Syllabus of Biochemistry (Hons.)

for SEM-I & SEM-II under CBCS

(to be effective from

Academic Year: 2017-18)

The University of Burdwan
Burdwan, West Bengal

1. Introduction

The syllabus for Biochemistry at undergraduate level using the Choice Based Credit system has been framed in compliance with model syllabus given by UGC.

The main objective of framing this new syllabus is to give the students a holistic understanding of the subject giving substantial weight age to both the core content and techniques used in Biochemistry.

The ultimate goal of the syllabus is that the students at the end are able to secure a job. Keeping in mind and in tune with the changing nature of the subject, adequate emphasis has been given on new techniques of mapping and understanding of the subject.

The syllabus has also been framed in such a way that the basic skills of subject are taught to the students, and everyone might not need to go for higher studies and the scope of securing a job after graduation will increase.

It is essential that Biochemistry students select their general electives courses from Chemistry, Physics, Mathematics and/or any branch of Life Sciences disciplines.

While the syllabus is in compliance with UGC model curriculum, it is necessary that Biochemistry students should learn “Basic Microbiology” as one of the core courses rather than as elective while. Course on “Concept of Genetics” has been moved to electives.

Also, it is recommended that two elective courses namely Nutritional Biochemistry and Advanced Biochemistry may be made compulsory.

Type of Courses

Course type	Description	Number of Courses
		B. Sc. (Honours)
CC	Core Course	14
DSE	Discipline Specific Elective	4
GE	Generic Elective	4
AECC (ENVS & ENGLISH/MIL)	Ability Enhancement Compulsory Course	2
SEC	Skill Enhancement Course	2
TOTAL CREDIT		**142**

Structure at a glance for Biochemistry (H) at UG level, B.U.:

1st Semester

Course Code	Course Title	Course Type	Credit per course	Marks
CC-1	Molecules of Life (Theo) Molecules of Life (Prac)	Core Course – I	4+2	75
CC-2	Cell Biology (Theo) Cell Biology (Prac)	Core Course – II	4+2	75
GE-1	Biochemistry of Cell (Theo + Prac)	Generic Elective – 1	4+2	75
AECC-1	ENVS	Ability Enhancement Compulsory Course – I	4	100
TOTAL			22	325

2nd Semester

Course Code	Course Title	Course Type	Credit per course	Marks
CC-3	Proteins (Theo) Proteins (Prac)	Core Course – III	4+2	75
CC-4	Enzymes (Theo) Enzymes (Prac)	Core Course – IV	4+2	75
GE-2	Proteins and Enzymes (Theo + Prac)	Generic Elective – 2	4+2	75
AECC-2	Communicative Eng./MIL	Ability Enhancement Compulsory Course – II	2	50
TOTAL			20	275

3rd Semester

Course Code	Course Title	Course Type	Credit per course	Marks
CC-5	Metabolism of Carbohydrates and Lipids (Theo) Metabolism of Carbohydrates and Lipids (Prac)	Core Course – V	4+2	75
CC-6	Physiology and Hormones (Theo) Physiology and Hormones (Prac)	Core Course – VI	4+2	75
CC-7	Physical Biochemistry (Theo) Physical Biochemistry (Prac)	Core Course – VII	4+2	75
SEC-1	Clinical Biochemistry or Bioinformatics and Biostatistics	Skill Enhancement Course – 1	2	50
GE-3	Fundamentals of Cell Biology and Immunology	Generic Elective – 3	4+2	75
TOTAL			26	350

4th Semester

Course Code	Course Title	Course Type	Credit per course	Marks
CC-8	Membrane Biology and Bioenergetics (Theo) Membrane Biology and Bioenergetics (Prac)	Core Course – VIII	4+2	75
CC-9	Metabolism of Amino Acid and Nucleic Acid (Theo) Metabolism of Amino Acid and Nucleic Acid (Prac)	Core Course – IX	4+2	75
CC-10	Basic Microbiology and Microbial Genetics (Theo) Basic Microbiology and Microbial Genetics (Prac)	Core Course - X	4+2	75
SEC-2	Techniques in Biochemistry or Protein Purification Techniques	Skill Enhancement Course – II	2	50
GE-4	Fundamentals of Genetic Engineering	Generic Elective – 4	4+2	75
TOTAL			26	350

