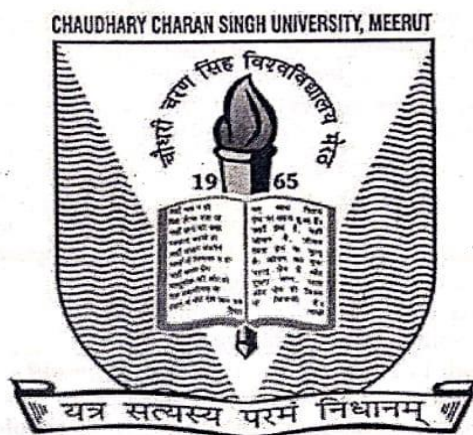


Chaudhary Charan Singh University, Meerut



PREVIOUS SYLLABUS

M.Sc. (Biochemistry)

[For fourth and fifth years of Higher education (PG)]

(For both University Campus and Colleges)


Coordinator
Biochemistry
C.C.S.U. Meerut

BCH 101 Organic Chemistry and Biomolecule

Unit 1: Basics

Electronic Theory of valency, dipole moments, electronic displacements in a molecule, inductive effect, electronic effect, resonance, hydrogen bond, vanderwal interaction, electrostatic force, hydrophobic interaction, atomic and molecular orbital, shapes of biomolecules, hybridization and tetravalency of carbon

Unit 2: Types of Organic Reaction

Substitution, SN1, SN2, neighboring group participation, addition, elimination, E1, E2 and E1 cb, condensation and polymerization, mechanism of substitution in benzene ring : o-, p- and m- directing groups, concepts of resonance with reference to benzene derivatives, Direct influence of substituent – electronic interpretation.

Unit 3: Biomolecules

Structure, function and types of biomolecules: Carbohydrate, Lipids, proteins, Nucleic acid and vitamins

Unit 4:

Heterocycling system occurring in living systems: Numbering of the ring and properties of pyran, Furan, thiozole, indole, pyridine, pyrimidine, quinoline, purine, Free radical in Biological system: oxygen as a free radical in auto oxidation of Fats, antioxidants, free radical inhibitors in the cell such as vitamin A, vitamin C, vitamin E, Se etc

Unit 5: Stereochemistry

Structural isomerism, stereoisomerism, geometrical isomerism (E and Z nomenclature), Optical isomerism, optical activity, meso compound, specific rotation, chirality, chiral center, enantiomers, diastereoisomer, D,L,R,S, threo, erythro rotations, conformation and configuration, dihedral angels, conformational analysis of ethane, n- butane , cyclohexane, mono and di substituted cyclohexane, monosaccharide, boat and chair forms, eclipsed, gauche and staggered conformations, axial and equatorial bonds. Anomers and mutarotation , glycosides, epimers, glucopyranose, fructopyranose, periodic and oxidation of sugars.

BCH 102 Physical Chemistry

Unit 1: Thermodynamics

Open, closed and isolated system, first law of thermodynamics, heat of formation and heat of reaction, second law of thermodynamics and calculation of entropy, application of the first and second law of thermodynamics in understanding in living cells and chemical potential, equilibrium constant

Unit 2: Colloidal Solution

Types of colloidal system, preparation and purification, general characteristics, coagulation, sensitization and stabilization, colloidal system, method of determination of particle size and shape, surface active agents and microemulsion

Unit 3: Electrochemistry

Types of electrode, standard electrode potential and its determination, its relationship with emf, electron transfer measures, Nernst equation, phosphate group transfer potentials, coupled reactions

Unit 4: Water

Physical properties and structure of water, hydrogen bonding, ionization of water, pH scale, acid bases, Henderson- Hasselbalch equation, buffers, buffer solution and their action, ionization behavior of amino acids and protein, titration curve, buffer solutions and their action

Unit 5: Molecular weight determination

Number average and weight average molecular weight, methods of determination of molecular weight of molecule by viscosity, centrifugation, light scattering method, end group analysis, colligative properties of solution

BCH 103 Cell Biology and Physiology

Unit 1: Structural organization and function of prokaryotic and Eukaryotic intracellular organelles

Cell wall, Nucleus, Mitochondria, Ribosomes, Golgi bodies, lysosomes, Endoplasmic reticulum, peroxisomes, plastids, Vacuoles, Chloroplast, structure and function of cytoskeleton and its role in motility

Cell division and cell cycle

Mitosis and meiosis, their regulation steps in cell cycle and control, programmed cell death, ageing, senescence, apoptosis

Unit 2: Cellular communication

Regulation of haemopoiesis, cell adhesion and role of different adhesion molecules, gap junction, ionophores, porin, nuclear pores, extracellular matrix, integrins.

