

NORTH MAHARASHTRA UNIVERSITY
JALGAON - 425 004

SYLLABUS

FOR

M.Sc. POLYMER SCIENCE

SEMESTER I

DEPARTMENT OF LIFE SCIENCES

NORTH MAHARASHTRA UNIVERSITY, JALGAON

SYLLABUS OF M.Sc. BIOCHEMISTRY

FIRST YEAR

SEMESTER - I

BC	-	101	:	Biomolecules.
UNIT	-	1	:	Biomolecules. I. Proteins.
UNIT	-	2	:	Biomolecules. II. Carbohydrates, Lipids etc.
BC	-	102A	:	Biophysical and Biorganic Chemistry.
UNIT	-	3	:	Biophysical Chemistry.
UNIT	-	4	:	Biorganic Chemistry.
				OR
BC	-	102B	:	Thermodynamics and Organic Chemistry.
UNIT-		3	:	Thermodynamics.
UNIT-		4	:	Biorganic Chemistry.
BC	-	103	:	Microbiology and Cell Biology
UNIT	-	5	:	Microbiology and Virology.
UNIT	-	6	:	Cell Biology.

SEMESTER - II

BC	-	201	:	Metabolism.
UNIT	-	7	:	Metabolism I. Bioenergetics & Metabolism.
UNIT	-	8	:	Metabolism II. Nitrogen Metabolism
BC	-	202	:	Biophysical Techniques.
UNIT	-	9	:	Biophysical Techniques I.
UNIT	-	10	:	Biophysical Techniques II.
BC	-	203	:	Physiology and Plant Biochemistry.
UNIT	-	11	:	Physiological Biochemistry I.
UNIT	-	12	:	Plant Biochemistry.
BC	-	204	:	Enzymology and Genetics.
UNIT	-	13	:	Enzymology
UNIT	-	14	:	Molecular Genetics and Statistics.

PRACTICAL UNITS OF M.Sc. 1st YEAR

BC	-	104	:	Laboratory Course I.
UNIT	-	15	:	Analytical Biochemistry I.
UNIT	-	16	:	Analytical Biochemistry II
BC	-	205	:	Laboratory Course II.
UNIT	-	17	:	Microbial Techniques.
UNIT	-	18	:	Practicals in Plant Biochemistry.
BC	-	206	:	Laboratory Course III.
UNIT	-	19	:	COMPUTER.
UNIT	-	20	:	Experiments in Biophysical Chemistry.

M.Sc. BIOCHEMISTRY IInd YEAR

THEORY UNITS

SEMESTER - III

BC - 301	:	Molecular Biology.
UNIT - 22	:	Molecular Biology. I
UNIT - 23	:	Molecular Biology. II
BC - 302	:	Medical Biochemistry and Immunology.
UNIT - 24	:	Medical Biochemistry.
UNIT - 25	:	Immunology.
BC - 303	:	Biochemistry of Membrane & Specialized Tissues.
UNIT - 26	:	Membrane Biochemistry.
UNIT - 27	:	Biochemistry of Specialized Tissues.

OPTIONAL COURSES

BC - 304	:	Advanced Biochemistry (Any two of the following units.)
UNIT - 28	:	Biophysics.
UNIT - 29	:	Environmental Toxicology.
UNIT - 30	:	Secondary Metabolism.
UNIT - 31	:	Radiation Biology.
UNIT - 32	:	Human Genetics.

Different combinations of units for P. course BC-304

(A)	28	#	29
(B)	28	#	30
(C)	28	#	31
(D)	28	#	32
(E)	29	#	30
(F)	29	#	31
(G)	29	#	32
(H)	30	#	31
(I)	30	#	32
(J)	31	#	32

SEMESTER - IV

BC - 401	:	Genetic Engineering - Molecular Biochemistry.
UNIT - 33	:	Genetic Engineering.
UNIT - 34	:	Molecular Biochemistry.
BC - 402	:	Physiological Endocrinology
UNIT - 35	:	Physiological Biochemistry II
UNIT - 36	:	Biochemical Endocrinology

BC = 403 optional course I : BIOTECHNOLOGY

(Any two)

UNIT - 37 : BIOTECHNOLOGY I.
UNIT - 38 : BIOTECHNOLOGY II.
UNIT - 39 : BIOTECHNOLOGY III.
UNIT - 40 : BIOTECHNOLOGY IV.

Different combinations of units for the course BC-403

(A) 37 # 38
(B) 37 # 39
(C) 37 # 40
(D) 38 # 39
(E) 38 # 40
(F) 39 # 40

BC = 404 : OPTIONAL COURSE II.

(Any two of the following units)

UNIT - 41 : Clinical Nutrition.
UNIT - 42 : Neuroscience.
UNIT - 43 : MOLECULAR EVOLUTION.

Different combinations of units for the course BC-404

(A) 41 # 42
(B) 41 # 43
(C) 42 # 43

PRACTICAL UNITS OF M.Sc. IIInd YEAR

BC - 305 : LABORATORY COURSE IV.
UNIT -44 : MOLECULAR BIOLOGY AND IMMUNOLOGY.
UNIT -45 : ENZYMOLOGY.

BC - 405 : LABORATORY COURSE V.
UNIT -46 : CLINICAL BIOCHEMISTRY.
UNIT -47 : TISSUE CULTURE.

BC - 406 : LABORATORY COURSE VI.
UNIT -48 & : PROJECT.
49

Important Note: For all theory courses, the question paper should include at least 20% weightage for problem solving.

M.Sc. Biochemistry Detailed Syllabus

Course BC - 101

UNIT 1 : Biomolecules I - Proteins

1. Amino acids: - Classification, Properties, reactions. rare amino acids separation techniques.
2. Protein classification: Reactions, functions, properties, peptide synthesis, Solid phase synthesis.
3. Structure:
 - a) Peptide bond end group analysis, sequencing.
 - b) Secondary-alpha-helix beta-structure, 310 helix, super secondary structure.
 - c) Tertiary Structure: Forces Stabilizing, unfolding/refolding expt. Prediction of Tertiary Structure.
 - d) Quaternary structure-haemoglobin.
 - e) Ramachandran plot.
 - f) Helix coil transitions Van der Waals electrostatic, helix bonding, and hydrophobic interactions.
 - g) Energy terms in Biopolymer conformational calculation
4. Globular Proteins.
5. Protein purification: Chromatography, electrophoresis, crystallisation etc. Determination of protein concentration and molecular weight etc., criteria of purity of proteins.
6. Fibrous proteins.
7. Protein evolution.

BOOKS

1. Principles of Biochemistry, Lehninger CBS, 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.S. Kalston, Int. Ed., McGraw-Hill Books Co.
4. Problem approaches in Biochemistry, Wood and Hood.

UNIT 2 : BIOMOLECULE II CARBOHYDRATES AND LIPIDS

1. Composition of living matter.
2. Properties of water.
3. Carbohydrates: Basic chemical structure-hemiacetals and ring forms, anomers, epimers, deoxy sugars, amino sugars and sugar acids, Mono, Oligo and Polysaccharides, Methylation and periodic oxidations, structure and function of complex carbohydrates, chitin, starch, glycogen, mucopolysaccharides and glycoproteins, etc.
4. Lipids: Classification, structure and function of major lipid subclasses, acylglycerols, phosphoglycerides, sphingolipids, waxes, terpenes, steroids and prostaglandins, lipoproteins.

Circulating lipids: Chylomicrons LDL, HDL and VLDL, etc.
Free fatty acids Pathological changes in lipid levels,
Micelles, Monolayers and liposomes.

