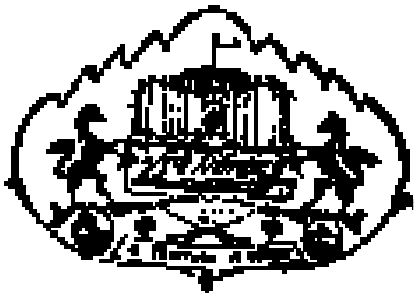
UNIVERSITY OF PUNE,

PUNE



SYLLABUS FOR

(Affiliated colleges)

Master of Science

In

Biochemistry

PART- I

(Semester I and II)

w.e.f. 2010-2011

UNIVERSITY OF PUNE

Syllabus for M. Sc. Biochemistry (Semester System) starting from June 2010

M. Sc. Biochemistry syllabus under Semester System at the affiliated colleges of University of Pune, Pune-411007 will be effective from the academic year 2010. The M. Sc. course in Biochemistry for two years will consist of 2000 marks and will have 1400 marks for theory and 600 marks for practical and project work. Each semester will run for 15 weeks.

			Marks
		Semester I Theory Courses	
BCH	170	Biomolecules	100
BCH	171	Enzymology and Biophysical Techniques	100
BCH	172	Microbiology and Cell Biochemistry of Eukaryotes	100
Semester II Theory Courses			
BCH	270	Bioenergetics and Metabolism	100
BCH	271	Techniques for Characterization of Biomolecules	100
BCH	272	Biostatistics, Bioinformatics and Physiological Biochemistry	100
BCH	273	Membrane Biochemistry and Genetics	100
Practical Courses for Part I			
BCH	167	Analytical Biochemistry I + II	100
BCH	168	Biophysical Techniques and Computers	100
BCH	267	Microbiology and Enzymology	100

* *The teacher can take liberty of introducing latest topics in the respective field. The teacher should also provide sufficient reading material to the student for such new topics/concepts being taught in the classroom*

M. Sc. Biochemistry Part I Syllabus
SEMESTER - I

BCH: 170 BIOMOLECULES

Biomolecules I: Carbohydrates and Lipids

1 **The molecular logic of life**: The chemical unity of diverse living organisms, composition of living matter. Macromolecules and their monomeric subunits. (2)

2 **Properties of water**: With interactions in aqueous systems. Ionization of water, weak acid weak bases. (2)

3 **Carbohydrates**: Classification, basic chemical structure, general reactions and properties, biological significance, Sugar derivatives, deoxy sugars, amino sugars, and sugar acids. (10)

4 **Lipids**: Classification, structure and function of major lipid subclasses-acylglycerols, Lipoproteins, chylomicrons, LDL, HDL and VLDL, rancidity. Formation of micelles, monolayers, bilayer, liposomes. (8)

5 **Vitamins and Co-enzymes**: Classification, watersoluble and fatsoluble vitamins. Structure, dietary requirements, deficiency conditions, coenzyme forms and their mechanism. (8)

Biomolecules II: Proteins

1 **Amino acids**: Classification, Properties, reactions, rare amino acids. (4)

2 **Protein classification**: Reactions, functions, properties and Solid phase synthesis, (5)

3 **Structural levels of protein:** (12)

   a. Primary Structure: Peptide bond, importance of primary structure.
   b. Secondary structure: X ray diffraction, alpha-helix, β - structure, β-helix, super secondary structure.
   c. Tertiary Structure: Forces stabilizing, unfolding/ refolding expt. Prediction of tertiary Structure
   d. Quaternary structure – hemoglobin.