5th Semester

Course Code	Course Title	Course Type	Credit per course	Marks
CC-11	Chromosome organization, DNA replication, Mutation and Repair (Theo) Chromosome organization, DNA replication, Mutation and Repair (Prac)	Core Course – XI	4+2	75
CC-12	Gene expression and regulation (Theo) Gene expression and regulation (Prac)	Core Course – XII	4+2	75
DSE-1	Nutritional Biochemistry (Theo + Prac) or Concept of Genetics (Theo + Prac)	Discipline Specific Elective	4+2	75
DSE-2	Infectious and Non-infectious Diseases (Theory) or Advanced Biochemistry (Theory)	Discipline Specific Elective	6	75
TOTAL			24	300

6th Semester

Course Code	Course Title	Course Type	Credit per course	Marks
CC-13	Recombinant DNA Technology and Genetic Engineering (Theo) Recombinant DNA Technology and Genetic Engineering (Prac)	Core Course – XIII	4+2	75
CC-14	Immunology (Theo) Immunology ((Prac)	Core Course – XIV	4+2	75
DSE-3	Neuro Biochemistry (Theo) or Molecular Diagnostics (Theo + Prac)	Discipline Specific Elective	6 or 4+2	75
DSE-4	Project Work or Dissertation followed by power point presentation	Discipline Specific Elective	6	75
TOTAL			24	300

1st Semester:

Course Code: CC-1

Course Title: Molecules of Life (Theo) 4 Credits

The foundations of biochemistry: Cellular and chemical foundations of life

Water

Unique properties, weak interactions in aqueous systems, ionization of water, water as a reactant and fitness of the aqueous environment. 02 lectures

Basic principles of Inorganic, Organic & Physical Chemistry

- Atomic structure and atomic properties:

Modern form of periodic table, periodicities of atomic-, ionic- and van der Walls radii, ionization energy, electron affinity, electronegativity, ionic potential. 03 lectures

- Chemical bonding:

Ionic bond, covalent bond, metallic bond, deformation of ions and Fajan's rule, hydrogen bonding, van der Waals' force, dipole moment, bond polarity. 03 lectures

- Redox properties:

Standard electrode potential, formal potential, complex formation and precipitation reaction on formal potential, disproportionation and comproportionation reactions. 03 lectures

- Metal ions in living systems:

Essential elements, toxic elements and their toxicities, classification of biological metal ions and ligands according to HSAB principle, chelation therapy. 03 lectures

- Boding and stereochemistry: 03 lectures

Hybridisation of carbon (sp^3, sp^2, sp), localized and delocalized bonds, inductive effect, field effect, electromeric effect, conjugation, resonance, hyperconjugation, tautomerism, aromaticity.

- Organic reaction mechanism: 05 lectures

Classification of reagents (nucleophile, electrophile, free radical, regioselective and chemoselective), thermodynamics and kinetics of organic reactions, energy profiles: intermediate and transition state, substitution reactions (S_N1, S_N2), elimination reaction (E1, E2, E1CB).

- Stereochemistry of carbon compounds

configuration and conformation of organic molecules, dihedral angle and angle of torsion – gauche, eclipsed and staggered arrangement, elementary idea about the conformational analysis of cyclohexane and its mono- and di-substituted derivatives (chair, boat and twist boat forms), Fisher, Newman, Sawhorse & Flying-wedge representation, configurational nomenclature – D/L, R/S; enantiomer, diastereomer, mesomer, racemic mixture, optical activity, optical isomerism, optical rotation, resolution of optical isomers. 06 lectures

