

Syllabus for B.Sc. Biochemistry 2015 on wards

First Year

FIRST YEAR: Semester 1	FIRST YEAR: Semester 2
Biomolecules (BCH-101)	Cell Biology, Microbiology & Immunology (BCH-103)
Unit I: Proteins	Unit I: Morphology of cell and cell organelles
Unit II: Carbohydrates	Unit II: Biomembranes
Unit III: Lipids	Unit III: Nutrition & Growth of bacteria
Unit IV: Nucleic Acids	Unit IV: Immunology
Lab Course (BCH-102)	Lab Course (BCH-104)

Second Year

SECOND YEAR: Semester 3	SECOND YEAR: Semester 4
Enzymology (BCH-201)	Intermediary Metabolism (BCH-203)
Unit I: Basic concepts of Enzymes	Unit-I: Carbohydrate Metabolism
Unit II: Enzyme Catalysis	Unit II: Lipid Metabolism
Unit III: Enzyme Kinetics	Unit III : TCA cycle and Oxidative Phosphorylation
Unit IV: Enzyme Inhibition	Unit IV: Amino Acid & Nucleic Acid Metabolism
Lab Course (BCH-202)	Lab Course (BCH-204)

Third Year

THIRD YEAR: Semester 5	THIRD YEAR: Semester 6
Biophysical & Biochemical Techniques (BCH-301)	Molecular Biology (BCH-303)
Unit I: Spectroscopic techniques	Unit I: DNA Replication
Unit II: Hydrodynamic methods	Unit II: Transcription
Unit III: Chromatography	Unit III: Translation
Unit IV: Electrophoretic and Immunological techniques	Unit IV: Regulation of gene expression in prokaryotes
Lab Course (BCH-302)	Lab Course (BCH-304)

Semester-I

Course Code: BCH-101

Course Title: Biomolecules

Unit I: Proteins

Amino acids: Structure & their classifications, stereoisomerisms and RS system of designation, optical isomers.

Proteins: classification, composition and functions. Structure of peptide bond, chemical synthesis of polypeptides. Determination of the amino acid sequence of the polypeptide chain. Levels of structure in protein architecture, forces stabilizing the tertiary structure and quaternary structure of proteins. Denaturation and renaturation of proteins.

Unit II: Carbohydrates

Definition, classification and structure of monosaccharides. Open and Ring structure, anomeric forms, mutarotation. Reaction of monosaccharides with special reference to glucose, Structure and functions of important oligosaccharides, Structure and functions of important polysaccharides. proteoglycans, Lipopolysaccharide, blood group polysaccharides. Bacterial cell wall polysaccharides

Unit III: Lipids

Introduction, classification, nomenclature, structure and properties of Fatty acids. Saturated and unsaturated fatty acids. Essential fatty acids, chemical properties and characterization of fats – hydrolysis, Saponification value, Reichert – Meissel number, Iodine number, rancidity of fats, Triacylglycerols and Cholesterol, Structure and functions of phospholipids and sphingolipids. Prostaglandins

Unit IV: Nucleic Acids

Evidence that DNA is the genetic material, compositions of RNA and DNA, generalized structural plan of nucleic acids, features of DNA double helix. Cot Curve. Structure and roles of different types of RNA, Central Dogma of Molecular Biology.

Laboratory Course (BCH 102)

- 1) Preparation of Standard buffers and determination of pH of a solution.
- 2) Qualitative tests for Carbohydrate
- 3) Qualitative tests for Proteins and Amino acids.
- 4) Qualitative tests for Lipids
- 5) Estimation of ascorbic acid

Books Recommended

1. Principles of Biochemistry by Lehninger, Nelson & Cox
2. Biochemistry by Lubert Stryer
3. Laboratory Manual of Biochemistry & Biotechnology by Syed Eazaz Hussain Rizvi

Semester-II

Course Code: BCH 203

Course Title: Cell Biology, Microbiology
& Immunology

Unit I: Morphology of cell and cell organelles:

Structure of prokaryotic and eukaryotic cells. Structure and function of sub cellular organelles like endoplasmic reticulum, nucleus, mitochondria, lysosomes, peroxisomes, golgi apparatus, ribosomes.

