivary amylase.
   d) Determination of Km and Vmax of salivary amylase
2. Acid Phosphatase
   a) Determination of specific activity of aid phosphatase by PNPP.
   b) Determination of optimum pH of acid phosphatase.
   c) Determination of Km and Vmax of acid phosphatase.

3. Colorimetric estimation

a) Glucose by DNS method.
b) Protein by Biuret method
c) Protein by Lowry's method
d) Extraction and estimation of DNA from coconut endosperm
e) Extraction and estimation of RNA from spinach leaves.
f) Agarose gel electrophoresis.

g) Demonstration of PAGE of protein.

References:

1. Fundamentals of Biochemistry-JL Jain, S. Jain and N.Jain (2000), S. Chand.
2. Lenhingers biochemistry- Nelson and Cox(2005) CBS Publishers.
3. Biochemisry- U.Sathyanrayana and U.Chakrapani(2006) .
4. Molecular Biology- David Freifilder(2000) ACS Publications

VI SEMESTER

BC-351: HUMAN PHYSIOLOGY AND CLINICAL BIOCHEMISTRY

24. Nervous System: **4Hrs**

Types of neurons, Generalized structure of multipolar neuron. Resting membrane potential, Action potential. Transmission of nerve impulse along an axon and across synapse. Neurotransmitters.

25. Muscle: **4Hrs**

Types of muscles and their structure. Ultrastructure of skeletal muscle. Contractile and regulatory proteins of skeletal muscle. Sliding filament model of skeletal muscle contraction.

26. Bone: **2Hrs**

Composition and structure of long bone. Growth and remodeling of long bone. Factors affecting its growth.

27. Excretory System: **2Hrs**

Structure of nephron. Formation of urine- Glomerular filteration, tubular reabsorption and tubular secretions.

Unit-II

28. Body Fluids: **6Hr**

Blood- Blood volume, composition and functions. RBC, WBC and platelets- structure and functions. Mechanism of blood coagulation. Biochemical events in transport of CO_2 and O_2 in blood. Blood brain barrier.Cerebrospinal fluid- composition and functions Lymph- composition and functions

29. Acid-Base balance: **3Hrs**

Blood buffers- Bicarbonate, phosphate and protein buffer system. Role of lungs and kidney in acid-base balance.

30. Liver: **3Hrs**

Structure of lobule. Functions- metabolic, storage and detoxification.

Unit-III

31. Endocrine System: **12Hrs**

Endocrine organs. Classification of hormones. Functions of the hormones of Hypothalamus, Pituitary, Adrenal, Thyroid, Pancreas and Gonads. General mechanism of hormone action. Mechanism of action of steroid hormones. Concept of second messengers- cAMP, DAG, IP3, G-protein.

Unit-IV

32. Urine: **3Hrs**

Normal composition of urine- volume, specific gravity. Constituents- urea, uric ,acid, creatinine, pigments and their clinical significance in brief. Kidney disorder.

33. Blood: **4Hrs**

Normal constituents of blood. Urea, Uric acid, Creatinine, Glucose, Bilirubin, Total protein, Albumin/ globulin ratio- Variation in pathological conditions. Lipid Profile- Cholesterol, Triglycerides, lipoproteins, HDL and LDL.

34. Diognostic enzymes: **3Hrs**

SGOT, SGPT, Alkaline Phosphatase. Cardiac injury profile- CPK and LDH.

35. Inborn errors of metabolism: **2Hr**

Sickle cell anaemia, Gylcogen storage disease, Neimann-pick disease, Lesch Nyhan syndrome

References:

1. Fundamentals of Biochemistry-JL Jain, S. Jain and N.Jain (2000), S. Chand.
2. Lenhingers biochemistry- Nelson and Cox(2005) CBS Publishers.
3. Biochemisry- U.Sathyanrayana and U.Chakrapani(2006) .

4. Textbook of Physiology- A.K.Jain(2005).APC.

VI SEMESTER

BC-353: NUTRITION,MICROBIOLOGY AND IMMUNOLOGY

Unit-I

36. Introduction: 4Hrs

Concept of nutrition. Calorific value of foods and its determination (bomb calorimeter). Different components of energy expenditure, respiratory quotient, basal metabolic rate, determination of BMR, factors affecting BMR, specific dynamic action of foods. Energy expenditure at rest and work.