5. Vitamins and Co-enzymes.

BOOKS

1. Biochemistry, L. Stryer, W.H. Freeman, San Francisco.
2. Harper's Review of Biochemistry, Lange Medical Pub, Calif.
3. Biochemistry, Lehninger.
4. Schaum's outline series of Theory and problems of Biochemistry, P.W. Kuchel and G.B. Ralston, Int. Ed., McGraw-Hill Books Co.
5. Vitamins and Co-enzymes-Wagner and Flocker.

COURSE EC-102 - A

UNIT 3 : BIOPHYSICAL CHEMISTRY

Thermodynamics: First and second laws of thermodynamics. Internal energy, enthalpy, entropy, free energy and work functions. Hydrophobic effects, free energy changes in Biological transformations. High energy compounds, redox potentials, effect of temperature and other variables. Thermodynamics of coordinate bond formation, stability of complexes, metal complexes of Biological importance examples and role of iron in Hemoglobin, Mo in oxidases, Co in vitamin B-12, Mg in Chlorophyll. Metal enzyme complexes, protein-metal interactions, Transition state theory and its importance to bio-chemical reactions.

Nuclear Radiation Chemistry. Discovery, decay characteristics alpha, beta decay and nuclear excitation. Detection of radioactivity: Geiger-Muller counter, scintillation counters, GM Counter, Scintillation counter. Counting errors. Interaction of radiation with matter, passage of neutrons through matter, interaction of gamma rays with matter, units of measuring radiation, absorption, Radiation dosimetry, Radiolysis of water, free radicals in water.

BOOKS

1. Physical Biochemistry, Kennel, Edward V., ed., Prentice Hall (1971).
2. Biochemical Calculations, Segal, John Wiley and Sons (1976)
3. Essentials of Nuclear Chemistry H.J. Arnikar, Wiley Eastern Ltd.

UNIT - 4 : BIOORGANIC CHEMISTRY

Structure of atoms: Nuclear isotopes, radioactivity, electronic configuration. Atomic and molecular orbitals. Bond formation, covalent, electrovalent; Weak interactions. Van der Waal's forces, intermolecular and intramolecular associations; Hydrogen bonds; Hydrophilic and hydrophobic interactions.

Acids and bases; inductive, resonance and steric effects; dipole moment,

Structural isomerism, Geometric isomerism, Optical isomerism, Conformational isomerism.

Asymmetric carbon; R. and S. configuration, enantiomers, diastereomers.

Conformational isomerism in alkalies, cyclohexanes, peptides, hexoses.

Features of organic reaction mechanism: elimination, aromatic substitution, condensation, rearrangements.

Examples from biochemical reactions.

Special characteristics of enzyme catalysed reactions. Mechanisms and functions of important cofactors and coenzymes.

Functional groups in biomolecules; Formation and reaction of alcohols, thiols, amines, vicinal thiols, aldehydes and ketones, acids esters, thiol esters, amides, ethers, sulphides and disulphides, Examples derived from biochemical reactions.

Free radicals in biochemical reactions

Heterocycles associated with biomolecules.

1. Organic Chemistry R.T. Morrison and R.N. Boyd Allyn and Bacon Inc.
2. Biochemistry edited by Zubay, Addison Wesley (1983).

CH 103

UNIT - 5 : MICROBIOLOGY AND VIROLOGY

1. Characterization and classification of microorganisms
2. Cell wall structure of peptidoglycon and other cell wall components.
3. Cultivation of Bacteria, nutrition, physiology and growth of microbial cells.
4. Reproduction and growth, synchronous growth, continuous culture of microorganisms.
5. Pure cultures and cultural characteristics
6. Fundamentals of control of microbial growth, control by physical agents, control by chemical agents.
7. Production of mutants by chemical and physical agents and their characterizations.
8. Host Microbe Interactions, endotoxins, exotoxins, capsular material. Enzymatic and other factors, tissue affinity, resistance and immunity.
9. Viruses, bacterial, plant and animal cells, structure classification, life cycle, Mycoplasma and viroids.

REFERENCES BOOKS

1. Microbiology. M.S.Petezar, K.S. Read, E.S. Chan McGraw Hill (1986) New York.
2. General Microbiology (Fifth edition). R.Y. Stanier et.al. Prentice Hall. (1986).
3. Biochemical Engineering. S.Aiba : A.N.Humphrey, Nancy F. Mills, University of Tokyo Press. (1978)
4. Introductory Microbiology. F.C.Ross. Charles Merrill Publication (1983).

UNIT - 6 : CELL BIOLOGY

1. Cell classification cell variability size, shape, complexity function.
2. Prokaryotes, cell structure and components.
3. Eukaryotic cell: structure, subcellular components: Nucleus chromosomes, plasma membrane, cell wall, endoplasmic reticulum, lysosomes, peroxisomes, golgi apparatus, mitochondria, cytoskeleton, pili, flagellum, subcellular fractionation, differential and density gradient centrifugation, specific staining of organelles or marker enzymes.
4. Cell division, mitosis and meiosis. cell cycle.
5. Plant cells: Cell wall and its function, xylem, phloem, and epidermal cells. The interaction and communication between the cells; cell cell recognition in plants. role of golgi vesicles in plasma membrane, cell growth and division.
6. Cell - cell adhesion and the extracellular matrix. species specific cell aggregation in sponges, cell junction, extracellular matrix.
7. Germ cells and fertilization, cell differentiation, organogenesis, functional and biochemical maturation of tissues. Placentation, Amniocentesis, Teratogenesis.
8. Differentiated cells and maintenance of tissues. Tissue with permanent cells, lens, photoreceptor cells of the retina, rod cells and cone cells liver cells, endothelial cells of the blood vessels, stem cells, humen of gut, epidermal cells blood cell formation osteoblasts, cartilage.
9. Cell aging and senescence.

BOOKS

1. Molecular Biology of the Cell Bruce Alberts - (J.Watson et al) Garland Publishing Inc. N.Y. (1983).
2. Cell Biology G.L.Avers. Addison Wesley Co. (1985).
3. Biology M Curtis. Worth Publ. (1986).
4. Molecular Cell Biology James Darnell (D Baltimore) W.H. Freeman (1986)
5. Cell and Molecular Biology DeRobertis. Saunders (1980)
6. The Cell C.P. Swanson (1989) Prentice Hall.

COURSE : 201

UNIT = 7 : METABOLISM I

1. Survey of metabolism-carbon, oxygen, nitrogen cyclic catabolism. use of mutants and isotopes in the study of metabolism, compartmentalisation. Food chain and energy flow.
2. Cell bioenergetics- concept of free energy, standard free energy change of a chemical reaction, ATP and high energy phosphate compounds.
3. Glycolysis-anaerobic pathway of glucose metabolism. Two phases of glycolysis, Detailed study of all the reactions, entry of other carbohydrates in glycolytic pathway. energy balance sheet. Regulation of glycolytic sequence by enzymes and hormones, alcoholic fermentations.
4. Citric acid cycle-aerobic pathway of glucose metabolism, historical background, details of the cycle, use of isotope for study of citric acid cycle, energetics of the cycle.
5. Alternate pathways of carbohydrate metabolism, Pentose phosphate pathway, glyoxylate cycle, glucuronic acid cycle interconversion of hexoses, Pasteur effect.
6. Lipid metabolism. Fatty acid metabolism-Beta oxidation of unsaturated fatty acids, the phases of fatty acid oxidation, energetics of beta oxidation, oxidation of fatty acids with odd no of carbon atoms, formation of ketone bodies. Other types of fatty acids oxidation.
7. Integration of lipid and carbohydrate metabolism.
8. Biosynthesis of lipids - requirements of Co₂ and citrate for biosynthesis, fatty acid synthetase complex, regulation of fatty acid biosynthesis. Biosynthesis of triglycerides.
9. Electron transport chain and oxidative phosphorylation.

