M.Sc. BIOCHEMISTRY (CBCS),

DEPARTMENT OF BIOCHEMISTRY,

PERIYAR UNIVERSITY,

SALEM-636011

M. SC. BIOCHEMISTRY

(**FOR THE ACADEMIC YEAR 2008 – 09 ONWARDS**)

Structure of M.Sc. Degree Course for Biochemistry

The Department of Biochemistry aims in developing human resources in Biochemistry and to expand and transfer knowledge in particular to the rural community based in and around Salem district of Tamil Nadu, India.

Every biological phenomenon is to be explained ultimately in terms of biochemical changes at the molecular level. Hence in-depth knowledge of biochemistry at molecular level is required for biological scientist. With the strong and systematic knowledge proposed to be imparted in this program, the graduated student will be able to understand the objectivity and to apply the same effectively in the field of Biochemistry and its allied field properly.

There is a greater demand globally, for trained manpower in the areas of Biochemistry for Research and Development in multinational companies, public sectors, quality control labs, biopharmaceutical companies, food industries as well as in universities.

The course designed has component of summer training giving opportunities to students to get experience and exposure in academic and research institutes and in industries.

Goals

- To provide foundation for a better understanding of biological molecules both individually and as a members of more complex structures.
- To provide training and research in the current fields of Molecular biology, genetic engineering, enzymology, down stream processing etc.

- To produce graduates qualified for careers in teaching and research in biochemistry in academic, research and industrial settings.
- To impart laboratory expertise in modern biochemical techniques, including the ability to analyse data and prepare scientific reports.

A two years M.Sc. program is formulated for developing competent biochemists for whom significant job opportunities exist in this country. The course is based on interdisciplinary nature of Biochemistry, Quantitative Biology, Genetics, Microbiology and Biophysics. The program obliges students to read original publications and envisages significant inputs in laboratory work, communication skill, creativity, planning, execution and critical evaluation of the studies undertaken. This program gives common basic knowledge (Cell Biology, Membrane Biochemistry, Enzymology, Immunology, Molecular Biology, Genetic Engineering, Biostatistics and Bioinformatics, Neurochemistry and Clinical Biochemistry) to become a good biochemists.

This programme is offered under choice Based credit system (CBCS). The CBCS enables the student to select variety of subjects as per his interest and requirement. Students can earn more credits than the stipulated minimum of 72 credits, through self study courses.

It is also suggested that every student undertake one hour library work under the supervision of faculty members. It is envisaged that the research projects (dissertation) and specializations will inculcate aptitude for research and practical applications. The students will also have basic inputs on communications skills and computers knowledge (information technology) and learn the basics of scientific writing and presentation.

Self study courses

To mould student's skills and individuality, this course extends certain opportunities as self learning courses.

- Summer Project for 30 days.
- Training in multispecialty hospitals for 30 days.
- Group project on developing and marketing a product.

Dissertation

Aim: (a) Application of knowledge to real life situation (b) to introduce research methodology. Topic of dissertation may be choosen form any area of biochemistry and may be laboratory based, field based or both or computational, with emphasis on originality of approach. It may be started during 2nd / 3rd semester and shall be completed by the end of the 4th semester. The Dissertation to be submitted should include (a) background information in the form of introduction (b) objectives of the study (c) materials and methods employed for the study (d) results and discussion thereon (e) summary and conclusions and (f) bibliography. Apart from these sections, importance of the results, originality and general presentation also may be taken into consideration for evaluation.

Candidates eligibility for admission into this course

Eligibility for Admission: Graduates in Biochemistry, Chemistry, Microbiology and Life Sciences as principle subject or Biochemistry as subsidiary subject are eligible for admission to the course.

Duration of the course: Two year degree programme

Number of seats: 24 Candidates be selected on merit cum Entrance examination basis.

Credit: One hour theory lecture per week per semester is equivalent to one credit. A three hour Practical per week is equivalent to one credit.

Teaching methodologies

The classroom teaching would be through conventional lectures and use of OHP and Power point presentations. The lecture would be such that the students should participate actively in the discussion, students seminars would be conducted and scientific discussions would be arranged to improve their communicative skill

In the laboratory, instructions will be given for the experiments followed by demonstration and finally the students have to do the experiments individually. Periodic tests will be conducted for the students. Slow learners will be given special attention.