Unit 3:

Biochemistry of vision

Blood : Blood corpuscles, composition and function of plasma proteins, hemoglobin: synthesis and estimation, blood coagulation, role of 2,3- DPG, Bohr effect and chloride shift, transfer of blood gases

Unit 4: Body System

Digestive system: Composition, function and regulation of saliva, gastric, pancreatic, intestinal and bile secretion, Digestion and absorption of carbohydrate, lipids, proteins, nucleic acids, minerals and vitamins.

Excretory system: Kidney, structure of nephron, glomerular filtration, tubular reabsorption of glucose, water and electrolytes and tubular secretion

Endocrine system: Human hormone, basic mechanism of hormone action.

Unit 5: Cancer

Genetic rearrangement in progenitor cells, oncogenes, tumor suppressor genes, virus induced cancer, metastasis and interaction of cancer cell with normal cells, apoptosis and therapeutic intervention of uncontrolled cell growth.

BCH104 : Bioenergetic and Intermediary Metabolism

Unit 1: Bioenergetics

Biological oxidation, oxygenases, Hydroxylases, Dehydrogenases, and membrane potential, photon energy interconversion, chemotaxis and chemoreceptors, chemiosmotic theory, ion transport across energy transducing membranes, influx and efflux mechanism, transport and distribution of cations, anions and ionophores, uniport, antiport and symport mechanism, active and passive transport system, shuttle system, The mitochondrial respiratory chain, order and organization of carrier protein, proton gradient, p/O and H/P

ratio, oxidative phosphorylation, uncouplers and inhibitors of energy transfer, fractionation and constitution of respiratory chain complexes.

ATP- synthetase complex, microsomal electron transport, partial reduction of oxygen, superoxides

Unit 2: Carbohydrate Metabolism

Approach for studying metabolism

Glycolysis, Citric Acid Cycle, its function in energy generation and biosynthesis of energy rich bonds, Pentose phosphate pathway and its regulation , alternate pathway of carbohydrate metabolism, Gluconeogenesis, interconversion of sugars, biosynthesis of glycogen, starch and oligosaccharides, glyoxylate cycle, regulation of blood glucose, hormonal regulation of carbohydrate metabolism

Unit 3: Fatty Acid Metabolism

Digestion and absorption of dietary lipids

Fatty acid biosynthesis: acetyl CoA carboxylase, fatty acid synthetase, desaturase and elongase, biosynthesis of saturated and unsaturated fatty acid

Fatty acid oxidation: α , β , γ oxidation and lipooxidation

Lipid biosynthesis: biosynthesis of triacyl glycerol and phosphoglycerides and shingolipids, biosynthetic pathways for terpenes, cholesterol, steroids and prostaglandins, ketone bodies: formation and utilization Metabolism of circulating lipids, chylomicron, LDL, HDL and VLDL, free fatty acids, lipids level in pathological conditions

Unit 4: Amino acid & Nucleic acid Metabolism

Amino acid: general concept of amino acid metabolism, intracellular proteins degradation (lysosomal, ubiquitin- the proteosomes) transamination, oxidative deamination, urea cycle and its regulation

Nucleic acid: Biosynthesis, degradation and regulation of purines and pyrimidines, biosynthesis, structure and regulation of ribonucleotides reductase, biosynthesis of ribonucleotides, deoxiribonucleotides, inhibitors of nucleic acid biosynthesis.

Unit 5: Cell signaling

Cell surface receptor, signaling through G-Protein, Coupled receptor, Signal transduction pathway, second messenger and regulation of signaling pathway

BCH-202 Advanced Enzymology

Unit 1: Enzymes

Characteristics of enzyme, isolation and purification of enzyme, methods of enzyme analysis, coenzyme, holoenzyme, prosthetic group and cofactor, IUB system of enzyme, nomenclature and classification, specific activity, enzyme assay, active site, factor affecting rate of enzyme catalyzed reaction.