Books:

Same as in Unit - 18.

UNIT = 8 : 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.
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).
3. Peptides, polyamines, Porphyrins, gamma glutamyl cycle, glutathione biosynthesis, Nonribosomal Protein Biosynthesis.
4. Purine pyrimidine degradation.
5. Biosynthesis of Purine and pyrimidine nucleotides. Regulation. Biosynthesis of nucleotide coenzymes.
6. Gluconeogenesis, Glycogen, starch and cellulose biosynthesis
7. Cholesterol Biosynthesis.

Books :

1. Biochemistry - Lehninger.
2. Metabolic Pathways - Greenberg.
3. Biochemistry - G. Zubay Addison Wesley Publ. (1983).
4. Biochemistry - Stryer (1988) 3rd Ed., W.H. Freeman and Co.

COURSE : BC = 202

UNIT = 9 : BIOPHYSICAL TECHNIQUES - I

1. Theory, phase contrast microscopy, fluorescence microscopy.
2. Electron microscopy: Theory, specimen preparation, freeze etching, freeze fracture, shadow casting, electron microscopy of nucleic acids, TEM, SEM.
3. Measurement of pH: pH, glass electrode, pH meter, buffers electrodes sensitive to other ions.

4. UV and visible spectrophotometry.
5. Membrane filter and dialysis : Nitrocellulose, fiber glass, Polycarbonate, Dialysis and concentration.
6. Chromatography: partition-paper, TLC, GLC, adsorption, Gel chromatography, theory, materials, advantages, molecular weight determination and other applications, ion exchange chromatography-properties of ion exchangers, choice, technique, HPLC, affinity chromatography, Hydrophobic chromatography, DNA-cellulose, MAK, Hydroxyapatite.
7. Electrophoresis : Theory, types, zone, paper, cellulose acetate, Gel electrophoresis, Disc PAGE, parameters, DNA agarose electrophoresis, mol. wt, shape, gyrase assay, Southern, Northern, Western transfers, DNA sequencing, Gradient electrophoresis, Isoelectric focussing, Fingerprinting, Homochromatography.

Books

Same as Unit - 10

UNIT - 10 : BIOPHYSICAL TECHNIQUES II.

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 examples of applications.
2. Partial specific volume, and the diffusion coefficient. Measurement of partial specific volume and diffusion coefficients.
3. Viscosity : Theory, effect of macromolecules on the viscosity of a solution, measurement, molecular weight determination.
4. Isotope tracer Technique : Types of radiations, measurement, scintillation and gamma counters, Back ground noise quenching, Applications.
5. Autoradiography.

Books :

1. Physical Biochemistry, Friefelder 2nd Edition.
2. Biochemical Calculations, Segel J.H. 2nd Edition (1976) Wiley publications.

COURSE : BC - 203

UNIT - 11 : PHYSIOLOGICAL BIOCHEMISTRY I.

1. Food utilization : Ingestion, digestion, absorption, transport, storage and disposal of food nutrients (proteins, carbohydrates, fats, vitamins and minerals)
2. Energy metabolism - factors affecting requirements, measurements, BMR and relation of temperature regulation to basal metabolism.
3. Role of food nutrients - Requirements and allowances. Proteins as building material, amino acid inter relationships, protein quality and metabolism. Factors affecting metabolism. Biochemical basis of causation and detection of anaemias.
4. Minerals and trace elements, osmoregulation.
5. Primary Nutritional diseases : PEM, Starvation-obesity, and Vitamin deficiency disorders.
6. Conditioned nutritional diseases: Anaemias, Diet and allergy, Gastrointestinal Tract disorders, Liver, Biliary tract and Pancreatic disorders.

Books :

1. Roses, Foundations of Nutrition.
2. Human Nutrition and dietetics, Davidson, R., Passmore, J.F. Crock & A.S. Truswell.
3. Human Nutrition, Benjamin, T., Burtrum.
4. An Integrated approach to nutrition, Pyke and Brown.
5. Text book of biochemistry by Devlin, 2nd ed. (1986), Willey & sons.

UNIT - 12 : PLANT BIOCHEMISTRY

1. Special features of plant biochemistry.
2. Photosynthesis : intracellular organisation of photosynthetic systems, fundamental reactions of photosynthesis, light & dark reactions, photosynthetic pigments, role of light, Hill reaction and its significance, photophosphorylation, light reactions, Cyclic and noncyclic photoinduced electron flow, energetics of photosynthesis, photosynthetic phosphorylation, photorespiration, Dark phase of photosynthesis, Calvin cycle, C4 pathway, Bacterial photosynthesis.

3. Nitrogen fixation : historical background, nitrogen cycle in nature, symbiotic nitrogen fixation, nitrogenase system, nitrate reductase.
4. Plant nutrition, fertilizers.
5. Plant diseases, pesticides and insecticides.
6. Plant hormones- auxins, gibberellic acids, cytokinins, etc.
7. Biochemistry of seed germination, seed storage proteins.
8. Gums, pectins, alkaloids, rubber, anthocyanins etc.
9. Bioluminescence.
10. Principles of plant breeding (Conventional and nonconventional) Polyploidy.
11. Plant tissue culture and plant Biotechnology. Haploidy. Somatic hybridization, protoplast fusion, cybrids, Transgenesis, Allopheny.
12. Phytochrome action and circadian rhythm.

Books

1. Biochemistry of Green plants. David Keegman, Prentice Hall India (1977).
2. Plant physiology, Deter Hess, Springer International Student Edition (1981).

COURSE : BC = 204

UNIT = 13 : ENZYMOLOGY

1. Historical perspectives.
2. Isolation purification criteria of purity.
3. Enzyme kinetics : One substrate reactions. pH, temperature. Two substrate reactions. Theory, ordered, analysis. Stopped flow technique. Relaxation methods.
4. Mechanism of enzyme actions : Orientation effect, acid base catalysis, microenvironment, experimental approaches to study mechanisms of enzyme reactions-kinetic studies, detection of modification, affinity labelling. Examples of chymotrypsin, triose phosphate isomerases, aldolase etc. Active site studies.

5. Control of enzyme activity : inhibitors, availability of substrates, cofactors, product inhibition.
 - a) Changes in covalent structures-Enzyme activation, phosphorylation.
 - b) Ligand induced changes: Allosteric enzymes, Theoretical models. Hill equation. M.W.C and R.N.F. model. Negative cooperativity, significance.
 - c) Control of metabolic pathway : signal amplification by substrate cycles, and Interconvertible enzyme cycles. examples.
6. Multienzyme complex : properties. pyruvate dehydrogenase system. Tryptophan synthetase, fatty acid synthase glycogen particle.
7. Enzyme turn over : Measurement correlation with function synthesis degradation, significance.
8. Clinical aspects of enzymology : LDH isozymes, SGOT, SGPT, creatine kinase, alpha amylase, phosphatase, inborn errors.
9. Enzyme technology : Immobilized enzymes. Enzyme electrodes, ELISA, Enzyme therapy.