Examinations

There shall be four examinations Two are in the first year and two in the second year. Candidates failing in any subject will be permitted to appear for such failed subjects at subsequent examination. The syllabus has been divided into 4 semesters. The examination for the Semester I & III will be held in November/December and that for the Semester II and IV will be in the month of April/May.

The Practical examination will be conducted at the end of I, II & III semesters. Candidates failing in the any of the practical examination will be permitted to appear for such failed practical examination at subsequent practical examination.

Scheme for Internal Marks (theory): Maximum marks – 25

- Seminar & Assignment – 10.
- Internal Tests- 10
- Attendance - 5

Pattern of Question paper (theory - external):

Duration of the examination - 3 hours Maximum marks – 75

Part A

Answer all questions 5x3 = 15

(Internal Choice questions)

Part B

Answer all questions 5x12= 60

(Internal Choice questions)

Scheme for Internal Marks (Practical): Maximum marks – 40

- Internal Tests- 30
- Record – 5
- Attendance – 5

Pattern of Question paper (External - Practical):

Duration of the examination - 6 hours Maximum marks – 60

Part A

Answer all questions 2x20 = 40 marks

Part B

Record = 5 marks

Spotters = 5 marks

Viva = 10 marks

Total = 60 marks

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Semester	Subject Code	Title of the subject	Credit	Marks			Duration of exam(HR)
				Internal	External	Total	
I	BCH-C01	Biomolecules	5	25	75	100	3
	BCH-C02	Cell Biology	5	25	75	100	3
	BCH-C03	Advanced Enzymology	5	25	75	100	3
	BCH-P01	Lab. In Enzymology	5	40	60	100	6
	BCH-E		4	25	75	100	3
	BCH-E		4	25	75	100	3
II	BCH-C04	Advanced Molecular Biology	5	25	75	100	3
	BCH-C05	Genetic Engineering	5	25	75	100	3
	BCH-C06	Bioenergetics and intermediary metabolism	5	25	75	100	3
	BCH-P02	Lab. In Molecular Biology and Genetic Engineering	5	40	60	100	6
	BCH-E		4	25	75	100	3
	BCH-S		4	25	75	100	3
III	BCH-C07	Plant Biochemistry	5	25	75	100	3
	BCH-C08	Advanced Clinical Biochemistry	5	25	75	100	3
	BCH-C09	Immunology	5	25	75	100	3
	BCH-P03	Lab. In Clinical Biochemistry and Immunology	5	40	60	100	6
	BCH-E		4	25	75	100	3
IV	BCH-C10	Industrial Microbiology	5	25	75	100	3
	BCH-C11	Project	5	50	150	200	-
TOTAL			90			2000	

Elective (Any 4)		
S.NO	**Title of the subject**	**Credits**
BCH-E01	Molecular Endocrinology	4
BCH-E02	Microbial Biochemistry	4
BCH-E03	Biophysics, Biostatistics and Bioinformatics	4
BCH-E04	NeuroBiochemistry	4
BCH-E05	Cancer Biology	4
BCH-E06	Chromatographic Separations	4
BCH-E07	Genetics for Biologists	4
BCH-E08	Genomics and Proteomics	4
BCH-E09	Plant Biotechnology	4

Supportive (Any 2)		
S.NO	**Title of the subject**	**Credits**
BCH-S0**1**	Introduction to Biochemistry	4
BCH-S0**2**	Tools and Techniques in Bioscience	4
BCH-S0**3**	Biodiversity	4
BCH-S0**4**	Methods in Molecular Biology	4

SEMESTER - I

Subject Code	Title of the subject	Credits			
		L	T	P	C
BCH -C-01	BIOMOLECULES	5	_	-	5

Unit I.

A general introduction to the science of biochemistry; properties of water and aqueous solution; pH and biological buffers; chemical equilibria; review of thermodynamic principles. Introduction to biomolecules; biochemical basis of structural and functional variations in the living beings; Prebiotic molecular evolution and origin of life; review of the variety and ecology of the living world; evolution of life.

Unit II.