37. Carbohydrates: 1Hr

Dietary sources, dietary fibres and protein sparing action.

38. Proteins: 3Hrs

Dietary sources, nutritional classification, nutritional value of protein- PER, NPU and biological value of proteins. Essential amino acids. Nitrogen balance. Mutual supplementation of proteins.

39. Fat: 1Hr

Dietary sources of fats, invisible fats, essential fattyacids and their biological importance.

40. Minerals: 3Hrs

Macronutrients- Ca, P, Na, K, Cl and Mg. Micronutrients- Fe, Zn, Cu, I_2. Dietary sources, physiological functions, deficiency disorders, absorption and excretion.

Unit-II

41. Water metabolism: 2Hrs

Distribution of water in body fluids. Factors influencing water metabolism.

42. Antinutritional factors: 2Hrs

Sources and harmful effects of antivitamins(eg: Avidin and dicoumarol), Natural toxicants(lathyrus sativa), and adulterants(eg: Butter yallow, Lead chromate, Malachite green).

43. Abnormal nutritional States: 2hrs

Malnutrition- Kwashiorkar and Marasmas. Obesity. Prescription of diet, Glycemic index of common food items.

44. Digestion: 4Hrs

Absorption and transport of carbohydrates, proteins and fats. GI tract, secretion, composition, and function of saliva, gastric juice, bile, pancreatic and intestinal juices. Appetite, Gastrointestinal hormones.

Unit-III

45. Study of microorganisms: 1Hr

Staining microorganism- principle and procedure of gram stain and acid fast stain

46. Microbial nutrition: 3Hrs

Growth of microorganisms, measurement of growth. Factors influencing growth- nutrition, carbon source, nitrogen source, temperature, pH, oxygen. Growth curve.

47. Industrial microbiology: 2Hrs

Production and importance of alcoholic beverages- beer and wine. Fermented products of milk- cheese, Antibiotic production- penicillin. Single cell protein- spirulina.

48. Antibiotics: 2Hr

Definition, mechanism of action of penicillin, streptomycin and chloramphenicol.

49. Viruses: 2Hrs

Classification. Plant viruses- TMV- morphology, general characteristics and its replication.

50. Bacteriophages: 2Hrs

Morphology, general characteristics, life cycle(lytic and lysogeny cycle) of T-even bacteriophage

Unit-IV

Immunology

51. Introdutction: 2Hr

Definition, Haptenes, Epitopes, General features. Antigenicity.primary lymphoid organs.

1. Antibodies: 2Hrs

Definition, types and structure of a typical immunoglobulin(IgG)

52. Antigen-antibody reaction in vitro:

3Hrs

Formation of antigen-antibody complex. Precipitation reactions- Immunodiffusion- single, double diffusion, immunoelectophoresis. ELISA, RIA.

53. Immunity: **5Hrs**

Cellular and humoral immunity. Role of immunologically important organs and cells- bone marrow, thymus, spleen and lymphocytes. Formation and functions of T and B lymphocytes and macrophages. Helper T-cells and Killer T-cells. Allergy- definition, types. AIDS.

BC-353: Biochemistry Practicals-VII

Physiology and Clinical Biochemicstry Experiments(3Hrs per week)

1. Qualitative analysis of organic and inorganic constituents of urine.
2. Qualitative analysis of abnormal constituents of urine.
3. Determination of titrable acidity of urine.
4. Estimation of reducing sugar by Nelson-Somogy's method.
5. Estimation of creatinine.
6. Urea by DAM method
7. Uric acid
8. Cholesterol by Zack's method
9. Determination of calcium in ragi.
10. Determination of iron in drumstick.
11. Gram Staining.
12. Growing microbes from soil and sewage water.
13. Estimation of inorganic phosphate by Fiske-Subbrao method.
14. Estimation of aminoacids by formal titration
15. Determination of saponification value of an oil or fat.

16. Determination of Iodine value of an oil or fat

17. Determination of acid value of an oil or fat.

Project report-10 Marks

Viva- 5Marks

References:

1. Fundamentals of Biochemistry-JL Jain, S. Jain and N.Jain (2000), S. Chand.
2. Text Book of Microbiology - R.Ananthanaryan and CKJ Pannikar (2005) CBS Publishers.
3. Immunology: Introductory text book- Nandini Shetty(2008) .New Age Publications
4. Textbook of Physiology- A.K.Jain(2005).APC.