4 End group analysis, sequencing and peptide synthesis (6)

5 Ramachandran plot. (3)

Reference Books:

1. Principles of Biochemistry, Lehninger C Rs. Publ. (1982).
2. Biochemistry, L. Stryer, W.H. Freeman, San Francisco.
3. Schaum's Outline Series of Theory and Problems of Biochemistry, Philip W. Kuchel and G.B. Ralston. Int. Ed., McGraw-Hill Book Co.
4. Problem Approaches in Biochemistry. Wood and Hood.
5. Biochemistry by Voet and voet
6. Biochemistry by Zubay

BCH 171 ENZYMOLOGY AND BIOPHYSICAL TECHNIQUES

Enzymology

1 Historical aspect: Remarkable properties, cofactors, nomenclature, classification, isoenzymes and multienzymes. (2)

2 Enzymes kinetics: One-substrate reactions, effect of pH, temperature, inhibitions, two substrate reactions: theory, order analysis, pre-steady state kinetics, stopped flow technique, relaxation methods. (8)

3 Mechanism of enzymes action: Theoretical background, factors leading to rate enhancement of enzyme catalyzed reactions, acid-base catalysis, proximity and orientation effects, covalent catalysis, strain or distortion and change in environment. Experimental approaches of determination of enzymes mechanism: Kinetics studies, detection of intermediates, X-ray crystallographic studies, chemical modification of amino acid side chain and affinity labeling. Examples of chymotrypsin, triose phosphate isomerases, Lysozymes and Ribonuclease. (8)

4 Regulation of Enzyme activity: Control of activities of single enzyme: Inhibitor molecules, availability of substrate or cofactor and changes in covalent structure of enzymes. Zymogen activation and phosphorylation, dephosphorylation, ligand binding and induced changes, allosteric enzymes, theoretical models, Hill equation, Adair equation, M.W.C. and K.N.F. Models, usefulness of the models. Significance of allosteric and cooperative behavior in enzymes. (8)

5 Enzyme turnover: Kinetics of enzyme turnover, measurement of enzyme turnover, Ks and Kd, correlation between the rates of enzyme turnover and structure and function of enzymes, mechanism of enzyme degradation, significance of enzyme turnover (4)

Reference Books:

1. Fundamentals of Enzymology by Price and Stevens
2. Enzymology by Dixon and Webb
3. Enzymes by Palmer

Biophysical Techniques (Principle, methodology and biological applications)

1 UV and visible Spectophotometry. (2)

2 Membrane filtration and dialysis: Nitrocellulose, fibre glass, Polycarbonate filters, dialysis and Concentration, reverse dialysis, freeze drying and lyophilization. (3)

3 Chromatography techniques: Partition and adsorption Chromatography- paper, TLC, GLC, gel filtration, ion exchange chromatography: properties of ion exchangers, choice, HPLC, HPTLC, affinity chromatography, hydrophobic interaction chromatography, metal chelate chromatography, covalent chromatography. Special chromatographic techniques for nucleic acids: DNA cellulose chromatography, MAK hydroxyl-apatite chromatography, separation of DNA fragments according to their base composition. (16)

4 Electrophoretic techniques: Types of electrophoresis: moving boundary electrophoresis and zone electrophoresis (paper, celluse-acetate electrophoresis, gel Electrophoresis (starch gel, native PAGE, disc PAGE, gradient PAGE, SDS-PAGE, agarose gel electrophoresis, Isoelectric focusing, 2D gel electrophorosis) (6)

5 Isolation, purification and criteria of purity of proteins and enzymes & other biomolecules. (3)

Reference Books :

1. Physical biochemistry by D. Freifelder IInd edition (1982)
2. Biochemical techniques by Wilson and Walker.
3. Biophysical techniques by Upadhye and Upadhye.