Carbohydrates

Structure of monosaccharides. Stereoisomerism and optical isomerism of sugars. Reactions of aldehyde and ketone groups. Ring structure and anomeric forms, mutarotation. Reactions of sugar due to hydroxyl groups. Important derivatives of monosaccharides, disaccharides and trisaccharides (structure, occurrence and functions of important ones). Structure, occurrence and biological importance of monosaccharides, oligosaccharides and polysaccharides e.g. Cellulose, chitin, agar, algenic acids, pectins, proteoglycans, sialic acids, blood group polysaccharides, glycogen and starch. Bacterial cell wall polysaccharides etc. Glycoproteins.

Unit III.

Lipids

Definition and classification. Fatty acids: introduction, classification, nomenclature, structure and properties of saturated and unsaturated fatty acids. Essential fatty acids, prostaglandins. Triacylglycerols: nomenclature, physical properties, chemical properties and characterization of fats - hydrolysis, saponification value, rancidity of fats, Reichert-Meissel number and reaction of glycerol. Biological significance of fats, phospholipids, lecithins, lysolecithins, cephalins, phosphatidyl serine, phosphatidyl inositol, Spingomyelins, glycolipids, cerebrosides, gangliosides. Properties and functions of phopsholipids, isoprenoids and sterols.

Unit IV.

Proteins

Introduction, classification based on solubility, shape, composition and functions. Amino acids: common structural features, stereo-isomerism and RS system of designating optical isomers, classification and structures of standard amino acids as zwitterion in aqueous solutions, physical and chemical properties, titration of amino acids, separation of amino

Peptides: structure of peptide bond, chemical synthesis of polypeptides

structure: levels of structure in protein architecture, primary structure of proteins, secondary structure of proteins – helix and pleated sheets, tertiary structure of proteins, forces stabilizing the tertiary structure and quaternary structure of proteins. Denaturation and renaturation of proteins.

Unit V.

Nucleic acids

Nature of genetic material; evidence that DNA is the genetic material, Composition of RNA and DNA, generalized structural plan of nucleic acids, nomenclature used in writing structure of nucleic acids, features of DNA double helix. Denaturation and annealing of DNA, structure and roles of different types of RNA. Size of DNA in procaryotic and eucaryotic cells, central dogma of molecular biology, Gene, genome, chromosome.

Subject Code	Title of the subject	Credits			
		L	T	P	C
BCH -C-02	CELL BIOLOGY	5	-	-	5

Unit-I

Cell classification: Cell variability (size, shape, complexicity, functions). Structural organisation of prokaryotic and eukaryotic cells. Plant and animal cells: Variation in structure and function. The ultra structure of nucleus, mitochondria, endoplasmic reticulum, golgi apparatus, lysosomes, peroxisomes and their functions. Genome organization inside the cells – different levels of genome organization; Definition of a gene; Gene structure, Prokaryotic gene structure; Simple and complex eukaryotic gene structure. Cell division – mitosis and meiosis.

Unit – II

The cytoskeleton – microtubules and microfilaments. Types of tissues, epithelium-types, epithelial apices-glycocalyx, microvilli. The basement membrane-structural feature and characterisitics. The extracellular matrix-collagen, elastin, fibrin, fibronectin, laminin and proteoglycans.

Biological membrane and transport: Physicochemical properties of cell membranes, molecular constituents of membranes-supra molecular architecture of membranes-asymmetrical organisation of lipids and proteins. Solute transport across membranes- Ficks law, types of transport.

Unit- III

Cell - cell and Cell - matrix adhesion: An Overview. Cell - cell interaction – ECM, collagen, hyaluronan and proteoglycans, laminin, integrins and fibronectins. Cell - Cell adhesion: Specialized junctions - Desmosomes, gap junctions, adhesion molecules - Cadherins and Connexins.

Unit -IV

Cell - Cell signaling - Signaling molecules and their receptors, functions of cell surface receptors, pathways of intracellular signal transduction, second messengers, G- protein coupled receptors, receptor tyrosine kinases, Ras, MAP kinases.

Unit -V

Cell cycle and cancer - Cell cycle - Overview of cell cycle and its control in mammalian cells, checkpoints in cell cycle regulation. Apoptosis (programmed cell death) - Pathways, regulators and effectors in apoptosis. Cancer - Properties of tumor cells and genetic basis and onset of cancer. Tumor viruses – DNA and RNA viruses as transforming agents, mechanism.