Books :

1. Enzymes, Graddon G. Hammer. Academic Press (1984).
2. Biochemical Calculation 2nd Edition Irwin, egal, John Wiley and Sons, New York (1976).
3. Proteins and enzymes, G.E. Reed and E.T. Bell Prentice Hall Inc. (1988).
4. Fundamentals of Enzymology. M.C. Price and L. Stevens.

UNIT - 14 : MOLECULAR GENETICS AND STATISTICS

1. Molecules of Heredity : Structures of DNA and RNA. DNA as genetic material. Double helix. Semi-conservative mechanism of replication. Nearest neighbour analysis. Denaturation and renaturation. A.B.Z. forms of DNA.
2. Laws of Heredity : Genotype. Phenotype Mendelian Laws of inheritance.
3. Basis of Biochemical genetics : One gene one cistron, complementation tests. Collinearity.

4. Molecular basis of Mutagenesis . Mutations by base analogues, specific mutagens like acridine, UV etc. Auxotrophs, prototrophs, conditional mutants. Mutant isolation and selection, Transformation, Transduction, conjugation, Transposition.
5. Sex factors and Plasmids : Fertility factor, Hfr, Mapping of E.coli chromosome, other plasmids.
6. Genetic Code : Biochemical and genetic analysis of the genetic code.
7. Bacteriophages : Life cycle, use of bacterial viruses in genetic studies.
8. Specialised genetic systems of fungi : Tetrad Analysis.
9. Statistics : Probability and statistical testing, Probability rules, chi square, the binomial expansion, coincidence limits, poisson distribution.

Books :

1. Genetics : Strickberger H.W., Macmillan Publ. Inc (1976).
2. 36 Lectures in Biology, S.E. Luria, M.I.T. Press Cambridge (1975).
3. The Genetics of bacterial viruses William Heyes, PBS Publ. (1984).
4. Molecular Biology of the gene, Watson et al Benjamin/Cummings Publ. Company (1987).

M.Sc. FIRST YEAR LABORATORY COURSES BC = 104.

UNIT = 15/16 : ANALYTICAL BIOCHEMISTRY I AND II

1. First aid, hazardous chemicals, antidote for toxic chemicals, Safety in lab, care of glasswares, handling of instruments. Planning, execution and recording of experiments.
2. Amino acid detections (Paper chromatography) and estimations
3. Comparative evaluation of different methods of protein analysis : Lowry, Biuret, Kjeldahl, UV.
4. Comparative evaluations of acid, alkaline and enzymatic hydrolysis of proteins.
5. Carbohydrate detection and estimations.
6. Preparation of Egg albumin and globulin/milk casein/cystine from hair.
7. Starch preparation and characterisation.
8. Alpha and beta amylolysis.
9. Cholesterol and lecithin from egg.
10. Vitamin estimations.
11. Moisture/ash/fibre in food.
12. Lipid detection and estimations.
13. Mineral determination - Mg, Cu, P, Fe etc.
14. Food Toxins -1. Trypsin Inhibitors 2. Aflatoxins.
15. Animal Experiments.

Books

1. Hawk's Physiological Chemistry, Tata McGRAW Hill Book Co Bombay (1981).
2. Experimental Methods in Modern Biochemistry G.Rendina (1971)

COURSE = 205

UNIT = 17 : MICROBIAL TECHNIQUES

1. Media preparation, pour plate and streak plate techniques. Microscopic examination (motility, monochrome staining and gram staining.)
2. Sterilization : Steam, Dry heat and filter.
3. Preservations of bacterial cultures.
4. Growth curve of E. coli.
5. Growth curve of yeast.
6. Total visible count determination. (pour plate and spread plate)
7. Ultraviolet irradiation and survival curve.
8. Isolation of auxotrophic mutants.
9. Plague assay for phage.
10. Methanogenesis.
11. BOD/COD.
12. Microbial assay of vitamin and antibiotic.
13. Alcohol Production.

Books.

1. Microbial methods - J. Collins.
2. Medical Microbiology, Vol. II - Cruickshank.

UNIT = 18 : PRACTICALS IN PLANT BIOCHEMISTRY

COURSE = BC : 206

UNIT = 19 : COMPUTER

1. Computer awareness.
2. Basic programming.
3. Writing of few basic programs related to Biochemistry.
4. Practice on packages.

5. Writing a BASIC program to plot graphs of enzyme kinetic data by a variety of linear transformations and the Michaelis-Menten hyperbolic plots.
6. Write a BASIC program to calculate the π of a dilute salt solution.
7. Write a BASIC program for the analysis of amino acid sequences.
8. Use of a packaged statistical computer program for the statistical analysis.
9. Use of computer program to analyse DNA sequences to find complementary sequences, search repeats, restriction sites, coding sequences, codon usage etc.

Books :

1. Computing for Biologists, A. Fielding (1985), Addison Wesley Publishers, Ltd. Wokingham UK.
2. Microcomputers in Biochemical Education, B.W. Wood (Editor) (1984), Taylor and Francis Ltd. UK.
3. Computer Games and Simulation for Biochemical Engineering H.R. Bungay (1985), John Wiley and Sons Ltd. New York.
4. Microcomputers in Biology : A Practical Approach, C.R. Ireland and S.P. Lang (1985), IRL Press Ltd. UK.

UNIT - 20 : BIOPHYSICAL EXPERIMENTS

1. Concept of pH, Preparation of buffers, pH meter.
2. pKa of amino acids.
3. Partition coefficient.
4. Optical rotation.
5. Viscometry.
6. Osmotic fragility.
7. Refractive index.
8. Freeze drying.
9. Activation analysis; estimation of Cu in milk. Half life.
10. Autoradiography.

11. Conductivity.
12. Electrophoresis.
13. Gel filtration.
14. Ion exchange chromatography.
15. UV and Visible spectrophotometry.

Books :

1. An Introduction to Practical Biochemistry - David T. Plummer
Tata McGraw-Hill Co. Ltd., Bombay.
2. Practical Physical Chemistry - A. Findley and J.A. Kitchner.
Langman.

COURSE = BC 301

UNIT = 22 : Molecular Biology I

1. DNA structure : Dynamic forms of DNA-transitions, supercoiling, topoisomerases, DNA gyrase.
2. Replication : DNA polymerase I, II and III, origin locus, okazaki fragments, replication fork.
3. Repair: Substitution, deletion and insertional mutations, pyrimidine dimer, uracil DNA glycosidase.
4. Gene Rearrangements : Recombination, Holliday structures, rec A,B,C,D proteins, SOS response, mobile genetic elements of *E coli*.
5. Transcription and Splicing : RNA Pol, promoter, Sigma and Rho factors, Initiation, elongation and termination of transcription, post translational modifications of tRNA and rRNA, inhibitors of transcription, RNA Pol I, II and III, alpha Enhancers, 5' capping, 3' poly A tailing, splice site, mechanisms of splicing, ribozyme.

Reference Books

1. Biochemistry (3rd Edition, 1988) International Student Edition. L. Stryer, W.H. Freeman and Co. N.Y.
2. Molecular Biology of the Gene. Volume I and II. (4th Edition 1987), J.D. Watson, N.H. Hopkins, C.W. Roberts, J.A. Steitz.
3. Molecular Cell Biology (1986). J. Darnell, H. Lodish and D. Baltimore, W.H. Freeman and Co.

4. Molecular Biology of the cell (1974), B. Alberts, D. Bray, J. Lewis, M. Raff, K. Roberts and P. Watson, Garland Publishing Inc. N.Y. & London.
5. Genes (2nd Edition, 1985), H. Lewin, John Wiley and Sons N.Y.