BCH 172 MICROBIOLOGY AND CELL BIOCHEMISTRY OF EUKARYOTES

Microbiology

1	Cell structure and components, characterization and classification of microorganisms.	(2)
2	Microscopy: Theory, phase contrast microscopy, fluorescence microscopy and electron microscopy: Theory, specimen preparation, freeze etching, freeze fracture, shadow casting, electron microscopy of nucleic acids, TEM, SEM.	(4)
3	Cultivation of Bacteria, nutrition, physiology and growth of microbial cells, reproduction and growth, synchronous growth, continuous culture of microorganisms.	(4)
4	Pure cultures and their characteristics.	(2)
5	Fundamentals of control of microbial growth control by physical agents and control biochemical agents.	(4)
6	Production of mutants by chemical and physical agents and their characterizations.	(2)
7	Host microbe interactions, endotoxins, exotoxins, capsular material. Enzymatic and other factors, tissue affinity, resistance and immunity.	(4)
8	Viruses of bacteria, plant and animal cells: Structure, classification and life cycle, mycoplasma and viriods, diseases.	(4)
9	Nitrogen fixation: Historical background, nitrogen cycle in nature, symbiotic nitrogen fixation, nitrogenase system, nitrate reductase.	(4)

Reference Books :

1. Microbiology, M.S. Pelczar, R.D. Reid, E.C.S. Chan, Mc Graw Hill, New York (1986).
2. General Microbiology (Vth Edition), R.Y. Stanier, Prentice Hall (1986)
3. Biology of Microorganisms by Brocks
4. Introductory Microbiology, F.C. Ross, Charles Merril Publication (1983).

Cell Biochemistry of Eukaryotes

1	Cell classification, cell variability, size, shape and complexity, function	(2)
2	Animal cell : Structure, sub cellular components: Nucleus, chromosomes, plasma membrane, endoplasmic reticulum, lysosomes, peroxisomes, Golgi apparatus, mitochondria, cytoskeleton, sub-cellular fractionation: Differential and density gradient centrifugation, specific staining of organelles and marker enzymes.	(12)
3	Cell division: mitosis, meiosis and cell cycle	(2)
4	Plant cells: Cell wall and its function, chloroplast, xylem, phloem and epidermal cells. The interaction and communication between the cells, cell-cell reorganization in plants, role of Golgi vesicles in plasma membrane, cell growth and division.	(5)
5	Fungi: Cell structure, classification and biological importance.	(2)
6	Cell-cell adhesion and the extracellular matrix, intercellular recognization, specific cell aggregation in sponges, cell junctions, extracellular matrix and role of collagen, elastin and fibronectin.	(4)

7 Germ cells and fertilization, stem cells, cell differentiation, organogenesis, functional and biochemical maturation of tissues. (3)

Reference Books:

1. Molecular Biology of the cell– Bruce Alberts – J.D. Watson et al Garland publishing Inc., N.Y. (1983) and recent edition.
2. Cell and Molecular Biology – DeRobertis and Saunders (1980).
3. The cell – C.P. Swanson, Prentice Hall (1989)
4. Cell Biology – C.J. Avers, Addision Wesley Co. (1986).
5. Molecular biology by Lodish and Baltimore

SEMESTER II

BCH: 270 BIOENERGETICS AND METABOLISM

Bioenergetics and Metabolism-I

1 Introduction of metabolism and overview. (1)
2 Bioenergetics: Basic low of thermodynamic, internal energy, enthalpy, entropy, concept of free energy, standard free energy change of a chemical reaction, redox potentials, high energy compounds, structure and significance of ATP (3)
3 Glycolysis: Detailed study, energetics, regulation and significance. (4)
4 Citric acid cycle: Detailed study, energetics, regulation and significance. (2)
5 Alternate pathways of carbohydrate metabolism: Pentose phosphate pathway, glyoxalate cycle, glucuronic acid cycle, inter conversion of hexoses, Pasteur effect. (3)
6 Polysaccharide metabolism: Biosynthesis, degradation and regulation of glycogen, starch and cellulose, inborn error of carbohydrate metabolism. (2)
7 Gluconeogenesis (1)
8 Photosynthesis: Intracellular organization of photosynthetic system, fundamental reactions of photosynthesis, light and dark reactions, photosynthetic pigments, role of light, Hill reaction and it's significance. Cyclic and non-cyclic photoinduced electron flow, Photophosphorylation, energetics, photorespiration, Calvin cycle, C3 and C4 pathway, Bacterial photosynthesis. (10)
9 Electron transport chain and oxidative phosphorylation. (3)