Unit II: Biomembranes

Composition and functions of Biomembranes. Various models of Biomembranes, Diffusion, passive and active transport, Porters.

Unit III : Nutrition & Growth of bacterial:

General organization of bacterial cells. Gram (+ve) and gram (-ve) organisms. Cell wall structure of gram (+ve) and gram (-ve) bacteria. Culture media and types of Culture media. Sterilization and various methods of sterilization.

Unit-IV: Immunology

Cells of immune system. Antigen recognition and antibody formation. Acquired immunity. Hypersensitivity and allergies. Serology.

Laboratory Course (BCH 104)

- 1) Preparation of culture media
- 2) Sterilization techniques
- 3) Staining of Gram +ve and Gram –ve bacteria
- 4) Blood grouping
- 5) Collection of various medicinal plants and assessment of their anti-bacterial activities

Books Recommended

1. Text book of Microbiology by Davis, Dulbecco et al.
2. General Microbiology by Roger Stanier

Semester -III

Course Code: BCH- 201

Course Title: Enzymology

Unit I: Basic concepts of enzymes

Classification and nomenclature of enzymes, isoenzymes, multi-enzyme complexes. Enzyme specificity, active site. Measurement and expression of enzyme activity, enzyme assays.

Unit II: Enzymes Catalysis

Role of cofactors in enzyme catalysis: NAD/NADP⁺, FMN/FAD, coenzymeA, biotin, cobalamine, lipoamide, TPP, pyridoxal phosphate, tetrahydrofolate and metal ions with special emphasis on coenzyme functions. Acid-base catalysis.

Unit III: Enzyme Kinetics

Factors affecting enzyme activity: Enzyme concentration, substrate concentration, pH and temperature. Derivation of Michaelis-Menten equation for uni-substrate reactions. K_m and its significance. Line Weaver-Burk plot and its limitations. Importance of K_{cat} / K_m .

Unit IV: Enzyme Inhibition

Reversible and irreversible inhibition, competitive, non-competitive and uncompetitive inhibitions, determination of K_m & V_{max} in presence and absence of inhibitor, Allosteric enzymes.

Lab course (BCH 202)

1. Verification of Beer-Lambert Law
2. Estimation of SGPT and SGOT in serum.
3. Assay of alkaline phosphatase activity.
4. Effect of substrate concentration on alkaline phosphatase activity and determination of its K_m value.
5. Effect of pH on enzyme activity and determination of optimum pH.

Books Recommended

1. Enzymes by Trevor Palmer
2. Text book of Biochemistry by Lubert Stryer
3. Text book of Biochemistry by Voet and Voet
4. Laboratory Manual of Biochemistry & Biotechnology by Syed Eazaz Hussain Rizvi

Semester- IV

Course Code: BCH 203

Course Title: Intermediary Metabolism

Unit I: Carbohydrate Metabolism

Reactions and energetics of glycolysis. Gluconeogenesis, glycogenesis and glycogenolysis. Reactions and physiological significance of Pentose Phosphate Pathway. Regulation of glycolysis.

Unit II: Lipid Metabolism

Introduction. Hydrolysis of Triacylglycerols, transport of fatty acids into mitochondria, β -oxidation of saturated and unsaturated fatty acids, ATP yield from fatty acid oxidation. Biosynthesis of saturated and unsaturated fatty acids. Cholesterol metabolism.

Unit III: TCA Cycle and Oxidative Phosphorylation

Entry of pyruvate into mitochondria, TCA cycle, sequence of electron carriers, sites of ATP production, inhibitors of electron transport chain, mitochondrial oxidative phosphorylation.

Unit IV: Amino Acid & Nucleic Acid Metabolism

Transamination, oxidative deamination and decarboxylation reactions of amino acids, Urea cycle. Biosynthesis and degradation of purines and pyrimidines.

