



Revised Syllabus For
B. Sc. II Biochemistry IDS (CBCS)
(Sem - III & IV)
B

Accredited By NAAC

Syllabus to be implemented from June 2022 onwards.

B. Sc. - II Biochemistry
SEMESTER - III
Paper – I: Biomolecules

UNIT - 1.

(15)

Carbohydrates:-

A. Definition, Classification and brief account of ... Monosaccharides (aldoses and ketoses):

Trioses – Glyceraldehyde, Dihydroxyacetone

Tetroses – Erythrose, Erythrulose

Pentoses – Ribose, Xylose, Ribulose, Xylulose

Hexoses – Glucose, Galactose, Fructose

Conformations of glucose: alpha & beta

Reactions of anomeric hydroxyl group viz. Fehling test and

Phenyl hydrazine test.

Disaccharides: Glycosidic bond, Maltose, Isomaltose, Lactose, Sucrose & Cellobiose
(Emphasis must be on nature of linkage, reducing properties and hydrolysis studies with acid and enzymes.)

Polysaccharides: Structure and biological role of Starch, Glycogen, Cellulose

B. Mucopolysaccharides: Hyaluronic acid, Heparin

Amino Acids:-

A. Definition, Nomenclature

Structure and classification of amino acids:

Neutral amino acids: Hydrocarbon chain amino acids - Glycine, Alanine, Valine, Leucine, Isoleucine

Hydroxy amino acids - Serine, Threonine

Sulphur containing amino acids - Cysteine, Methionine

Aromatic amino acids - Phenylalanine, Tyrosine, Tryptophan

Heterocyclic amino acids – Proline

Acidic amino acids and their amides: Aspartic acid, Glutamic acid, Asparagine, Glutamine

Basic amino acids: Lysine, Arginine, Histidine

B. Zwitterion and isoelectric pH

C. Ninhydrin reaction and its significance

Proteins:

- A. Definition, Classification (based on structure)
- B. Peptide bond and its nature.
- C. Structural studies of proteins – i) Primary structure ii) Secondary structure
iii) Tertiary structure iv) Quaternary structure
- D. Forces involved in maintaining different structural levels of proteins.
- E. Structure and function of oxytocin and myoglobin
- F. Amino acid sequencing –i) Sanger, ii) Edman methods

Enzymes:

- A. Definition, Explanation of terms – Holoenzyme, Apoenzyme, Coenzyme, Prosthetic group, Cofactor
- B. Classification of enzymes into in to six major classes with one example of each class, Enzyme as catalyst (concept of activation energy in enzyme catalysed reaction)
- C. Units of enzyme activity, Specific activity, Turnover number
- D. Active site of enzyme and its features
- E. Theories of mechanism of enzyme action - Lock and key and induced fit theory
- F. Factors affecting enzyme activity - substrate concentration, pH, temperature
- G. Enzyme kinetics - derivation of michaelis menten equation, significance of K_m and V_{max} ,
- H. Enzyme inhibition - competitive, non-competitive inhibition
- I. Isoenzymes of LDH and its clinical importance

Lipids

- A. Definition and classification of lipids with two examples of each class
- B. Fatty acids – Properties, Classification, Essential & non-essential fatty acids.
- C. A brief account of structure and functions of...
 - I) Simple lipids : triglyceride and fatty acids
 - II) Compound lipids : Phospholipids, viz. lecithin, cephalin, phosphatidylserine, sphingomyelin, glycolipids (cerebrosides & gangliosides)
 - III) Derived lipids: steroids (cholesterol).
- D. Lipid bilayer and Fluid mosaic model of membrane.

Paper –II
(Metabolism and Nutrition)

UNIT- I

(15)

Biological oxidation:

- A. High-energy compounds and their significance viz. ATP, PEP, 1,3-DPG
- B. Mitochondrial respiratory chain, components & carriers of ETC, Inhibitors of ETC C.
- Mechanism of oxidative phosphorylation (chemiosmotic hypothesis)

Vitamins and coenzymes:

Definition, classification & Biochemical functions of water-soluble vitamins viz. Thiamine, Riboflavin, Niacin, Pyridoxine, Pantothenic acid

Carbohydrate metabolism:

- A. Glycolysis and its significance.
 - I) Aerobic glycolysis: -glucose to pyruvate synthesis and its energetics Anaerobic II) glycolysis: -glucose to ethanol synthesis and its energetics
- B. Oxidation of pyruvate to acetyl CoA, PDH complex
- C. TCA cycle and its energetics
- D. Glycogenesis and Glycogenolysis

UNIT – II

(15)

Lipid metabolism:

- A. β - oxidation of fatty acid (Palmitic acid) and its energetic & significance
- B. Biosynthesis of fatty acid (Palmitic acid)
- C. S structure of fatty acid synthetase complex (Eu)
- D. Synthesis and utilization of ketone bodies.