Bioenergetics and Metabolism-II

1 Oxidative degradation of amino acids: Proteolysis, transamination, oxidative deamination, acetyl CoA, alpha ketoglutarate, acetoacetyl CoA, succinate, fumarate and oxaloacetate pathway. Decarboxylation, urea cycle, ammonia excretion. (6)
2 Biosynthesis of amino acids: Amino acid biosynthesis, precursor functions of amino acids, biosynthesis of aromatic amino acids, Histidine, one carbon atom transfer by folic acid (Biosynthesis of glycine, serine, cysteine, methionine, threonine.) (9)
3 Inborn errors of amino acid metabolism (2)
4 Peptides, polyamines, porphyrins, gamma glutamyl cycle, glutathione biosynthesis, nonribosomal protein biosynthesis. (4)
5 Purine and pyrimidine degradation. (1)

6 Biosynthesis of purine and pyrimidine nucleotides, regulation and biosynthesis of nucleotide coenzymes. (2)

7 Lipid metabolism: Beta oxidation of even and odd number carbon atoms fatty acids, energetics and regulation. Formation of ketone bodies, other types of fatty acid oxidation. (3)

8 Biosynthesis of lipids: Requirements of carbon dioxide and citrate for biosynthesis, fatty acid synthase complex, regulation of biosynthesis. Biosynthesis of triglycerides, cholesterol and phospholipids. (3)

Reference Books

1. Biochemistry – Lehninger.
2. Metabolic Pathways - Greenberg.
3. Biochemistry – G. Zubay, Addision Wesley Publ. (1983).
4. Biochemistry – Stryer (1988) 3rd Edition W.H. Freeman and Co. Harper's Biochemistry
5. Medical biochemistry by Harper's

BCH-271 TECHNIQUES FOR CHARACTERIZATION OF BIOMOLECULES

Biophysical Techniques

1 Sedimentation: Theory, Preparatory and analytical ultracentrifuges, factors affecting sedimentation velocity, sedimentation coefficient, measurement of S, Zonal centrifugation, DNA analysis, Determination of molecular weight by sedimentation, diffusion and sedimentation equilibrium methods. Specific example of application. (9)

2 Partial specific volume and the diffusion coefficient, Measurement of partial specific volume and diffusion coefficients. (3)

3 Viscosity: Theory, effect of macromolecules on the viscosity of a solution, measurement, molecular weight determination. (3)

4 Isotope Tracer Technique: Types of radiations, measurement scintillation and gamma counters. Background noise quenching, free radicals and raidiolysis of Water and its applications. Interaction of radiation with matter, passage of neutrons through, matter, interaction of gamma rays with matter, units of measuring radiation absorption, Radiation dosimetry. (7)

5 Autoradiography (3)

6 Atomic Absorption Spectroscopy (2)

7 X-Ray diffraction studies (3)

Structure determination of Biomolecules

1 Spectroscopic methods: (a) NMR, (b) ESR, (c) IR, (d) Fluroscence, (e) ORD and CD (16)

2 Mass Spectrometry: LCMS, GCMS, MALDI-MS, MALDI-TOF-MS (10)

3 Biosensors (4)

Reference Books:

1. Physical Biochemistry by D. Freifelder IInd Edition Freeman publication (1982)
2. Biochemical techniques by Wilson and Walker.
3. Biophysical techniques by Upadhye and Upadhye.