Laboratory Course (BCH 204)

1. Estimation of protein by Lowry method.
2. Estimation of glucose by Nelson-Somogyi method.
3. Estimation of bilirubin (conjugated and unconjugated) in serum.
4. Estimation of cholesterol.
5. Separation and identification of amino acids/sugars by paper chromatography.

Books Recommended

1. Text book of Biochemistry by Lubert Stryer
2. Text book of Biochemistry by Voet and Voet
3. Text book of Biochemistry Lehninger by Nelson & Cox
4. Understanding Carbohydrate Metabolism by Rabia Hamid
5. Laboratory manual of Biochemistry and Biotechnology by Syed Eazaz Hussain Rizvi

Semester V

Subject Code: BCH 301

**Course Title: Biophysical and
Biochemical Techniques**

Unit I: Spectroscopic techniques

Beer-Lambert Law, Light absorption and its transmittance, determination and application of extinction coefficient, applications of visible and UV spectroscopic techniques, spectrofluometry.

Unit II: Hydrodynamic methods

Expression for sedimentation velocity, preparative and analytical ultracentrifugation techniques, determination of molecular weight by hydrodynamic methods (derivation excluded numerical included)

Unit III: Chromatography

General principles and applications of

1. Molecular sieve chromatography
2. Ion exchange chromatography
3. Affinity chromatography
4. HPL chromatography

Unit IV: Electrophoretic and Immunological techniques

Basic principles of agarose electrophoresis, PAGE and SDS-PAGE, Isoelectrofocussing. Immune diffusion, Rocket immune electrophoresis, Radioimmuno assay, ELISA.

Laboratory Course (BCH-302)

1. Isolation and characterization of Mitochondria by Centrifugation method.
2. Isolation and characterization of Chloroplast by Centrifugation method.
3. Separation of proteins by SDS-PAGE.
4. Isolation of DNA from Blood and analysis of its spectrophotometric characteristics.

Books Recommended

1. Biophysical Chemistry by Uphadya, Uphadya and Nath
2. Principles and Techniques of Biochemistry and Molecular Biology by Keith Wilson and John Walker
3. Laboratory Manual of Biochemistry & Biotechnology by Syed Eazaz Hussain Rizvi

Semester-VI

Subject Code: BCH 303

Course Title: Molecular Biology

Unit I: DNA Replication

DNA replication in prokaryotes- experimental evidence for semi conservative replication. DNA polymerases, other enzymes and protein factors involved in replication. Mechanism of replication, inhibitors of DNA replication.

Unit II: Transcription

RNA polymerase, promoter, initiation, elongation and termination of RNA synthesis, inhibitors of transcription. Reverse transcriptase, post transcriptional processing of RNA in eukaryotes.

Genetic code: Basic features of Genetic code, biological significance of degeneracy, Wobble hypothesis.

Unit III: Mechanism of translation

Ribosome structure, A and P sites, Mechanism of Translation in prokaryotes Charging of tRNA, f-met-tRNA, initiator codon, Shine-Dalgarno consensus sequence (AGGA) formation of 70S initiation complex, role of EF-TU, EF-Ts, EF-G and GTP, non-sense codons and release factors, RF1 and RF2.

Unit IV: Regulation of gene expression in prokaryotes

Enzyme induction and repression, operon concept, Lac and Trp operon. Restriction endonucleases, vectors, plasmids, cosmids, Brief steps in DNA cloning. Applications of recombinant DNA technology.

Laboratory Course(BCH 304)

1. Estimation of DNA by Diphenylamine method.
2. Extraction of RNA and its estimation by Orcinol method.
3. Denaturation of DNA, hypo- and hyperchromacity.
4. Agarose Gel electrophoresis of DNA.
5. Demonstration of PCR.

Books Recommended

1. Molecular & Cell Biology by Lodish
2. Molecular Biology by Robert Weaver
3. Laboratory Manual of Biochemistry & Biotechnology by
Syed Eazaz Hussain Rizvi