JSS College for Women (Autonomous)

Saraswathipuram, Mysuru -09

Department of biochemistry

Revised NEP syllabus

2024-25

Syllabus Theory and Practical

B.Sc. Semester-I

Course code:DSC-1T: SEPBC-101
Course Title: BIO-ORGANIC, BIO-INORGANIC & BIO-PHYSICAL CHEMISTRY (Theory)

Course title	BIO-ORGANIC, BIO-INORGANIC & BIO-PHYSICAL CHEMISTRY
Couse code	DSC-1T: SEPBC-101
Course credits	03
Total contact hours	45
Duration of ESA (Hour)	03
Formative assessment marks	20
Summative assessment marks	80

Unit 1: Bioorganic Chemistry **15 HRS**

i. Concept of Biochemistry:
Definition and scope of biochemistry. Important discoveries in biochemistry.

ii. Hydroxy acids: Structure, properties & biological importance of Lactic acid (Action of heat, oxidation), tartaric acid (salt formation) and citric acid (Action of heat, salt formation).
Dicarboxylic acids and Ketoacids Structure & biological importance of Succinic acid , fumaric acid, Pyruvic acid, α - ketoglutaric acid and oxaloacetic acid.

iii. Heterocylics:
Occurrence, structural formula and biological importance of the following -Furan, pyrrole, thiophene, pyridine, pyran, thiazole, pyrimidine, purine, indole, imidazole.

iv. Steroids:
Basic ring system in steroids, structure & biological importance of cholesterol. Biological importance of ecdysone, ergosterol, estrediol

v. Terpenes:
Isoprene rule, classification. Occurrence and importance of: limonene, Juvenile hormone-I, phytol, lycopene.

vi. Flavanoids/ Phenolics:

v. Alkaloids:
Definition, classification based on their chemical composition with examples. physiological action of LSD and morphine. Biological importance of reserpine, piperine, cocaine, theobromine, caffeine, nicotine and atropine. .

Unit 2: Bioinorganic Chemistry 15 HRS

i. Co-ordination compounds:
Transition metals, Properties (Colour, Oxidation States, Magnetic Properties). Co-ordinate bond, double and complex salts – differences with examples. Co-ordination number.
Porphyrin nucleus and classification. Structure and the biological role of metal ions in important metalloporphyrins occurring in nature, (Hb, cytochrome, chlorophyll, Vit-B_{12}). Bile pigments: chemical nature.

ii. Radiochemistry:
Natural and artificial radioactivity, Characteristics of radioactive elements, units of radioactivity, disintegration constant, Half-life, α, β and γ radiation. Detection of radioactivity by GM counter, scintillation counter and its advantages. Applications of radioisotopes – ^{3}H, ^{14}C, ^{131}I, ^{60}CO and ^{32}P. Biological effects of radiations. Safety measures in handling radioisotopes

iii. Elements and its biological and environmental effects:
a) **Nitrogen**: Fixation of atmospheric nitrogen – symbiotic and non-symbiotic. Nitrogen cycle. Environmental pollution by nitrogen compounds
b) **Phosphorous**: Importance of phosphorus compounds in biological system, phosphorous cycle.
c) **Oxygen:** Formation of ozone in atmosphere. Role of ozone in maintenance of life on earth. Effects of environmental pollutants on ozone layer.
d) **Sulphur and selenium :** Importance of compounds of sulphur and selenium in biological system. Effect of sulphur compounds on environmental pollution.

Unit 3: Biophysical Chemistry 15 HRS

i. Concentration units:
Avagadro's number, molecular weight, mole, mole fraction, molarity, equivalent weight, normality, molality, percentage solutions. **(To become familiarize with Terminology, Students can be advised to perform basic calculations**)

ii. Properties of Water

Molecular structure of water, physical properties of water. Water as an universal solvent.

iii. Distribution law:
Distribution law, partition coefficient, application of distribution law.

iv. Acids, bases and buffers:
Lewis concept of acids and bases. Ionic product of water. pH scale, buffers, Henderson Hasselbalch equation, pKa values, buffer capacity, preparation of acidic and basic buffer solutions. Theory of acid-base indicators. Choice of indicators. pH titration curve and isoelectric pH of aminoacids.

v. Electrochemistry:
Specific, Equivalent and Molar conductance. Reference electrodes (Hydrogen Electrode and Calomel electrode), Quinhydrone electrode, Glass electrode. Conductometric titrations [Strong acid against strong base, weak acid (amino acid) against NaOH]. Determination of pKa value of amino acid by pH meter.

vi. Photochemistry:
Definition of photochemistry, Phosphorescence, fluorescence, chemiluminescence and bioluminescence. explanation with examples
Beer-Lambert's law.
Colorimeter and Spectrophotometer - construction, principle and applications.
Principles & applications of IR, fluorescence, NMR and CD spectra.