Subject Code	Title of the subject	Credits			
		L	T	P	C
BCH -C-03	ADVANCED ENZYMOLOGY	5	-	-	5

UNIT –I

Concept of convergent and divergent evolution of enzymes. Mechanism of enzyme catalysis: Effect of temperature – Arrhenius equation and its application (derivation not included); Determination and application of Vmax, Km, Turnover number(kcat), inhibition constant (Ki) and dissociation constant (Kd). Kinetics of single substrate enzyme catalysed reactions- the Haldane relationship for reversible reactions. Kinetics of multisubstrate enzyme catalysed reactions – rate equation of alberty and Dalziel; Inhibition and activation of enzymes. Hills equation, Adair equation, Scachard plot and their application.

UNIT –II

Allosteric enzymes, Sigmoidal kinetics and their physiological significance. Symmetric and sequential modes for action of allosteric enzymes and their significance.

Multienzyme system-Mechanism of action and regulation of pyruvate dehydrogenase and fattyacid synthetase complexes.

UNIT –III

Immobilized enzymes- Various methods of immobilization - ionic bonding, adsorption, covalent bonding (based on R groups of amino acids) microencapsulation and gel entrapment. Immobilized multienzyme systems. Applications of immobilized enzymes. Enzyme engineering: strategies for enzyme engineering, molecular graphics in protein engineering. Protein structure prediction: Secondary structure prediction, sequence structure relationship, modelling of homologous proteins.

UNIT –IV

Enzyme regulation: General mechanisms of enzyme regulation: Feed Back Inhibition and Feed forward stimulation; Enzyme repression, induction and degradation, control of enzymic activity by products and substrates; Reversible and irreversible covalent modifications of enzymes; Mono-cyclic and multi-cyclic cascade systems with specific examples.

UNIT –V

Large scale application of microbial enzymes in food and allied industries: Leather industry, Textiles, paper industries and antibiotic production; Medical application of enzymes. Use of enzymes in analysis: Enzymes in calorimetric, potentiometric, Amperometric, optical, peizo-electric biosensors.

Subject Code	Title of the subject	Credits			
		L	T	P	C
BCH-P-01	LAB. IN ENZYMOLOGY	-	-	6	5

I. ENZYME ISOLATION AND ASSAY OF ENZYMATIC ACTIVITY

Extraction of commercially important enzymes from natural sources

Development of enzyme assays

Quantification of enzyme activity and specific activity.

II. ENZYME KINETICS

Estimation of Michaelis Menten parameters,

Effect of pH and temperature on enzyme activity,

Inhibition and kinetics of inhibition.

III. IMMOBILISED ENZYME REACTIONS

Techniques of enzyme immobilisation-matrix entrapment, ionic and cross linking,

Bioconversion studies with immobilised enzyme

SEMESTER - II

Subject Code	Title of the subject	Credits			
		L	T	P	C
BCH -C-04	**Advanced Molecular Biology**	5	-	-	5

Unit –I

Molecular structure of genes and chromosomes. Molecular definition of gene - pro and eukaryotic transcription units. Chromosomal organization: Structural organization of eukaryotic chromosomes.- Histone proteins, Chromatin nonhistone proteins,. Tandemly repeated genes, Single sequence DNA. Mobile DNA - mobile elements, bacterial Insertion sequence. Transposons.

Unit –II

DNA REPLICATION : Messelson and Stahl's semi-conservative replication model. DNA polymerase I, II and III, role of DNA polymerase in replication, continuous and discontinuous synthesis of DNA (Okazaki fragments), proof reading capacity of DNA polymerase. Role of Topoisomerase, DNA ligase, helicase and SSB proteins, Primase. DNA replication in eukaryotics, multiple initiation sites, uni and bi directional replication. Telomerase, Rolling circle model, replication of mitochondrial DNA.

TRANSCRIPTION: (In prokaryotes and eukaryotes) Structure and function of RNA polymerase. Fine structure of gene, Initiation, elongation and termination of transcription. Post-transcriptional modifications Various classes of RNAs - mRNA, rRNA, tRNA, snRNA, hnRNA. Transcription in eukaryotes, multiple transcription factors, enhancer sequences, RNA editing, ribozymes and RNA splicing. Inhibition of transcription. RNA replicase and reverse transcriptase.