- Biophysical properties

Viscosity: General features of fluid flow (streamlined and turbulent), nature of viscous drag for streamlined motion, Definition of viscosity coefficient, Origin of viscosity of liquids, expression for viscosity coefficient of liquids (no derivation): Poiseuille's equation, temperature dependence of viscosity coefficient of liquids, Stoke's law and terminal velocity, Determination of viscosity coefficient of liquids, Diffusion of solutes in solution, Fick's law. 05 lectures

Surface tension: Definition, angle of contact, interfacial tension, capillary rise, determination of surface tension, temperature effect. 03 lectures

Preliminary idea of Chemical equilibrium: Equilibrium constant, Le Chatelier's principle and its simple applications. Ionic equilibrium: Standard solution, Molar, Normal, Molal, Formal and percent strengths, Hydrolysis of weak acids and bases. pKa, pKb, pH, pOH acid- base neutralization curves, Buffer action definition, Henderson -Hasselbalch equation and preparation of buffers, buffer capacity, Solubility product principle and application. 04 lectures

Electrochemistry: Electrical conductance, cell constant, specific conductance and equivalent conductance., Variation of equivalent conductance of strong and weak electrolytes with dilution, Kohlrausch's law of independent migration of ions, ion conductance and ionic mobility, Equivalent conductance at infinite dilution for weak electrolytes and determination of dissociation constants of weak electrolytes from conductance measurements. EMF of cell (no derivation). 05 lectures

Lipids

Brief idea about lipids: fatty acids, triglycerides, P-lipids, sphingosine, ceramide, sphingomyelin, sterols and cholesterol, glycolipids, sphingolipids, (blocks of lipids - fatty acids, glycerol, ceramide. Storage lipids - triacyl glycerol and waxes). Structural Lipids in biological membranes – Phospholipases: phospholipase A2, phospholipase C, phospholipase D, Inositol tris- phosphate and diacyl glycerol as signaling molecules. 05 lectures

Amino Acids

Structure and classification, essential and non essential amino acids, physical, chemical and optical properties of amino acids. 04 lectures

Nucleic Acids

Nucleotides - structure and properties. Nucleic acid structure – Watson-Crick model of DNA. Structure of major species of RNA - mRNA, tRNA and rRNA. Nucleic acid chemistry - UV absorption, effect of acid and alkali on nucleic acids. Other functions of nucleotides – source of energy, component of coenzymes. 06 lectures

Reference Books

1. Outlines of Biochemistry: Conn and Stumpf
2. Biochemistry: Debojyoti Das
3. Lehninger: Principles of Biochemistry (2013) 6th ed., Nelson, D.L. and Cox, M.M., W.H.
4. Freeman and Company (New York), ISBN: 13: 978-1-4641-0962-1 / ISBN: 10:1-4292-3414-
5. Textbook of Biochemistry with Clinical Correlations (2011) 7th ed., Devlin, T.M., John Wiley & Sons, Inc. (New York), ISBN: 978-0-470-28173-4.
6. Biochemistry (2012) 7th ed., Berg, J.M., Tymoczko, J.L. and Stryer L., W.H. Freeman and Company (New York), ISBN:10:1-4292-2936-5, ISBN:13:978-1-4292-2936-4.
7. Fundamental of Biochemistry, Voet and Voet.
8. *General and Inorganic Chemistry*, R. Sarkar, Part I, 2nd Edition, New Central Book Agency, Kolkata.
9. *Inorganic Chemistry*, R. L. Dutta, Part I, The New Book Stall, Kolkat.
10. *Bioinorganic Chemistry*, A. K. Das, Books and Allied (P) Ltd, Kolkata.
11. *Organic Chemistry*, I. L. Finar Volumes 1 and 2: Stereochemistry and chemistry of natural products, 5th Edition, ELBS.

12. *Organic Chemistry*, T. W. G. Solomons, C. B. Fryhle, S. A. Snyder, 11th Edition (International Student Version), Wiley.

13. *A Guide Book to Mechanism of Organic Chemistry*, P. Sykes, 6th Edition, Pearson.