Course code: DSC-1P: SEPBC-102;

Course Title: Volumetric Analysis – Practicals-1

Course title	Volumetric analysis – practicals-1
Couse code	DSC-1P: SEPBC-102
Course credits	02
Total contact hours	45 (4 h/ week)
Duration of ESA (Hour)	3
Formative assessment marks	10
Summative assessment marks	40

Volumetric Analysis

1. Concept of molarity, molality and normality. Calculation and preparation of molar solutions. (Problems to be given in exams). Calculation and preparation of normal solutions and percent solutions and dilute solutions.
2. Calibration of volumetric glassware (Burette and Pipette).
3. Preparation of standard Oxalic acid solution. Standardization of NaOH solution and estimation of H_2SO_4 in the given solution. (phenolphthalein).
4. Preparation of standard Sodium carbonate solution, standardization of HCI (Methyl orange) and estimation of NaOH in the given solution (methyl orange or phenolphthalein).
5. Preparation of $ZnSO_4$ solution. Standardization of EDTA solution and estimation of total hardness of water using Eriochrome black- T indicator.
6. Preparation of standard oxalic acid solution. Standardization of NaOH solution and estimation of acidity in vinegar.
7. Preparation of standard Potassium dichromate and estimation of ferrous/ferric mixture using diphenylamine indicator (Demonstration).
8. Preparation of standard Oxalic acid solution. Standardization of $KMnO_4$ solution and estimation of calcium in milk.
9. Preparation of standard potassium biphthalate solution, standardization of sodium hydroxide solution and estimation of hydrochloric acid present in the given solution.
10. Preparation of standard potassium biphthalate solution, standardization of sodium

hydroxide solution and estimation of alkalinity of antacids

Syllabus Theory and Practical

B.Sc. Semester-II

Course code:DSC-2T: SEPBC-201

Course Title: BIOMOLECULES (Theory)

Course title	BIOMOLECULES
Couse code	DSC-1T: SEPBC-201
Course credits	03
Total contact hours	45
Duration of ESA (Hour)	03
Formative assessment marks	20
Summative assessment marks	80

UNIT I: Carbohydrates 15 hours

Definition, classification and biological importance.

i. 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. Stereochemistry of monosaccharides, (+) and (-), D and L, epimers, anomers, and diastreoisomers. Mutarotation. Structure of galactose, mannose, ribose and fructose. Structure and biological importance of deoxy sugars and sugar acids.

ii. Disaccharides: Occurrence and structures of Maltose, Isomaltose, Sucrose, Lactose and Trehalose. Biological Importance of Trehalose.

iii. Polysaccharides: Partial structure, occurrence and importance of Starch, Glycogen, Inulin, Cellulose, Chitin, and Pectin.

iv. Glycosaminoglycans: Structure of amino sugars, neuraminic and muramic acid. Occurrence, importance and the structure of the repeating units of heparin, hyaluronic acid, teichoic acid and chondroitin sulphate. Bacterial cell wall polysaccharide, peptidoglycans.

UNIT II: Lipids and Nucleic acid 15 hours

Classification and biological role, fatty acids – nomenclature of saturated and unsaturated fatty acids.

i. Acylglycerols: Mono, di and triacylglycerols. Saponification, saponification value, iodine value, acid value and significance. Rancidity, hydrolysis.

ii. Phosphoglycerides: Structure of lecithin (phosphatidylcholine), cephalins and phosphatidyl inositol. Biological role of phosphoglycerides.

iii. Sphingolipids: Structure and importance of sphingomyelin.

iv. Glycerosphingolipids and Ecosanoids : Composition and importance of gangliosides and cerebrosides. Prostaglandins: Types, structure of PGE_2, and PGF_2 Alpha. Biological roles of thromboxanes, leukotrienes and prostaglandins.

v. Plasma lipoproteins: Types and functions.

vi. Nucleic acids: Composition of DNA and RNA. Nucleosides and Nucleotides. Other functions of nucleotides – source of energy, component of coenzyme and second messengers. Chargaff's rule. Watson and Crick model of DNA. Nucleic acid chemistry- UV absorption, Effects of alkali and acid on DNA, Chemical reactions of RNA and DNA. Melting of DNA (Tm). Types of RNA (mRNA, tRNA and rRNA), Secondary structures of tRNA – clover leaf model.

UNIT III: Amino acids and Proteins 15 hours

i. Amino acids

Structure and classification of amino acids based on polarity. D and L notation, zwitterionic properties, pKa values, Reactions of the amino groups with HNO_2, $LiAlH_4$, phenylisothiocyante, dansyl chloride, 1-fluro2,4-dinitro benzene. Reaction of carboxyl group with hydrazine. **Essential and Nonessential Amino acids with Examples.**

ii. Peptides:

Peptide bond-formation and characteristics. Structure and biological importance of glutathione. Biological importance of valinomycin, leu-enkephalin and endorphins, Chemical synthesis of di-peptides by Merrifield solid phase synthesis.

iii. Proteins:

Isolation of proteins: – dialysis, salting in & salting out, pH precipitation and solvent precipitation. Criteria of purity of proteins.
Classification of proteins based on solubility, structure and functions with examples.

Structural organization of proteins:
Primary structure of proteins, methods of determining N and C-terminal amino acid residues, sequencing by Edman's degradation method.
Secondary Structure – α helix. β-sheet, β- bend
Tertiary structure: Forces stabilizing the structure- structure of myoglobin.
Quaternary structure: 3D structure of hemoglobin.
Denaturation and renaturation of proteins, Anfinsen's experiment.

Course code: DSC-2P: SEPBC-202;

Course Title: Biomolecules – Practicals-2

Course title	Biomolecules– practicals-2
Couse code	DSC-2P: SEPBC-202
Course credits	02
Total contact hours	45 (4 h/ week)
Duration of ESA (Hour)	3
Formative assessment marks	10
Summative assessment marks	40

- Qualitative analysis of monosaccharides (glucose, fructose).
- Qualitative analysis of disaccharides & polysaccharides (lactose, maltose, sucrose & starch).
- Reactions of lipids: triacylglycerol and cholesterol (solubility, acrolein test, Salkowski test, Lieberman-Burchard test).
- Precipitation reactions of proteins (albumin).
- Colour reactions of proteins (albumin, casein, gelatin).
- Qualitative analysis of amino acids (arginine, tryptophan, tyrosine, cysteine & phenylalanine).
- Reactions of nucleic acids: diphenylamine test, orcinol test