Unit 2: Enzyme Kinetics

Uni and multi substrate reaction with e.g. of each class, concept of ES complex steady state hypothesis and Michaelis & Menton equation different plot for determination of K_m and V_{max} and their physiological significance, activation energy, enzyme turnover and its significance, collision and transition state theory, determination of K_i .

Unit 3: Enzyme Regulation

General mechanism of enzyme regulation feed back inhibition, feed forward stimulation, enzyme repression. induction and degradation, control of enzyme activity by product and substrate, reversible and irreversible inhibition, covalent modification of enzyme, monocyclic and multicyclic cascade system with specific e.g., Allosteric concept with special reference to aspartate transcarbamylase and phosphofructokinase.

Unit 4: Mechanism Of Enzyme Action

Experimental approach to study enzyme action: orientation and proximity effect, Acid-Base catalysis, covalent catalysis, nucleophilic catalysis, and microenvironment, mechanism of action of chymotrypsin, lysozyme, ribonuclease and triose phosphate isomerase and serine protease.

Unit 5: Qualitative Description Of Concerted And Sequential Mode

Protein ligand binding, scatchard plot, hill plot. co-operative index, half-site reactivity, isoenzyme, apozyme, ribozyme, immobilized enzyme and their industrial application.

Multienzyme Complex: Occurrence, isolation and their properties, mechanism of action and regulation of pyruvate dehydrogenase and fatty acid synthesis complex, role of vitamins and coenzyme, enzyme engineering, enzyme therapy assay of enzyme activity for diagnostic purpose.

BOH-203 IMMUNOLOGY

Unit 1: Introduction To Immune System

Innate and acquired immunity, active and passive immunity, humoral and cell mediated immunity, primary and secondary immune modulation, haptens and adjuvant, structure and function of primary and secondary lymphoid organs and cells of immune system, T and B cells lymphocytes with subsets and surface markers,

Unit 2: Nature Of Antigens And Antibody

Antigen vs. immunogenicity, factors that influence immunogenicity, immunoglobulin as antigen, structure and function of immunoglobulin, antibody classes and biological activities, generation of diversity in immune system, antigen antibody interaction, clonal selection theory.

Unit 3: Immuno-Activation

Major histocompatibility complex, polymorphism of MHC genes. HLA and H2 system, MHC antigen in transplantation, antigen processing and presentation, T-cell diversity, T-cell activation and differentiation B-cell activation and proliferation.

Unit 4: Immune Effector Mechanism

Cytokines, complement system, vaccination, transplantation immunology, ELISA, RIA.

Unit 5: Immunity And Infection

Autoimmunity, hypersensitivity immunotherapy, immune response during bacterial (tuberculosis), parasitic (malaria) and viral (HIV) infection, congenital and acquired immunodeficiency.

BCH 204 COMPUTER AND BIOINFORMATICS

Unit I: Computer peripheral and hardware description

Computer system designs, recognition and structure of different component of a computer system and their respective usages, I/O and storage devices with data communication with introduction of internet.

Operating system: System and application software, evolution of operating systems, layered structure of operating system, CUI and GUIs, DOS, internet and external commands, batchfields; WIN 95/98, anatomy of windows and features, multitasking

Office applications: MS-office 95/97/2000 including MS word, MS excel, MS powerpoint

Logic development Generation of programming languages emulation of common DOS command using C and C++, data structures in C, objects and classes, pointers, arrays(one and two dimensional) , normal string and file handling in C++

UNIT 2

Internet representation of data: bits and bytes, binary decimals, octal and hexadecimalsystem, positive and negative number, integer and real, characters and codes-BCD, ASCII., EBCD16 coding, algorithms and flowcharts. Introduction and application of programming language elementary idea of development of computer programmes

UNIT 3

The scientific method, components of experimental planning-collection of data, its representation, analysis(measuring central tendency, dispersions, simple correlations, regressions, X2 test and Ftest) interpretation of results minimizing experimental errors replication, randomization

UNIT 4 Bioinformatics and computer biology

definition, biological database information networks, protein and genome information sources

Sequential analysis- genome DNA sequencing(including a brief idea of human genome project) analysis of transcriptome and proteome sequence motifs

UNIT 5

Analysis of gnome sequence data, sequence pairwise alignment (Needleman-wunch global alignment algorithm, smith-waterman algorithm for the identification of common molecular subsequences) alignment of cDNA and genomic DNA sequences database searching, FASTA, BLAST, multiple alignment and phylogenetic analysis, sequence assembly. Approaches to gene prediction and protein structure. Computer aided drug design neutral theory of molecular evolution GENE BEE NET for analyzing biopolymer structure; TREEVIEW