Unit -III

GENETIC CODE: Salient features of genetic code, wobble hypothesis, decipheration of genetic code. Contribution of Nirenberg, Matthaei and Khorana. Natural variation in the genetic code.

TRANSLATION: (In prokaryotes and eukaryotes) t-RNA and its adaptor function, activation of amino acids. Aminoacyl t-RNA synthetase, Ribosomes and its composition. Formation of initiation complex, elongation, termination of protein biosynthesis. Translation in eukaryotes. Post-translational modifications, Inhibitors of translation, in vitro translation.

Unit –IV

REGULATION OF GENE EXPRESSION :

Basic elements in the control of gene expression, structural and regulatory genes, mechanism of activation of gene expression, operon model, viz., lactose, arabinose, and tryptophan, attenuation. Transcriptional control in eukaryotes, zinc finger motifs, leucine zippers, steroid receptors.

Unit V

Mutations, DNA damage and repair. Recombination - Holliday model, Rec BCD enzyme, Rec A protein, Messelson radding model, site specific recombination. Retroviruses, retroposons and oncogenes

Subject Code	Title of the subject	Credits			
		L	T	P	C
BCH –C05	**Genetic Engineering**	5	-	-	5

Unit- I

Introduction to Gene Manipulation. Basic Techniques: Isolation and purification of Nucleic Acids, Agarose Gel Electrophoresis, Southern, Northern and western blotting, PCR, Enzymology of Recombinant DNA.

Unit-II

Genetic carriers - Plasmids as vectors - properties, Natural plasmids, pSC 101, pBR 322, vectors pUC vectors . Bacteriophage vectors - Lamda phage,- Lamda Vectors, packing of Lamda - *in vitro*. Cosmid vectors, cosmid cloning SS DNA vectors - development of M13 vector, PMBL vector, Lambda ZAP. Viral vectors - SV40, retrovirus, adenovirus, recombinant vaccinia virus vectors. Transposons as vectors. Restriction mapping of DNA fragments and Map construction. DNA Sequencing.

Unit-III

Isolation and characterization of Gene transcripts: Converting mRNA transcripts into cDNA, Screening Representative cDNA libraries, Functional sequencing of cDNA Expression libraries, Nucleic acid microarray.

Unit-IV

Site directed Mutagenesis, Screening Recombinant clones for site-directed Mutagenesis, detection of Mutation by SSCP. T-DNA and Transposon tagging: Role of Tagging in gene analysis, T-DNA and transposon tagging, identification and isolation of genes through T-DNA or transposon.

Unit-V

Gene Therapy; Antisense oligonucleotides, SiRNA, Ribozymes, Artificialy designed aptamers, Gene therapy for inherited diseases, ADA, FH, Cystic Fibrosis, Neoplastic disorders, Somatic Cell Gene therapy, The Human Genome Project. Stem cells and its application in medicine.

Subject Code	Title of the subject	Credits			
		L	T	P	C
BCH –C06	**Bioenergetics and intermediary metabolism**	5	-	-	5

UNIT-I

Bioenergetics: Energy transformation, Laws of thermodynamics, Biological oxidations, oxygenases, hydroxylases, dehydrogenases and energy transducing membranes. Gibbs energy, free energy changes and redox potentials, phosphate potential, ion electrochemical potentials, proton electrochemical potential, membrane potentials, photons energy interconversions.

ATP – synthetase complex. Microsomal electron transport, partial reduction of oxygen, superoxides.

UNIT –II

Glycolysis, citric acid cycle its function in energy generation and biosynthesis of energy rich bonds, pentose phosphate pathway and its regulation. Alternate pathways of carbohydrate metabolism.

Gluconeogenesis , interconversions of sugars, Biosynthesis of oligosaccharides, glycogen and starch.