4. Biochemistry by L. Stryer 4th edition
5. Molecular biology of gene by J. D. Watson
6. Fundamentals of biochemistry by D. Voet, J. Voet and C.W. Prott
7. Molecular cell biology 4th ed. Lodish B., Zipursky Matsudaira, Ball

BCH-272 BIOSTATISTICS, BIOINFORMATICS AND PHYSIOLOGICAL BIOCHEMISTRY

Biostatistics

Principles and practice of statistical methods in biological research, samples and populations, Basic statistics-average, statistics of dispersion, coefficient of variation, confidence limits, Probability distribution, normal, binomial and Poisson distribution. Mean variants, standard deviations and standard error, correlation and regression, test of statistical significance, and analysis of variance, latest software, introduction of softwares, exercise on biochemical problems. (12)

Bioinformatics (8)

Introduction, DNA sequence databases- GenBank, Protein sequence database- SwissProt, Sequence alignment and analysis, Global and Local alignment, BLAST, FASTA, CLUSTALW, Protein structure database (PDB), structure visualization

Physiological Biochemistry (40)

1 Muscle contraction and cell motility: skeletal muscle structure of muscle cell, ultra structural organization, protein components of myofibrils, molecular organization of thick and thin filaments, mechanism of muscle contraction, metabolism of muscle, cardiac muscle contraction, regulation of contraction, contractile proteins in cells other than muscle filaments, microfilaments, microtubules, cilia and flagella of eukaryotic cells

2 Liver: anatomy, physiological functions, Liver function tests, Liver disorders:- hepatitis, cirrhosis, Jaundice: etiology and symptoms

3 Kidney: anatomy, physiological functions, diseases/disorder, diagnostic tests

4 Respiration: Principles of gaseous exchange during respiration, Bohr effect, transport of oxygen and carbon dioxide in the blood, regulation of respiration.

5 Digestion and Absorption of food: •Generalized structure of digestive tract and associated digestive gland. Function of different parts- peristalsis, regulation of saliva, gastric, pancreatic, Intestinal and bile secretion (i.e. digestion), Absorption – (carbohydrate, protein, lipid, minerals and vitamin) transport and excretion of nutrients.

6 Biochemistry of blood clotting , clotting factors, intrinsic and extrinsic pathways, mechanism of formation of thrombin, fibrin, fibrin clot, role of vitamin K clotting process, lysis of fibrin clot. Conditions that cause excessive bleeding in humans.

7 Regulation of acid-base balance, types and functions of acid-base buffers, clinical abnormalities associated with acid-base imbalance.

Reference Books

1. Biochemistry, L Stryer, Freeman and Co, NY
2. Biochemistry, Zubay, Addison Wesley and Co.
3. Textbook of Physiology, Guyton
4. Physiology, Berne and Levy

5. Harper's Biochemistry- 27th edition
6. Text book of Human Biochemistry- Ed. G. P. Talwar

BCH 273 MEMBRANE BIOCHEMISTRY AND GENETICS

Membrane Biochemistry

1	Biological membrane, structure, and assembly: Constituents, asymmetry, flip flop, protein lipid interaction, factors affecting physical properties of membranes. Membrane models: biological and physical model, membrane associated diseases	(6)
2	Membrane transport: Diffusion, passive, active and facilitated, transport role of proteins in the process, exocytosis, receptor mediated endocytosis, osmoregulation and ATP-ADP exchanger.	(7)
3	Na, H dependent processes and phosphotransferase synthesis, specialized mechanism for transport of macromolecules, gap junctions, nuclear pores, toxins, control of transport processes and binding proteins.	(6)
4	Role of Na, K ATPase and passive permeability of the plasma membrane to Na, K and Cl, voltage and ligand gated ion channels.	(3)
5	Molecular mechanisms, ionophores, ion translocating antibiotics, valinomycin, gramicidin, ouabain, group translocation.	(3)
6	Drug transport: How antimicrobial agents and lipozomes reach their targets, cellular permeability, barrier to drug penetration, some examples of modes of penetration of antimicrobial agents.	(4)
7	Assembly of virus membrane receptor	(1)