14. Physical Chemistry, P. C. Rakshit, Sarat Book House, Kolkata.

15. Physical Chemistry, I. N. Levine, Tata McGraw-Hill.

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Course Code: CC-1

Course Title: Molecules of Life (Prac.) 2 Credits

List of Practical:

1. Safety measures in laboratories, use and calibration of pipettes.
2. Preparation of normal, molar solutions and percent solutions.
3. Concept of pH and preparation of buffers.
4. Determination of pK_a of acetic acid and glycine.
5. Separation of amino acids by paper chromatography.
6. Separation of lipids by thin layer chromatography.

Course Code: CC-2

Course Title: Cell Biology (Theo) 4 Credits

Cells: Prokaryotic (archaea and eubacteria) and eukaryotic cell (animal and plant cells). 05 lectures

Subcellular organelles and membranes

Cell membrane-peripheral and integral membrane proteins. Structure of biological membranes – Gorter & Grendel Model, Danielli and Davson model, Unit membrane model and Singer and Nicolson model, Nucleus, lysosomes, endoplasmic reticulum, Golgi bodies, mitochondria, chloroplast, perixysomes, cell wall. Endosymbiont hypothesis of the biogenesis of mitochondria and chloroplast, Marker enzymes and proteins of subcellular organelles, and their membranes, cytosol and cell membrane. 15 lectures

Cytoskeletal proteins

Structure and organization of actin filaments. Role of ATP in microfilament polymerization, organization of actin filaments. Non-muscle myosin. Intermediate filament proteins, assembly

and intracellular organization. Assembly, organization and movement of cilia and flagella.

10 lectures

Functional proteins

Outline of structural proteins, transport proteins and immunoglobulins. 03 lectures

Cell wall and extracellular matrix

Prokaryotic and eukaryotic cell wall, cell matrix proteins. Cell-matrix interactions and cell- cell interactions. Adherence junctions, tight junctions, gap junctions, desmosomes, hemidesmosomes, focal adhesions and plasmodesmata. 07 lectures

Protein trafficking

Regulation of nuclear protein import and export. Import and export of proteins and lipids in ER. Protein sorting and processing in Golgi. Mechanism of vesicular transport – the Dolichol phosphate pathway. 10 lectures

Cell cycle, cell death and cell renewal

Eukaryotic cell cycle and its Regulation. Cell division. Outline on apoptosis and necrosis.

03 lectures

Tools of Cell Biology

Cells as experimental models, Light microscopy, phase contrast microscopy, fluorescence microscopy, confocal microscopy, electron microscopy, FACS, Differential and density gradient centrifugation for subcellular fractionations. 07 lectures

Reference Books:

1. The Cell: A Molecular Approach (2009) 5th ed., Cooper, G.M. and Hausman, R.E., ASM Press & Sunderland (Washington DC), Sinauer Associates, MA, ISBN: 978-0-87893-300-6.
2. Molecular Cell Biology (2012) 7th ed., Lodish, H., Berk, A., Zipursky, S.L., Matsudaira, P., Baltimore, D. and Darnell. J., W.H. Freeman & Company (New York), and ISBN: 13:978-1-4641-0981-2 / ISBN: 10: 1-4641-0981-8.
3. Molecular Biology of the Cell (2008) 5th ed., Alberts, B., Johnson,A., Lewis, J.
4. Enlarge, M., Garland Science (Princeton), ISBN: 0-8153-1619-4 / ISBN: 0-8153-1620-8.

Course Code: CC-2

Course Title: Cell Biology (Prac.) 2 Credits

List of Practical

1. Visualization of animal and plant cells by methylene blue & Micrographs of different cell components and study of mitosis and meiosis from permanent slides (dry lab);

2. Identification of different stages of mitosis in onion root tip;

3. Identification of different stages of meiosis in grasshopper testis/ onion flower bud anthers;

4. Isolation of different sub-organelles and their identification by respective marker enzyme/protein;

5. Staining and visualization of mitochondria by Janus green stain: &

6. Identification of live cells by Trypan blue exclusion test.

Course Code: Generic Elective-1 (Theo.) 4 Credits

[**Only for the students of Biochemistry (Hons.)**]