UNIT - 23 : MOLECULAR BIOLOGY - II

1. **Protein Synthesis** : Amino acid activation, fidelity, tRNA, Anticodons, Wobble hypothesis, Suppressor mutations, Ribosomal RNAs, Ribosome assembly, Direction of translation, Polyribosomes, f Met-tRNA^f, shine-Dalgarno sequence, Initiation complex, Elongation factors, A and P site peptide bond formation, Release factors, Inhibitors of protein synthesis, Heme controlled inhibitor, Diphtheria toxin.
2. **Control of Gene Expression in Prokaryotes** : Lac operon, Catabolic repression, Arabinose operon, Lambda-regulation of lytic and lysogenic cycle, Attenuation in Trp. operon, stringent response, phase variation in Salmonella.
3. **Eukaryotic Chromosomes and Gene Expression** : Histones, nucleosomes, chromatin ARS, alpha, beta, RNA Pol, Telomeres, Chloroplast mitochondrial DNAs, repeat sequences, centromeres, -DNA Histone genes, globin gene family, Methylation.
4. **Molecular Virology** : DNA and RNA viruses, self assembly of TMV, T4, Replication of RNA virus, Retro virus Retroviruses, SV 40, oncogenes, AIDS, Interferons.

Reference Books :

Same as in Unit 22.

COURSE - BC 302

UNIT - 24 : MEDICAL BIOCHEMISTRY

1. Mechanism of action at molecular level of selected antibiotics, antimetabolites, analgesics, hallucinogens and other drugs, mechanism of resistance to antibiotics and other drugs.
2. Lysosomes and their physiological role.
3. Diseases of cardiovascular system.
4. Cancer - causative agents and control theories of cancer and carcinogenesis, viral etiology, control of cancer - basic approaches.
5. Biochemical basis of infective diseases.

6. Genetic diseases and genetic counselling. Teratogenesis.
7. Blood coagulation, clotting factors, mechanism of coagulation, fibrinolysis, abnormal hemoglobins.

Reference Books

1. Biochemistry of antimicrobial action, 4th Edition. T.J. Franklin and G.A. Snow, Chapman Hall (1989).
2. Mechanism of Microbial Diseases, M. Schaechter et al. Williams and Wilkins International Edition (1989).
3. General Microbiology by Pelczar, Reid and Chain (1987).
4. Biochemistry, L. Stryer, 3rd Edition. (1988), W.H. Freeman and Co. N.Y.
5. Text-Book of Biochemistry with clinical correlations, Thomas M. Devlin, 2nd Edition. (1986) John Wiley & Sons.
6. Biochemical aspects of human diseases (1983), R.L. Elkeles and A.S. Tavill, Blackwell Scientific Publishers, Oxford.
7. Analogues of Nucleic acids, Ray-Berman (1970), Spring Verlag.

UNIT - 25 : IMMUNOLOGY

1. Cellular basis of immunity: immunological memory specificity, diversity, discrimination between self and nonself, primary & secondary lymphoid organs, cell mediated and humoral immune responses. T and B lymphocytes, autoimmune reactions.
2. Antigen and antibody : antigen, antigenic determinant, immunopotency, Structure of antibody: constant and variable regions. Fab, F(ab)2 & Fc fragments, different classes of antibodies and their functions. Fine structure of antibodies: X-ray diffraction studies, isotypes, allotypes and idiotypes.
3. Measurement of antigen-antibody interaction -diffusion, immunodiffusion, immunoelectrophoresis, radioimmunoassay, immunofluorescence, ELISA, Western blotting.
4. Clonal selection theory of antibody production. Monoclonal and polyclonal antibodies.
5. Complement system : classical and alternate pathway.

6. T lymphocytes and cell mediated immunity. T cell subpopulations. immune response genes. MHC gene complex polymorphism, graft rejection. graft versus host response.
7. Hypersensitivity. immunodeficiency diseases.
8. Vaccines. interferon. AIDS.
9. Blood antigens : blood group substances and Rh factor.

Reference Books

1. Molecular biology of the cell, Garland Publishing Inc., New York & London.
2. Biochemistry-L Stryer. Third Edition, 1988. Freeman and Company. New York.
3. Essentials of immunology (5th Edition) Roitt. Blackwell Scientific Publishing. London.
4. Basic and clinical immunology. Lange Medical Publication Maruzen Asia.

COURSE = 303

UNIT = 26 : MEMBRANE BIOCHEMISTRY

1. Biological membrane, structure and assembly : constituents. bacterial cell envelope, asymmetry-flip-flop. protein-lipid interaction. factors affecting physical properties of membranes.
2. Membrane models : biological and physical models : Energetics and transduction phenomena. biochemical chemiosmotic hypothesis of Mitchell.
3. Assembly of virus membrane receptor.
4. M. Transport : diffusion. passive. active and facilitated transports. role of proteins in the process. Exocytosis. receptor mediated endocytosis. osmoregulation.
5. Na^+ , H^+ dependent processes and phosphotransferase synthesis specialized mechanism for transport of macromolecules (gap junctions, nuclear pores. toxins. control of transport processes, binding proteins. hormone effects and the role of lipide).

6. Role of Na^+ , K^+ ATPase and the passive permeability of the plasmalemma to Na^+ , K^+ and Cl^- , voltage and ligand gated ion channels ATP-ADP exchanger.
7. Molecular mechanisms, ion translocating antibodies, valinomycin, gramicidin, ouabain, group translocation, ionophores, electrical gradient. Energy coupling mechanism.
8. Penetrating the defenses: how antimicrobial agents reach their targets, cellular permeability barrier to drug penetration, some examples, of modes of penetration of antimicrobial agents, the exploitation of transport systems in the design of new antimicrobial agents.

Reference Books

1. Biochemistry of antimicrobial action, 4th Edition. Chapman and Hall T.J. Franklin & G.A. Snow (BCL).
2. Biochemistry; G. Zubay. Adison Wesley, 1983.
3. Biochemistry. Stryer. 3rd Edition. 1989. Freeman & Co. N.Y.
4. Principles of Biochemistry. Lehninger.
5. Biochemistry with Clinical Correlation, Thoms M. Dehlin, 2nd Edition, 1986, John Wiley & Sons.
6. Membranes and their Cellular functions, I.B. Filnean, R Coleman and R.H. Michell, 1984, Blackwell Scientific Publishers, Oxford, 3rd Edition.

UNIT = 27 : BIOCHEMISTRY OF SPECIALIZED TISSUES

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 contraction, source of energy for muscle contraction, metabolism of muscle cardiac muscle-metabolism, regulation of contraction. contractile proteins in cells other than muscle filaments. microfilaments and microtubules. cilia and flagella of bacteria, eukaryotic cells.
2. Nerve conduction - structure and composition of nervous tissue, creation and propagation of nerve impulses, action potential, Na^+ and K^+ channels. Transmission of nerve impulse, cholinergic receptors, acetyl choline receptors, electroplaques as a source of acetyl choline receptor, acetyl-choline esterase., nerve poisons, other neurotransmitters.

3. Biochemistry of vision - structure of eye, lens and retina. Perception of light, rods and cones. rhodopsin. primary event in visual excitation. cyclic GMP and transducin in generation of nerve impulse. colour vision.
4. Biochemistry of taste and smell.
5. Biochemistry of hearing and speech.
6. Bioluminescence.

Reference Books

1. Biochemistry, L. Stryer, Freeman and Co., New York.
2. Biochemistry, Zubey, Addison Wesley (1983).
3. Text book of Physiology, English Language Books service/ churchill Livingston.