Genetics

1	Molecules of Heredity: Structure of DNA and RNA, DNA as genetic material, double helix, semi conservative mechanism of replication, nearest neighbor analysis, denaturation and renaturation, A, B, and Z forms of DNA.	(6)
2	Laws of Heredity: Genotype, Phenotype and Mendelian Laws of inheritance.	(3)
3	Basis of Biochemical genetics: Concept of gene by Benzer, One gene one cistron, complementation tests and Co-linearity.	(3)
4	Auxotroph, prototroph, conditional mutants, mutant isolation and selection. Transformation, conjugation and transduction.	(6)
5	Sex factors and Plasmids: Fertility factor, Hfr, mapping of *E. coli* chromosome, Cloning vectors: Plasmids, phases, cosmids. Introduction to Operon.	(5)
6	Genetic Code: Biochemical and genetic analysis of the genetic code.	(2)
7	Genetic disorders: Chromosomal origin, gene origin –mutation, human teratogenesis.	(3)
8	Specialized genetic systems of fungi: Tetrad Analysis. \	(2)

Reference Books:

1. Biochemistry of antimicrobial action- 4th edition, Chapman and Hall , TJ Franklin and GA Show
2. Biochemistry-G Zubay , Addison Wesley, 1983
3. Biochemistry, L Stryer, 3rd/4th/5th ed, 1989 , Freeman and Co. NY
4. Principles of Biochemistry –Lehninger

5. Biochemistry with clinical correlation- Thomas Devlin, 2nd ed, John Wiley and sons
6. Membranes and their cellular functions- IB Filnean, R.Coleman and RH Michell, 1984, Blackwell scientific publishers, Oxford, 3rd ed.
7. Genetics – Strickberger M.W., Macmillan Pub;. Inc. (1976).
8. 36 Lectures in Biology – S.E. Luria, M.I.T. Press, Cambridge (1975).
9. The Genetics of Bacterial viruses – William Hayes, PBS Publ. (1984).
10. Molecular Biology of the Gene- Watson Benjamin / Cummings Publ. Company (1987).
11. Genetics Analysis and Principles: R.J. Brooker Addison-Wesley.

BCH 167 ANALYTICAL BIOCHEMISTRY I AND II

1. Separation of amino acid mixture by Paper chromatography
2. Estimation of amino acid by Ninhydrin method
3. Estimation of protein by Biuret method
4. Estimation of protein by Lowry et.al method.
5. Estimation of protein by Bradford method
6. Specific reactions for Carbohydrate
7. Estimation of sugar by Folin-wu method
8. Estimation of sugar by Ferricyanide method
9. Estimation of sugar by DNSA method
10. Identification of carbohydrate mixture with suitable tests.
11. Isolation of amino acid cystine from hair hydrolysate.
12. Isolation of Egg albumin and globulin.
13. Isolation of milk casein by IpH precipitation.
14. Isolation of Starch and characterization.
15. Alpha and Beta amylolysis.
16. Isolation of Cholesterol and lecithin from egg.
17. Estimation of Vitamin C from lemon fruits.
18. Isolation of Lipid and estimations.
19. Determination on alpha amino nitrogen of amino acid.
20. Estimation of inorganic phosphorus by Fiske-Subbarow method.

Reference Books

1. Practical Biochemistry: Principles and techniques: K. Wilson and J. Walker.
2. Practical Biochemistry by David Plummer
3. Introductory Practical Biochemistry by S.K. Sawhney and R.Singh.

BCH 168 BIOPHYSICAL TECHNIQUES AND COMPUTERS

Biophysical Techniques

1. Concept of pH, preparation of buffer of desired pH and molarity and measurement of pH.
2. pH metry: Acid base titration curves. Measurement of pKa of amino acids.
3. Ion exchange chromatography: Nature of ion exchanger, capacity of column, Separation of amino acids.
4. Gel filtration: Determination of void volume, Determination of partition coefficient, and Separation of two components in a sample.

5. Viscosity: Viscosity of hydrolyzed, partially hydrolyzed and unhydrolyzed starch. Determination of relative viscosity, Specific viscosity and intrinsic viscosity.
6. Electrophoresis: Separation of serum proteins by paper or agarose gel electrophoresis/Polyacrylamide Gel electrophoresis (PAGE).
7. UV and Visible Spectrophotometry: Absorption spectra, Varification of Lamberts-Beer's Law, absorption spectrum of proteins and amino acids, Absorption spectra of hemoglobin derivatives – oxyhemoglobin, carboxyhemoglobin and methemoglobin.
8. Dialysis, reverse dialysis and membrane filtration.
9. RBC membrane fragility.