Calorimetry and Nutrition:

- A. Nutrition, food, nutrient definition, Balanced diet,
- B. Caloric value of food stuffs and its measurement (bomb calorimeter).
- C. Respiratory quotient

B.Sc. II Biochemistry
SEMISTER - IV
Paper-III
(Biochemical Techniques & Bioinformatics)

UNIT – I

(15)

Chromatography

Definition and classification Principle, technique and applications of i) Paper ii) Thin layer, iii) Ion exchange, iv) Gel permeation chromatography

(The discussion should include selection of matrix, preparation of plates, column packing, sample application, mechanism of separation, important applications and advantages of each one of the methods)

Electrophoresis:

A. Definition of the terms: electrophoresis, electrophoretic mobility

B. Factors affecting electrophoretic mobility

C. Principle, technique and applications of Paper, PAGE and SDS –PAGE (The discussion should include preparation of gel plates, sample application, mechanism of separation, development of plates, important applications and advantages of the method.)

Absorption spectroscopy-

- A. Beer Lambert's law, Limitations of Beer Lambert's law
- B. Meaning of the term's transmittance, absorbance, molar and specific absorbance
- C. Construction, working and applications of i) colorimeter ii) uv spectrophotometer
- D. Advantages of spectrophotometer over colorimeter
- E. Absorption spectra of proteins, nucleic acids, cytochrome and NAD^+

UNIT II

(15)

Enzyme immobilization: -

- A. Definition, classification
- B. Types – i) Adsorption, ii) covalent binding, iii) intermolecular cross linking, iv) Entrapment (gel)
- C. Industrial applications of immobilization.

Basic Immunology and Techniques: -

- A. Natural and acquired Immunology
- B. T Cells and B Cells
- C. Structure of IgG E. Antigen –antibody interaction
- E. Phagocytosis by Macrophages
- F. ELISA

Bioinformatics: -

- A. Introduction to bioinformatics
- B. Databases
- C. Information sources (NCBI, GDB, and MGD)
- D. Data retrieval tools (ENTREZ, OMIM and PubMed)
- E. Database similarity searching (BLAST)
- F. Applications

Paper-IV
(Molecular biology & Biotechnology)

UNIT- I

(15)

Nucleic acids:

- A. Definition, Types and Distinction between DNA and RNA
- B. Chemical composition of nucleic acids i) purines ii) pyrimidines iii) phosphate iv) Sugars
- C. nucleosides and nucleotides
- D. Representation of primary structure of polynucleotide chain
- E. Watson Crick model of DNA, Structure and functions of mRNA, rRNA and tRNA (yeast)

Molecular biology

- A. Mechanism of prokaryotic replication
- B. Mechanism of prokaryotic transcription
- C. Mechanism of prokaryotic translation of DNA
- D. Genetic code
- E. Regulation of gene expression, with operon concept (E.coli lac operon model)

Genetic Engineering and Biotechnology:

- A. Introduction to Tools and techniques in genetic engineering
 - i) Enzymes a) Restriction endonucleases- introduction to class I, II and III, eg- EcoRI, Bam HI b) Reverse transcriptase, c) S1 nuclease, d) DNA ligase, e) Alkaline phosphatase
- B. Basic concept of gene cloning technique,
- C. Principal, working and applications of PCR.
- D. Blotting techniques-southern, northern and western blotting and their application,
- E. Applications of genetic engineering.

UNIT- II

(15)

Biochemistry of Diabetes Mellitus: -

- A. Introduction structure of insulin
- B. Metabolic effect of insulin

- C. Overview of mechanism of action of insulin
- D. Explanation of term i) hyper and hypoglycaemia ii) renal threshold value
- E. Meaning and type of diabetes mellitus
- F. Symptoms of diabetes mellitus
- G. Secondary complication of diabetes mellitus i) Nephropathy ii) Retinopathy iii) Neuropathy iv) Cardiovascular disease

(Only overview of the secondary complications)

- H. Hyperglycaemic drugs e.g. i) Sulfonylurea ii) Metformin

Biochemistry of AIDS:

- A. Structure of HIV,
- B. Transmission of HIV,
- C. Immunological abnormalities in AIDS,
- D. Lysis of CD4 cells,
- E. Natural course of AIDS – i) Acute ii) Chronic, iii) Crises phases. Graphical representation,
- F. Anti-AIDS drugs – AZT (Zidovudine) & DDI (Didanosine): their structure and mechanism of action.