COURSE = BC 304

UNIT = 28 : BIOPHYSICS

1. Basic concepts of theoretical conformational analysis of proteins.
2. Spectroscopic methods CD, ORD, fluorescence, Raman, NMR, ESR, Mossbauer spectroscopy.
3. Ligand Binding.
4. Scattering.
5. X-ray diffraction.

Books

1. Physical Biochemistry, Friefelder, Freeman Publishers, (1983).
2. Physics for applied biologists (1977), N.C. Hilyard & H.C. Biggin.
3. An introduction to Biophysics (1977), J. Sybeoma Acad. Press New York.
4. Physical Biochemistry Kansal Edward Van Holde, Foundation of modern Biochemistry Series (1971) Prentice Hall.

UNIT = 29 : ENVIRONMENTAL TOXICOLOGY

1. Environmental pollution.
2. Evaluation of toxicity.
3. Toxicity of pesticides, food additives, animal and plant toxins, industrial chemicals and heavy metals.
4. Metabolism of toxic substances.
5. Toxic responses of different tissues and organs.
6. Occupational Health and Industrial Toxicity.
7. Regulation of safety and social aspects in relation to toxicants.
8. Applications of Toxicology : Forensic, clinical.
9. Control of environmental pollution.

Books

1. Hayes Principles and Methods of Toxicology Ed. A. Wallace Hayes. Pub. Raven Press New York.
2. Casarett and Doull's Toxicology. Ed. John Doull, Curtis D. Klaassen and Mary D. Anderson, Mac. Millan Publisher Co. New York.
3. Appraisal of the safety of chemicals in foods, drugs and cosmetics. Ed. The editorial committee of Association of Food and Drug officials of the United States.
4. Toxicology-Mechanisms and Analytical Methods Vol. I & II. Ed. Stewart C.F. & Stolman A. Pub- Academic Press.
5. Veterinary Toxicology by R.J. Garner Ed. Bailliere. Tindall & Cox.. London.
6. The Chemistry and Microbiology of Pollution (1975) I.J.Higgins and R.G. Burne Acad Press New York.
7. Introduction to ecological Biochemistry (1977) J.B. Harbone Acad. Press New York.

UNIT = 30 : SECONDARY METABOLISM

Secondary metabolism leading to the biosynthesis of Vitamin, Penicillin, Streptomycin, rubber, Terpenoids, Flavones, Alkaloids etc. Microbial Transformation.

Reference Books

1. Biosynthesis of antibiotics Vol. 1.
2. Alkaloids Bullock.
3. Advances in Enzymology.

UNIT = 31 Radiation Biology

The syllabus will be prepared later

UNIT = 32 Human Genetics

The syllabus will be prepared later

SEMESTER = IV

COURSE : BC = 401

UNIT = 33 : GENETIC ENGINEERING

1. Genetic Engineering concepts.
2. Enzymes in Genetic Engineering.
3. Plasmids, bacteriophages, Shuttle vectors.
4. Cloning in yeast, Bacillus, and Strept. species.
5. Animal, virus and derived vectors.
6. Ti plasmids and Plant genetic engineering.
7. Genomic and c-DNA library construction.
8. Selection of recombinant DNA clones.
9. Hybridization and Immunological Techniques.
10. Characterization of recombinant gene-S1 mapping.

sequencing.

11. Restriction mapping. Chromosome walking.
12. In vitro mutagenesis.
13. R LP, PCR etc.
14. Transgenetic plants and animals.
15. Applications of genetic engineering in medicine, agriculture and industry.

Reference Books

1. Recombinant DNA short course - J.D. Watson, Cold Spring Harbour.
2. Principles of Gene Manipulation in Introduction to Genetic Engineering.

UNIT - 34 : MOLECULAR BIOCHEMISTRY

1. Molecular basis of development.
2. Metal binding fingers in regulatory proteins.
3. Molecular basis of evolution.
4. The Calcium signal.
5. RNA as enzyme.
6. Protein targeting.
7. Protein engineering.
8. Gene therapy.

Reference Books

1. Biochemistry - L. Stryer, Third Edition - 1988 W.H. Freeman and Company New York.
2. Molecular Biology of the Gene - Fourth Edition. The Benjamin/Cummings Publishing Company, INC.
3. Articles from recent volumes of Scientific American Volumes.

COURSE : CH - 402

UNIT - 35 : PHYSIOLOGICAL BIOCHEMISTRY - II

1. **Chemistry of Respiration :**
Gas transport and pH regulation. Need for a carrier of oxygen in blood. Hb and allosterism. Interrelationship between Hb, oxygen, carbon dioxide, H and 2,3 DPG. Introduction to pH regulation. Buffer system of plasma, interstitial fluid, CO_2 - HCO_3^- buffer system, acid - base balance, and its maintenance, compensatory mechanisms. Measures of Acid - base imbalance, significance of Na⁺ and Cl⁻ imbalance.
2. Blood composition, plasma protein and their diseases blood counting and their significance. Leucocytes and erythrocytes.
3. The Kidney: Formation and acidification of urine. Abnormalities of acid-base regulation by the kidney. Mechanism of action of diuretics, tests of renal function, composition of urine and hormones of the kidney.
4. Water and mineral metabolism.
5. Enzymes in clinical diagnosis.
6. Liver function and its disorders.

Reference Books

1. Text books of biochemistry with clinical correlation Thomas M. Devlin. 2nd edition. 1983. J. Wiley and sons.
2. Physiological chemistry - Harper.
3. Text book of Medical Physiology - Guyton. A.C. H. Sanders. Philadelphia. (1981).
4. Physiological basis of Medical practice - West J.B (1985) Best and Taylor.
5. Introduction to Physiology, Davson, H. and M.B. Segal. (1978) Acad Press.

UNIT - 36 : BIOCHEMICAL ENDOCRINOLOGY

1. General Characteristics of hormones Chemistry, Structure. Synthesis, Secretion, transport, metabolism & mechanism of action of thyroid, hypothalamus, pituitary, pancreas, adrenals, sex hormones, prostaglandins and Gastro-intestinal hormones.
2. Secondary Messengers and their mode of action.

3. Cell membranes and intercellular receptors for hormones.
4. Hormonal inter - relationships.
5. Biosynthesis of Steroid hormones, cholera toxin, adenylate cyclase, and TP, hormone overproduction, and Target cell insensitivity.
6. EGF, NGF, PDGF, Enkephalin.

Reference Books

1. Vertebrate Endocrinology : Norris D.O. (1985) 2nd Ed.
2. Endocrine Physiology : Martin, C.R. (1985) Oxford Univ. Press (N.Y.)
3. Physiological Chemistry : Harper, Ed.17, Lange Medical
4. Biochemistry, : Zubary G, (1983). Addison, Wesley Publ. Co.
5. Text book of biochemistry, : Williams, 6th Ed., Saunders Co. (1981).
6. Biochemical Endocrinology : E. Frieden (1983).

COURSE = BC 403

UNIT = 37 : BIOTECHNOLOGY = I

Application of Genetic Engineering to plants and animals.

Expression of foreign DNA in bacteria

1. Detection and overproduction.
2. Cloning in yeast : vectors and their uses.

Gene cloning in mammalian cells

3. Methods of transfection, vectors, expression, genetically engineered animal cells.
4. Application of Genetic engineering to genetic diseases.

Plant Biotechnology

5. Natural Plant products and their uses : plant tissue culture technique and somoclonal variation, totipotency, protoplast fusion, Ti plasmids, direct gene transfer, plant cell cultures for production of useful chemicals, RFLP, Nif genes, resistance to diseases, stress etc.