Course Title: Biochemistry of Cell

Biomolecules in their cellular environment

The cellular basis of life. Cellular structures – prokaryotes and eukaryotes. Chemical principles in biomolecular structure. Major classes of biomolecules. Role of water in design of biomolecules. 12 lectures

Amino acids and peptides

Types of amino acids and their chemistry, derivatives of amino acids and their biological role. Introduction to biologically important peptides. 08 lectures

Sugars and polysaccharides

Basic chemistry of sugars, optical activity. Disaccharides, trisaccharides and polysaccharides - their distribution and biological role. 08 lectures

Nucleosides, nucleotides and nucleic acids

Structures and chemistry, DNA structures and their importance, different types of RNA. Unusual DNA structures, other functions of nucleotides. 08 lectures

Lipids

Various classes of lipids and their distribution, storage lipids, structural lipids in membranes, lipids as signals, cofactors and pigments. 08 lectures

Vitamins, coenzymes and metal ions

Occurrence and nutritional role. Coenzymes and their role in metabolism, metal ion containing biomolecules, heme, porphyrins and cyanocobalamin – their biological significance. 8 lectures

Signalling Molecules

Second messengers - cAMP, cGMP, IP3, dactyl glycerol, Ca2+, NO. Brief account of their importance and role in signalling and signal transduction. 08 lectures

References:

1. Lehninger: Principles of Biochemistry (2013) 6th ed., Nelson, D.L. and Cox, M.M., W.H. Freeman and Company (New York), ISBN: 13; 978-1-4641-0962-1 / ISBN: 10-14641-0962-1.
2. Textbook of Biochemistry with Clinical Correlations (2011) 7th ed., Devlin, T.M., John Wiley & Sons, Inc. (New York), ISBN: 978-0-470-28173-4.

Course Code: Generic Elective-1 (Prac.) 2 Credits

[**Only for the students of Biochemistry (Hons.)]**

Course Title: Biochemistry of Cell

List of Practical

1. General safety procedures in a laboratory. Calibration and Use of auto pipettes.
2. Making solutions and buffer preparation - acetate and tris buffers.
3. Qualitative tests for biomolecules - carbohydrates, lipids, amino acids, proteins, bases and nucleic acids.
4. Separation of amino acids by paper chromatography.
5. Estimation of ascorbic acid in fruit juices.

2nd Semester:

Course Code: CC-3

Course Title: Proteins (Theo) 4 Credits

Introduction to amino acids, peptides and proteins

Amino acids and their properties - hydrophobic, polar and charged.

Biologically important peptides - hormones, antibiotics and growth factors. Multimeric proteins, conjugated proteins and metallo proteins. Diversity of function (Specific examples of Proteins/Peptides may be included under each category). 12 lectures

Extraction, Separation and Characterization of Proteins

Solubilization of proteins from their cellular and extracellular locations. Use of simple grinding methods, homogenization and centrifugation. Ammonium sulphate fractionation, solvent fractionation, dialysis and lyophilisation. Ion- exchange chromatography, molecular sieve chromatography, hydrophobic interaction/reverse phase chromatography, affinity chromatography, HPLC and FPLC.

Determination of purity, molecular weight, extinction coefficient and sedimentation coefficient, IEF, SDS-PAGE and 2-D electrophoresis. 20 lectures

. *Covalent structure of proteins*

Organization of protein structure into primary, secondary, tertiary and quaternary structures. 03 lectures

Three dimensional structures of proteins

Nature of stabilizing bonds - covalent and non-covalent. Importance of primary structure in folding. The peptide bond - bond lengths and configuration. Dihedral angles psi and phi. Helices, sheets and turns. Ramachandran plot. Techniques used in studying 3-D structures - X-ray diffraction and NMR (introductory). Motifs and domains. 10 lectures

Protein folding and conformational diseases

Denaturation and renaturation of Ribonuclease A. Introduction to thermodynamics of folding and molten globule. Assisted folding by molecular chaperones, chaperonins and PDI. Defects in protein folding and associated diseases --- Alzeimer's disease. 07 lectures