List of books

1. Outlines of Biochemistry - Cohn and Stumph
2. Principles of Biochemistry - White, Handler and Smith.
3. Biochemistry - O. P. Agrawal.
4. Text book of Biochemistry - West, Todd and Manson.
5. Biochemistry - Lubert stryer.
6. Text book of Biochemistry and Human Physiology - G .P. Talwar.
7. Harper's Review of Physiological Chemistry - H. A. Harper.
8. Hawk's Physiological Chemistry - Oser.
9. Introduction to Chromatography theory and practice - Shrivastava.
10. Chromatography - B .K. Sharma.
11. Biochemistry - S.C. Rastogi.
12. Text book of Biochemistry - R. C. Dubey.

13. Text book Biochemistry - A. V. S. S. Ramarao.
15. Biochemistry - J.H. Weil.
16. Biochemistry - Zubey.
17. Fundamentals of Biochemistry - Voet, Voet & Pratt.
18. Fundamentals of Biochemistry - J. L. Jain.
19. Biochemistry - U. Satyanarayan.
20. Theory and Problems in Biochemistry - P. W. Kuchel and Ralston.
21. Nutritional Biochemistry - Dr.S.Ramkrishna & Dr. S. Vyankatrao.
22. Cell and Molecular biology - P. K. Gupta.
23. Elements of Biotechnology - P. K. Gupta.
24. A Text Book of Biotechnology – R. C. Dubey.
25. Genetic engineering - Sandhya Mitra.
26. Basic Biotechnology - S. Ignacimuthu.
27. Biotechnology - B. D. Singh.
28. Biotechnology - M. P. Arora.
29. Introduction to Bioinformatics - T. K. Attwood & D. J. Parry- Smith
30. Bioinformatics : Principle and applications - Harshwardhan P. Bal.
31. Immunology .- Kuby.

Practical Course

The practical course is to be covered in two days per week (total eight periods per week). At the end of the year there should be practical examination of 100 marks conducted in two consecutive days for not less than six hours on each day. Figures shown to the right indicate number of practical required.

Practical Course-I

- a) Fundamentals of Biochemical analysis. (1)
- b) Control and Accuracy. (1)

Separation methods:

- Paper chromatographic separation & identification of amino acids from binary Mixture. (1)
- Paper chromatographic separation & identification of carbohydrates from binary Mixture (1)
- Uptake of Na ions by cation exchange resin. (1)

Isolations :

- Isolation and characterization of starch from potatoes. (1)
- Isolation and characterization of casein from milk. (1)
- Isolation and characterization of albumin from egg. (1)

Colorimetric estimations:

- Verification of Beer Lambert's law and estimation of copper sulphate. (1)
- Estimation of protein by Biuret method. (1)
- Estimation of inorganic phosphate by Fiske-Subbarow method. (1)
- Estimation of glucose from DNSA method. (1)
- Estimation of RNA by Bial's orcinol method. (1)
- Estimation of urea by DAM method. (1)

Practical Course - II

Volumetric Estimations:

Estimation of glycine by formal titration. (1)

Estimation of lactose in milk by Fehling's or Benedict's method. (1)

Estimation of total chlorides in urine by Volhard's method (1)

Estimation of vitamin-C in biological samples & tablet by 2, 6 dichlorophenol indophenol method. (1)

Determination of saponification value of oil. (1)

Immobilization of baker's yeast cells by gel entrapment for invertase activity. (2)

Quantitative Estimation of amylase activity. (2)

Problems on DNA - RNA sequence, Genetic code (2)

Qualitative Analysis

Detection of Carbohydrates -Glucose, Fructose, Lactose, Sucrose, Starch. (3)

Detection of normal and abnormal constituents of urine. (2)

Determination of blood groups. (1)

Detection of enzymes (any four) (2)

Urease, Amylase, Invertase, Phenol oxidase, Alkaline- Phosphatase.

Demonstration Experiments

Bioinformatics experiment to determine three dimensional structure of proteins by visualizing softwares- RasMol. (1)

Extraction of lecithin from egg yolk. (2)

Separation of indicators proteins by gel electrophoresis. (1)

Effect temperature and pH on amylase enzyme (2)

There shall be a study tour for not more than four days to visit industries and institutions of biochemical importance. One teacher will accompany a batch of 16 students. As per university rules T.A. and D.A. should be paid to the teacher.

List of the Laboratory equipments :

1. Colorimeter
2. pH meter
3. Electrophoresis apparatus
4. Computer with printer.
5. Water bath / Incubator
6. Mixer
7. Oven
8. Chemical balance / Single pan balance
9. Suction pump
12. Centrifuge machine
13. Heating mantle with magnetic stirrer
14. Soxhlet extraction apparatus.
15. Micropipetes
16. Glassware