BIOTECHNOLOGY = II

UNIT = 38 : FERMENTATION AND ENZYME TECHNOLOGY

1. Characteristics of industrial microorganisms.
2. Strain improvement.
3. Methods and parameters of cultivation of microorganisms.
4. Fermenters.
5. Fermentation Process.
6. Application of Fermentation. Enzymes and industrial catalysts. Rationale for immobilizing enzymes. Methods of enzyme immobilization. Supports and their selection. Properties of immobilized enzymes. Applications of immobilized enzymes-affinity. chemical engineering aspects of enzyme immobilization. Whole applications. Cell immobilization - rationale, methods and applications. Industrial stabilization of enzymes. Downstream processing-large scale protein purification.

Reference Books

1. Molecular biology and biotechnology Edited by J.M. Walker and E.B. Gingold. Royal Society of Chemistry (1983).
2. Biotechnology Vol. 1 Edited by. H.J. Rehm and Reed Verlag chemie.
3. Biochemical engineering-Aiba. Humphrey and Miles. University of Tokyo Press.
4. Immobilized enzymes: An Introduction and application in Biotechnology - Micheal Trevan. John Wiley Sons. (1980).
5. Immobilized Enzymes : Zaborsky (1973) CRC Press deareland Ohio.

BIOTECHNOLOGY = III

UNIT = 39 : TISSUE CULTURE & MEDICAL TECHNOLOGY

1. Development of tissue culture.
2. Cell, organ and embryo culture.
3. Methods, equipments and precautions.
4. Primary culture.
5. Cell nutrition and growth parameters.
6. Characterization of culture, cryopreservation and transshipment.
7. Mass cultivation -fermenters.
8. Cell cycle and synchronization.
9. Tissue culture for virus propagation and studies.
10. Vaccine preparation.
11. Amino lexis, methodology and application.
12. Cybrid and hybridoma technology-monoclonal antibodies.
13. Cytotoxicity testing application.
14. Microinjections of metabolites and genes.
15. Methods of transfection and gene cloning.
16. Diagnosis of genetic diseases: RFLP. Gene therapy, DNA fingerprinting.

Reference Books

1. Molecular Biology and Biotechnology Edited by J.M. Walker and E.E. Gingold. Royal Society of Chemistry (1989).

BIOTECHNOLOGY - IV

UNIT - 40 : FOOD PROCESSING AND FOOD TECHNOLOGY

1. Food of animal and plant origin.
2. Monitoring food quality.
3. Primary feedstock.
4. Proteins from unconventional sources ODP, SMP etc.
5. Isolation of proteins from leguminous seed, oil seeds, etc.
6. Enzymes in food analysis, toxins, alcohol, amino acids, glucose etc.
7. Enzymes in food processing, meat tenderization and fruit canning.
8. Biochemistry of food spoilage, principles of food preservation.
9. Food additives, sugar and sweeteners, flavouring agents colours etc.

Reference Books

1. Enzymes and food Processing, G.G. Birch, N. Blickbrough (1981).
2. Nutrition and food Processing, M.G. Muller, V. Tobin, AVI Publishing Co., Cress Hill, 1980.
3. Introduction to food sciences and Technology - G.F. Stewart and M.A. Amerine (1973) Acad Press.

COURSE - CH 404

UNIT - 41 : CLINICAL NUTRITION

1. Diet and nutrition in India : Assessment of nutritional status.
2. Factors affecting digestion and absorption of food.
3. Effects of Irradiation, cooking, refining, sprouting and fermentation of nutritional quality of food.
4. Food toxins. Adverse effects of alcohol, tobacco and tea.
5. Interrelationship between dietary lipids and cholesterol metabolism.

6. Malnutrition and infection.
7. Malnutrition and mental development.
8. Infant and Geriatric nutrition.
9. Nutritional basis of behaviour. Natural tranquilisers.
10. Amino acid therapy.
11. Acidic and alkaline foods.
12. Dietary fibre: its chemical composition and importance.
13. Physiological effects and metabolic adaptation during exercise.
14. Nutritional management of inborn errors of metabolism.

Reference Books

1. Essentials of Food and Nutrition - M Swaminathan Vol. II. Applied Aspects (1974). Genesh Publication, Madras.
2. Human Biochemistry - James Orten and Otto Neuhaus. 10th Ed. C.W. Mosby Co., London (1982).
3. Human Nutrition and Dietetics - Davidson and Passmore
4. Amino acids in Therapy - Leon Chaitow. Thieme Publishers Inc. N.Y. (1985).
5. Physiological Chemistry - Hawk (Other details ...)

UNIT - 42 : NEUROSCIENCE

1. Neuromorphology and neuroanatomy - Central nervous system, spinal cord and different regions of the brain, peripheral nervous system - afferent pathways and sense organs, efferent pathways.
2. Nerve and synapse structure, structure-function correlation at the synapse. Transmission across the synapse: membrane potential in the steady state; action potential generation and propagation.
3. Sensory system: Types of receptors, properties sensory modalities and sensory circuits. Sensory perception.
4. Chemical composition of the brain.

5. Specific aspects of carbohydrate, protein, lipid and amino acid metabolism in the brain.
6. Neurotransmitter metabolism.
7. Neuropeptides - turnover and regulation.
8. Cerebro-spinal fluid, blood brain barrier.
9. Coordination between Nervous and Endocrine systems.
10. Natural, genetic and environmental factors affecting the development of CNS.
11. Neural plasticity, learning.
12. Localization of higher functions : EEG patterns.

Reference Books

1. Guyton's Text books of Physiology.
2. Kandel E.R. and J.H. Schwartz (1981) "Principles of Neural Science" Elsevier/North-Holland, N.Y.
3. Shephard G.M. (1983) "Neurobiology" Oxford Univ. Press, N.Y.
4. Junge D. (1981): "Nerve and Muscle Excitation" Sinauer Associates, Sanderland, Mass.

UNIT - 43 : MOLECULAR EVOLUTION

1. Theories of evolution-the time scale and some evolutionary principles, Chemical evolution and origin of life, Prototypes of metabolic pathways.
2. Genesis of oxygen generating photosynthesis and aerobic respiration. Methanogens - evolution of prokaryotes.
3. Evolution of protists.
4. Origin of Eukaryotes.
5. Theories regarding origin of mitochondria and chloroplast, the five kingdom classification of living organisms, Outline of eukaryote evolution-evolution of primates.
6. Construction of phylogenetic trees- molecular data set based on sequences.

7. Evolution of proteins and nucleic acid-elastic analysis.
8. Evolution of introns.
9. Evolutionary view of exon domain relationships.

Reference Books

1. Evolution and Diversity of life by E. Mayer Belknap Press Pub. 1976.
2. Population species and evolution (1973) by E. Mayer Press Pub.
3. Biochemistry by Lehninger 1975, Worth Pub.
4. Origin of Eukaryotic Cells, Margulis L. (1977).
5. The origin of life, Molecules and Natural selection by Orgel L.E.
6. Biomolecular structure, conformation and Evolution Vol. III Pergamon Press.

PRACTICAL COURSE OF SECOND YEAR

COURSE = BC 305

UNIT = 44 : MOLECULAR BIOLOGY/IMMUNOLOGY

1. Isolation of DNA from *E. coli*/liver/M13 phage/plasmid.
2. Determination of base composition (spectrophotometry).
3. Agarose electrophoresis of DNA.
4. Estimation of DNA by diphenylamine reaction.
5. Isolation of DNA from yeast/liver.
6. Estimation of RNA by orcinol method.
7. Labelling of DNA and autoradiography.
8. DNA polymerase assay and scintillation counting.
9. Determination of blood groups.
10. Use of Elisa technique.