Myoglobin and haemoglobin and Membrane Proteins

Structures of myoglobin and haemoglobin, Oxygen binding curves, influence of 2,3-Biphosphoglyceric acid, CO2 and Cl-. Hill plot. Cooperativity between subunits and models to explain the phenomena – concerted and sequential models. Haemoglobin disorders and associated diseases – sickle cell anemia, and thalasemia. 08 lectures

Reference Books:

1. Lehninger: Principles of Biochemistry (2013) 6th ed., Nelson, D.L. and Cox, M.M., W.H. Freeman and Company (New York), ISBN: 13: 978-1-4641-0962-1 / ISBN: 10:1-4292-3414-8.
2. Physical Biochemistry (2009) 2nd ed., Sheehan, D., Wiley-Blackwell (West Sussex), ISBN: 9780470856024 / ISBN: 9780470856031.
3. The Tools of Biochemistry (1977; Reprint 2011) Cooper, T.G., Wiley India Pvt. Ltd. (New Delhi), ISBN: 978-81-265-3016-8.
4. Biochemistry (2012) 7th ed., Berg, J.M., Tymoczko, J.L. and Stryer L., W.H. Freeman and Company (New York), ISBN:10:1-4292-2936-5, ISBN:13:978-1-4292-2936-4.

Course Code: CC-3

Course Title: Proteins (Prac.) 2 Credits

List of practical

1. Verification of Lambert-Beer's Law
2. Estimation of proteins using UV absorbance and Biuret method.
3. Assay of proteins using Lowry/Bradford method, standard curve preparation.
4. Determination of Isoelectric pH of glycine and alanine.
5. Determination of molecular mass of protein by SDS-PAGE using bovine serum albumin as the standard.

Course Code: CC-4

Course Title: Enzymes (Theo) 4 Credits

Introduction to Enzymes

Nature of enzymes - protein and non-protein (ribozyme). Cofactor and prosthetic group, apoenzyme, holoenzyme. IUBMB classification of enzymes. 07 lectures

Features of enzyme catalysis

Factors affecting the rate of chemical reactions, collision theory, activation energy and transition state theory, catalysis, reaction rates and thermodynamics of reaction. Catalytic power and specificity of enzymes (concept of active site), Fischer's lock and key hypothesis, Koshland's induced fit hypothesis. 10 lectures

Enzyme Kinetics

Relationship between initial velocity and substrate concentration, steady state kinetics, equilibrium constant - monosubstrate reactions. Michaelis-Menten equation, Lineweaver- Burk plot, Eadie-Hofstee and Hanes plot. K_m and V_{max}, K_{cat} and turnover number. Effect of pH, temperature and metal ions on the activity of enzyme. 13 lectures

Enzyme inhibition

Reversible inhibition (competitive, uncompetitive, non-competitive, mixed and substrate). Mechanism based inhibitors - antibiotics as inhibitors. 05 lectures

Mechanism of action of enzymes

General features - proximity and orientation, strain and distortion, acid base and covalent catalysis (chymotrypsin, lysozyme). Metal activated enzymes and metalloenzymes, transition state analogues. 07 lectures

Regulation of enzyme activity

Control of activities of single enzymes (end product inhibition) and metabolic pathways, feedback inhibition, allosteric regulation (aspartate transcarbomoylase), reversible covalent modification phosphorylation (glycogen phosphorylase). Proteolytic cleavage- zymogen.

Multienzyme complex as regulatory enzymes. Occurrence and isolation, phylogenetic distribution and properties (pyruvate dehydrogenase, fatty acyl synthase) Isoenzymes - properties and physiological significance (lactate dehydrogenase). 13 lectures

Involvement of coenzymes in enzyme catalysed reactions

TPP, FAD, NAD, pyridoxal phosphate, biotin, coenzyme A, tetrahydrofolate, lipoic acid.