BCH 301 Biotechnology

Unit 1: Recombinant DNA technology

Methods of creating recombinant DNA molecules, spacing properties of restriction enzymes and their modes of action, selection screening, construction of DNA library, genomic Vs. cDNA library, synthesis of genes, cloning vector(lambda phage, plasmid, M-13 phage, Cosmid, BAC, YAC) shuttle vectors yeast and viral vector, expression vectors production in bacteria, cloned genes, subcloning, sequencing by Sanger's method, protein production in bacteria, site directed mutagenesis, AFLP, PCR, RAPD, antisense- RNA technology, chromosomal walking, jumping, landing , DNA chips, genomics and proteomics

Unit2: Hybridoma Technology

Monoclonal antibodies, mycelium cell fusion, selection of hybrid, hybridomas, protoplast fusion and HAT- medium, screening assay, purification and application of monoclonal antibodies

Unit 3: plant cell culture

Micropropagation, somatic cell culture, somaclonal variation, somatic cell hybridization, protoplast isolation, protoplast fusion, protoplast culture, genetic transformation various method for gene transformation(all vectors and vector less method), production of transgenic plants and their uses, production of secondary metabolites, primary and transferred cell culture, differentiated cell in culture

Unit 4: Animal Cell Culture

Primary cell culture and established cell line, measurement of viability and cytotoxicity, characterization of culture cell, disaggregation of tissues and primary culture, maintenance of cell culture, cell separation, scaling up of animal cell culture, cell synchronization, cell transformation, application of cell culture

Unit 5: Fermentation Technology

Primary and secondary metabolites in biotechnology, continuous and batch type culture technique, principle types as of fermentor, general design of fermentor, fermentation process brewing, manufacture of penicillin, production of single cell protein, production strategies for antibodies and other organic compounds

BCH 302 : Molecular Biology

Unit 1: DNA

DNA as genetic material-Biochemical evidence, Primary, secondary and three dimensional structure of DNA, Circular and Spherical DNA, Satellite and Repetitive DNA, Structure of Chromosomes and Chromatin, Heterochromatin, Euchromatin, DNA Supercoiling, Denaturation and Renaturation of DNA, Histones, Nucleosomes, DNA replication, DNA repair and Recombination

Unit 2: RNA

Role of RNA, Types of RNA, Primary and Secondary structure of RNA, Transcription –DNA directed RNA synthesis, Transcription Factor, RNA polymerase, Initiation, Elongation, and Termination of transcription, RNA processing, inhibitors of transcription, post transcriptional Modification—Splicing, cap addition, Polyadenylation, RNA directed DNA synthesis

Unit 3: Translation

Structure and function of ribosome, genes, split genes, general features of genetic code, identification of genetic codes, identification of anticodon, wobble hypothesis, initiation elongation & termination of protein synthesis in prokaryotes and eukaryotes, post translation modification of protein, protein sorting and targeting

Unit 4: Gene Regulation in Prokaryotes and Eukaryotes

Interaction between DNA-DNA binding protein in eukaryotes, short term and long term, regulation of gene expression, DNA binding protein to regulate transcription, (Zinc Finger, Leucine, Zipper, Helix loop Helix protein), DNA methylation coordination control of gene – operon model, inducible system-lactose and arabinose operon, repressible system-tryptophan operon, lytic cascade and lysogenic, repression attenuation and antitermination, antisense RNA

Unit 5: Transposable genetic element

Transposons, prokaryotic transposable genetic elements and mechanism of transposition, eukaryotes transposable genetic element in yeast, drosophila and maize, reassociation kinetics c-values paradox, cot curve, counterions

BCH 303 : Nutritional Biochemistry

Unit 1: Basic concepts

Composition of Human body energy content of foods, measurement of energy expenditure: direct and indirect calorimeter, definition of BMR and SDA and factor affecting these, thermogenic effect of foods, energy requirement of man and women with factor affecting energy requirement

Carbohydrates: Dietary requirements and source of available and unavailable carbohydrates, physico chemical properties and physiological action of unavailable carbohydrates (dietary fibers)

UNIT 2: Proteins and Lipids

Protein-protein reserves of human body ,nitrogen balance studies and factor influencing nitrogen balance, essential amino acid for man and concept of protein quality, cereal proteins and their limiting amino acids, protein requirement at different stages of development