UNIT = 45 : ENZYMOLOGY

1. Cell fractionation.
2. Distribution of enzymes.
3. Purification of an enzyme.
4. Effect of different parameters on enzyme activity.

COURSE = BC 405

UNIT = 46 : CLINICAL BIOCHEMISTRY

1. Estimation of lipoproteins.
2. Glucose tolerance test.
3. Estimation of bilirubin.
4. Estimation of blood urea.
5. Blood sugar determination by Folin Wu method.
6. Estimation of creatine phosphokinase.
7. Normal and abnormal constituents of urine.
8. Determination of blood cholesterol.
9. Determination of glucose by glucose oxidase.
10. Estimation of glycosylated hemoglobin.
11. Estimation of LDH and its isoenzymes.
12. Estimation of alkaline phosphatase from serum.
13. Estimation of total protein and albumin from serum.
14. Determination of SGPT and SGOT.
15. Estimation of serum amylase.

UNIT = 47 : TISSUE CULTURE

COURSE = BC 406

UNIT 48 & 49 : PROJECT

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NORTH MAHARASHTRA UNIVERSITY, JALGAON

SYLLABUS OF M.Sc. BIOCHEMISTRY

FIRST YEAR

CH - 170 : Biomolecules.
 UNIT - 1 : Biomolecules. I, Proteins.
 UNIT - 2 : Biomolecules. II, Carbohydrates, Lipids etc.

CH - 171A : Biophysical and Bioorganic Chemistry.
 UNIT - 3 : Biophysical Chemistry.
 UNIT - 4 : Bioorganic Chemistry.

OR

CH - 171B : Thermodynamics and Organic Chemistry.
 UNIT - 3 : Thermodynamics.
 UNIT - 4 : Bioorganic Chemistry.

CH - 172 : Microbiology and Cell Biology
 UNIT - 5 : Microbiology and Virology.
 UNIT - 6 : Cell Biology.

SEMESTER II

CH - 270 : Metabolism.
 UNIT - 7 : Metabolism I, Bioenergetics & Metabolism.
 UNIT - 8 : Metabolism II, Nitrogen Metabolism

CH - 271 : Biophysical Techniques.
 UNIT - 9 : Biophysical Techniques I.
 UNIT - 10 : Biophysical Techniques II.

CH - 272 : Physiology and Plant Biochemistry.
 UNIT - 11 : Physiological Biochemistry I.
 UNIT - 12 : Plant Biochemistry.

CH - 273 : Enzymology and Genetics.
 UNIT - 13 : Enzymology
 UNIT - 14 : Molecular Genetics and Statistics.

PRACTICAL UNITS OF M.Sc. 1st YEAR

CH - 167 : Laboratory Course I.
 UNIT - 15 : Analytical Biochemistry I.
 UNIT - 16 : Analytical Biochemistry II
 CH - 267 : Laboratory Course II.
 UNIT - 17 : Microbial Techniques.
 UNIT - 18 : Scientific writing and Presentation.

CH - 268A : Laboratory Course III A.
 UNIT - 19 : COMPUTER.
 UNIT - 20 : Experiments in Biophysical Chemistry.

M.Sc. BIOCHEMISTRY IIInd YEAR

THEORY UNITS

SEMESTER III

CH - 370	:	Molecular Biology.
UNIT- 22	:	Molecular Biology. I
UNIT- 23	:	Molecular Biology. II
CH - 371	:	Medical Biochemistry and Immunology.
UNIT -24	:	Medical Biochemistry.
UNIT -25	:	Immunology.
CH - 372	:	Biochemistry of Membrane & Specialized Tissues.
UNIT -26	:	Membrane Biochemistry.
UNIT -27	:	Biochemistry of Specialized Tissues.

OPTIONAL COURSES

CH -360	:	Advanced Biochemistry (Any two of the following units.)
UNIT -28	:	Biophysics.
UNIT -29	:	Environmental Toxicology.
UNIT -30	:	Secondary Metabolism.
UNIT -31	:	Radiation Biology.
UNIT -32	:	Human Genetics.

Different combinations of units for the course CH-360

(A)	28	#	29
(B)	28	#	30
(C)	28	#	31
(D)	28	#	32
(E)	29	#	30
(F)	29	#	31
(G)	29	#	32
(H)	30	#	31
(I)	30	#	32
(J)	31	#	32

SEMESTER IV

CH -470	:	Genetic Engineering & Molecular Biochemistry.
UNIT - 33	:	Genetic Engineering.
UNIT - 34	:	Molecular Biochemistry.
CH - 471	:	Physiological Endocrinology
UNIT - 35	:	Physiological Biochemistry II
UNIT - 36	:	Biochemical Endocrinology

CH = 460 optional course I : BIOTECHNOLOGY

(Any two)

UNIT - 37 : BIOTECHNOLOGY I.
UNIT - 38 : BIOTECHNOLOGY II.
UNIT - 39 : BIOTECHNOLOGY III.
UNIT - 40 : BIOTECHNOLOGY IV.

Different combinations of units for the course CH-460

(A)	37	#	38
(B)	37	#	39
(C)	37	#	40
(D)	38	#	39
(E)	38	#	40
(F)	39	#	40

CH = 461 : OPTIONAL COURSE II.

(Any two of the following units)

UNIT - 41 : Clinical Nutrition.
UNIT - 42 : Neuroscience.
UNIT - 43 : MOLECULAR EVOLUTION.

Different combinations of units for the course CH-461

(A)	41	#	42
(B)	41	#	43
(C)	42	#	43

PRACTICAL UNITS OF M.Sc. IIInd YEAR

CH - 367 : LABORATORY COURSE IV.
UNIT -44 : MOLECULAR BIOLOGY AND IMMUNOLOGY.
UNIT -45 : ENZYMOLOGY.

CH - 467 : LABORATORY COURSE V.
UNIT -46 : CLINICAL BIOCHEMISTRY.
UNIT -47 : SPECIAL EXPERIMENTS.

CH - 468 : LABORATORY COURSE VI.
UNIT -48& : PROJECT.
49

Important Note: For all theory courses, the question paper should include at least 20% weightage for problem solving.

1. Analysis and preparation of Scientific reports and verbal communication.
 Compilation of experimental record :
 Writing helps you remember, observe and think.
 Writing an account of an experiment during its process
 Writing a progress report.
 Communication as a part of Science.

2. How Scientist should write :
 Explanation Clarity, Completeness, impartiality,
 objectivity, order, accuracy, simplicity, appropriateness,
 balanced brevity, consistency, control, interest,
 persuasiveness, precision sincerity, unity.

3. Examples of unscientific writing.

4. Thinking and Planning - information, ideas, topic, outline.
 order of paragraph writing, revising context.

5. Use of good english.
 Noun, pronoun, verb, adverb, adjective, conjunction,
 articles, tenses, spelling etc.

6. Use of vocabulary.
 Meaning of words, precise usage, tautology, synonyms,
 unnecessary qualifications of words, ambiguity, superfluous
 words, circumlocution, verbosity, loss of context.

7. Technical terms and nomenclature.

8. Helping the reader.
 Decide what the reader needs to know. Writing for easy
 reading (how to begin, control, explain, sentence length,
 rhythm, style). Capture and holds reader's interest
 obstacles to effective communication.