Reference Books:

1. An introduction to practical Biochemistry – David T. Plummer, Tata Mc Graw Hill Co. Ltd., Bombay.
2. Introductory Practical Biochemistry (2001). Ed. S.K. Sawhney and Randhir Singh.
3. Practical Biochemistry Sadasivam and Manickam.
4. Practical Biochemistry, Principles and Techniques (1995). Ed. Keith Wilson and John Walker.

Computer Programming

The student is expected to write and execute at least six of the following or similar computer programs in BASIC/Fortran/C

1. Linear regression
2. Quadratic equation
3. Simulation of pH titration
4. Michaelis Menten enzyme kinetics
5. Analysis of amino acid sequences
6. Analysis of DNA sequences, Complementary sequences, repeat frequencies, etc
7. Handling of atomic co-ordinates, files and distance statistics in large molecules
8. Determination of number of covalent or weak bonds from the given atomic co-ordinate files of a protein molecule. These programs are only indicative. The instructor may choose other programs to illustrate the use of computers in chemistry.

Reference Books:

1. Computers and Common Sense- *R. Hunt and Shelley*, Prentice Hall, New Delhi (1998).
2. Computer Programming in FORTRAN-90- *V. Rajaraman*, Prentice Hall, New Delhi (1990).
3. Computing for Biologists- *A. Fielding*, Addison Wesley Pub., UK (1985).
4. Microcomputers in Biochemical Education- *E. J. Wood (Ed)*, Taylor and Francis Ltd., UK (1984).
5. Computer Games and Simulation for Biochemical Engineering- *H. R. Bungay*, John Wiley and Sons Ltd., New York (1985).
6. Microcomputers in Biology- A practical approach- *C. R. Ireland and S.P. Lang*, IRL Press Ltd., (1985)

BCH 267 MICROBIOLOGY AND ENZYMOLOGY

Microbial Techniques

1. Media preparation, pour plate and streak plate techniques,
2. Microscopic examination (motility, monochrome staining and gram staining).
3. Sterilization: Steam, Dry heat and filter.
4. Detection of amylase, caseinase, catalase activity
5. Preservations of bacterial cultures.
6. Phosphatase test for the quality of milk
7. Methylene blue reduction test (MBRT) for quality of milk
8. Growth curve of *E. coli*.
9. Total viable count determination (pour plate and spread plate).
10. Ultraviolet irradiation and survival curve.
11. Isolation of auxotrophic mutants.
12. Plaque assay for phage.
13. Immobilization of yeast cells
14. Microbial assay of vitamin and antibiotic.
15. Transformation
16. Lac operon by studying β-galactosidase

Reference Books :

1. Microbial methods – J.Collins.
2. Medical Microbiology, Vol. II – Cruickschank.

Enzymology

1. Detection of some common enzymes.
2. Extraction and Isolation of enzyme invertase/amylase/peroxidase/catalase.
3. Study of specific activity and progress curve.
4. To Asses effect of substrate conc.(Vmax and Km)on enzyme activity.
5. To Asses effect of pH on enzyme activity.
6. To Asses effect of enzyme conc.
7. To Asses temperature stability of the enzyme.
8. To Asses effect of activator on enzyme activity.
9. To Asses effect of inhibitor on enzyme activity.
10. Effect of enzyme immobilization on its activity.
11. Statistical analysis of data

Reference Books:

1. Biochemical Techniques Theory and Practice: J.R. Robyt and B.J. White.
2. Practical Biochemistry: Principles and techniques: K. Wilson and J. Walker.
3. Practical Biochemistry by David Plummer
4. Introductory Practical Biochemistry by S.K. Sawhney and R.Singh