Lipids: major classes of dietary lipids properties and composition of plasma lipoproteins, dietary needs of lipids, essential fatty acids and their physiological functions

Unit 3: Electrolytes and Water Balance

Electrolyte concentration of body fluids, acid-base regulation by the human body concept of metabolic and respiratory acidosis and alkalosis

Minerals: Nutritional significance of dietary calcium, phosphorous, magnesium, iron, iodine, zinc and copper

Unit 4: Vitamins

Dietary sources, biochemical functions and specific deficiency diseases associated with fat and water soluble vitamins, nutritional requirement during pregnancy, lactation and of infant & children, protein energy malnutrition (PEM) Aetiology, clinical features, metabolic disorders and management of marasmus and kwashiorkor diseases

Unit 5: Starvation

Techniques for the study of starvation, protein metabolism in prolonged fasting, protein sparing treatment during fasting, basic concept of high protein, low calorie weight, reduction diets

Obesity : definition and classification, genetic and environmental factors leading to obesity, obesity related and management of obesity, role of leptin in regulation of body mass, clinical nutrition, role of diet and nutrition in the prevention and the treatment of diseases: dental caries, fluorosis, renal failure, hyperlipidemia, Atherosclerosis and rheumatic disorders, inherited metabolic disorder, phenyl ketonuria, maple syrup disease, Hemocystinuria, galactosemia, gout, diabetes insipidus and diabetes mellitus, nutrigenomics

BCH 304 Analytical Biochemistry

Unit 1 : Spectroscopy

Electromagnetic radiation, absorption and emission spectroscopy UV and Visible spectroscopy- Basic principle, instrumentation, Beer's Lambert Law, Fischer Woodward rules and application atomic absorption

Spectroscopy: principle, instrumentation and applications

Unit 2: Resonating spectroscopy

IR-Basic principle instrumentation and application, calculation of vibrational frequencies, modes of vibration and infrared spectra of common functional group- Carbonyl, hydroxyl and nitrogen comp.

, NMR- Nuclear resonance, shielding and deshielding, chemical shift, spin-spin interaction, coupling constant and instrumentation

Unit 3: Electrophoretic technique

Basic principle and instrumentation factors affecting electrophoretic mobility, zonal electrophoresis-paper electrophoresis, gel electrophoresis: page and agarose, isoelectric focusing, immunoelectrophoresis, electrophoresis in genetic analysis: southern mad northern blotting, DNA sequencing, DNA foot printing, restriction mapping

Unit 4: Chromatography and Sedimentation Technique

Chromatography: normal and reverse phase chromatography, paper and thin layer chromatography, column chromatography: adsorption & gas liquid chromatography, ion exachange, Affinity chromatography, HPLC—Basic principle, instrumentation and application

Sedimentation technique: Basic principle, relate centrifugal force, instrumentation factors affecting sedimentation velocity, sedimentation cofficient, determination of molecular weight, differential centrifugation, density gradient, rate zonal, isoprene centrifugation

Unit 5: Radioisotope technique & microscopy

Radioisotope: properties of different type of isotopes normally used in biology, their detection and measurement, incorporation of radioisotope in biological tissues and cells, quenching, internal standard channel ratio, external standard, emulsion counting, autoradiography

Microscopy: Light microscopy, electron (scanning and transmission) microscopy, and phase contrast, freeze-etch and freeze-fracture methods for EM staining of organelles and marker enzyme, resolving power of different microscopes

BIOCHEMISTRY PRACTICAL

1. To estimate glucose in urine sample.
 2. To estimate sugar in blood.
 3. Isolation of different protein by electrophoresis.
 4. Separation and identification of sugar by TLC.
 5. To identify lipids in given sample by TLC.
 6. Separation and identification of amino acids by ascending paper chromatography.
 7. By descending paper chromatography.
 8. By two dimensional paper chromatography.
 9. Extraction of total nucleic acids from plant tissue.
 10. Estimation of DNA by diphenyl amine reaction.
 11. Determination of RNA by arcinol method.
 12. Quantitative determination of DNA and RNA by spectrophotometric method.
 13. To verify the validity of Beer's Law and determine molar extinction coefficient of NADH.
 14. Estimation of starch by anthrone method.
- To fractionate leaf cell by differential centrifugation technique


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