05 lectures

Reference Books:

1. Lehninger: Principles of Biochemistry (2013) 6th ed., Nelson, D.L. and Cox, M.M., W.H. Freeman and Company (New York), ISBN: 13: 978-1-4641-0962-1 / ISBN: 10:1-4292-3414-8.
2. Biochemistry (2011) 4th ed., Donald, V. and Judith G.V., John Wiley & Sons Asia Pvt. Ltd. (New Jersey), ISBN: 978-1180-25024.
3. Fundamentals of Enzymology (1999) 3rd ed., Nicholas C.P. and Lewis S., Oxford University Press Inc. (New York), ISBN:0 19 850229 X.
4. Enzymes, (1973), Malcolm Dixon, Edwin Clifford Webb, Prentice Hall Press, ISBN: 0 58 2462177.
5. Biochemical Calculations, (1976) 3nd ed., Irwin H. Segel, John Wiley and Sons ISBN: 0 47 1774219

Course Code: CC-4

Course Title: Enzymes (Prac) 2 Credits

List of practical

1. Purification of alkaline phosphatase from germinating mung bean.
2. Assay of enzyme activity and specific activity of alkaline phosphatase.
3. Effect of pH on enzyme activity
4. Determination of K_m and V_{max} using Lineweaver-Burk graph.
5. Zymogram assay of protein.

Course Code: Generic Elective-2 (Theo) 4 Credits

[**Only for the students of Biochemistry (Hons.)]**

Course Title: Proteins and Enzymes

Introduction to proteins

Polypeptides and proteins. Subunit structures, conjugated proteins, diversity of function. 05 lectures

Isolation and analysis of proteins

Techniques to isolate and analyze proteins- salt fractionation, ion-exchange chromatography, gel permeation, HPLC, SDS-PAGE, and IEF. Protein primary structure - sequencing by Edman degradation, use of enzymes and chemical reagents to obtain overlap peptides. Synthesis of peptides using Merrifeld method. 15 lectures

Introduction to protein three-dimensional structures

Secondary structure- helices and sheets, Ramachandran maps. Nature of non-covalent bonds and covalent bonds in protein folding. Tertiary and quaternary structures. 07 lectures

Myoglobin and haemoglobin - structure and function

Oxygen binding curves, cooperativity models for haemoglobin. 03 lectures

Introduction to enzyme catalysis

Features of enzyme catalysis, superior catalytic power. General mechanisms of catalysis. Nomenclature. 05 lectures

Enzyme Kinetics

Principles of reaction rates, order of reactions and equilibrium constants. Derivation of Michaelis-Menten equation. Significance of K_m and V_{max}. Catalytic efficiency parameters. Competitive and mixed inhibitions. Kinetics and diagnostic plots. Types of irreversible inhibitors. 15 lectures

Mechanisms of enzyme action and regulation

Mechanism of action of chymotrypsin. Inhibitors of enzymes - antibiotics. Allosteric Regulation of enzyme activity and its importance - aspartate transcarbamoylase. 05 lectures

Enzymes in medicine and industry

Enzymes used in clinical biochemistry as reagents, diagnostics and therapy. Role of immobilized enzymes in industry. 05 lectures

Reference Books:

1. Lehninger: Principles of Biochemistry (2013) 6th ed., Nelson, D.L. and Cox, M.M., W.H. Freeman and Company (New York), ISBN: 13; 978-1-4641-0962-1 / ISBN: 10-14641-0962-1.
2. Fundamentals of Enzymology (1999) 3rd ed., Price, N.C and Stevens, L., Oxford University Press Inc., (New York), ISBN:13: 978-0-19-806439-8.

Course Code: Generic Elective-2 (Prac.) **2** Credits

[**Only for the students of Biochemistry (Hons.)]**

Course Title: Proteins and Enzymes

List of Practical

1. Protein estimation by UV absorbance and Biuret method.
2. Protein microassay by Lowry/Bradford method.
3. Ammonium sulphate fractionation of crude homogenate from germinated mung bean.
4. Setting up assay for alkaline phosphatase and activity measurements of the ammonium sulphate fractions (progress curve and effect of pH).
5. Determination of K_m and V_{max} of enzyme enriched fraction.

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