Regulation of blood glucose homeostasis, Hormonal regulation of carbohydrate metabolism

UNIT – III

Lipids

Fatty acid oxidation: α,β,ω oxidation. Fatty acid biosynthesis: AcetylCoA carboxylase, fatty acid synthase, desaturase and elongase. Lipid biosynthesis: biosynthesis of triacylglycerol, phosphoglycerides and spingolipids. Biosynthetic pathways for terpenes, steroids and prostaglandins. Ketone bodies: formation and utilization. Metabolism of circulating lipids: Chylomicrons, LDL, HDL and VLDL. Free fatty acids. Lipid levels in pathological conditions.

UNIT – IV

Amino Acids

Biosynthesis and degradation of amino acids and their regulation.

Urea cycle and its regulation,

In-born errors of amino acid metabolism.

UNIT –V

Nucleic acids

Biosynthesis of purines and pyrimidines. Degradation of purines and pyrimidines. Regulation of purine and pyrimidine biosynthesis. Structure and regulation of ribonucleotide reductase. Inhibitors of nucleic acid biosynthesis.

Subject Code	Title of the subject	Credits			
		L	T	P	C
BCH-P02	LAB. IN GENETIC ENGINEERING & MOLECULAR BIOLOGY		-	6	5

1. Genomic DNA isolation
2. Plasmid DNA isolation
3. Agarose gel electrophoresis
4. Transfer to membrane
5. Hybridisation (demonstration)
6. Expression of beta-galactosidase and assay(demonstration).
7. Restriction analysis of DNA
8. Preparation of competent *E coli* – transformation
9. Cloning of DNA into plasmid vector(demonstration)
10. Transformation(demonstration)
11. Selection of recombinants(demonstration)
12. Polymerase chain reaction for amplification of DNA (demonstration)

SEMESTER - III

Subject Code	Title of the subject	Credits			
		L	T	P	C
BCH –C07	**Plant Biochemistry**	4	1	-	5

UNIT –I

Structure and functions of plant cell (including cell wall, plasmodesmata, meristematic cells, vacuoles, secretary systems and root quiescent zone), Isolation of cell organelles, absorption, adsorption and transport of water and ions in plants. Evapotranspiration.

Plant genome organization. Plant nuclear genome organization. Biogenesis of organelles - developlment of chloroplast. Interaction between nuclear and organellar genome.

UNIT –II

Photosynthesis – structure of organelles involved in photosynthesis in plants and bacteria. Proton gradients and electron transfer in chloroplasts of plants and in purple bacteria – differences from mitochondria. Light receptors – chlorophyll, light harvesting complexes, bacteriorhodopsin, rhodopsin as ion pump.

Photosystems I and II, their location, mechanism of quantum capture and energy transfer between photosystems – ferridoxin, plastocyanin, plastoquinone, carotenoids.

The Hill reaction, photophosphorylation and reduction of CO_2.

C_3, C_4 and CAM metabolism, light and dark reactions. Light activation of enzymes, regulation of photosynthesis. Photorespiration.

UNIT –III

N2 fixation – Molecular and Enzymology of N2 fixation. Symbiotic N2 fixation, Non- symbiotic fixation. Interaction between nitrate assimilation of carbon metabolism. Sulphur chemistry and functions, Reductive sulfate assimilation pathway. Synthesis and function of glutathione and its derivatives.

UNIT –IV

Special features of secondary plant metabolism, formation of phenolic acids, tannins, lignins, lignans, pigments, terpenes, terpenoids, plant phenolics, alkaloids and surface waxes - their biosynthesis and functions.

UNIT –V

Plant hormones - Growth regulating substances and their mode of action. Molecular effects of auxin in regulation of cell extension and of gibberellic, abscisic acids and cytokinins in the regulation of seed dormancy, germination, growth and development, and embryogenesis.

Biochemistry of seed development and fruit ripening.

Defence system in plants.

Subject Code	Title of the subject	Credits			
		L	T	P	C
BCH –C08	**ADVANCED CLINICAL BIOCHEMISTRY**	4	1	-	5

Unit - I

Automation in the clinical biochemistry. Precision, reliability, reproducibility and other factors in quality control. Normal values, radioisotopes in diagnosis. Disorders of mineral metabolism. Iron, calcium and phosphorus. Blood clotting mechanism.

Unit - II

DISORDERS OF AMINO ACID METABOLLSM: Inborn errors of metabolism including phenylalaninemia, homocystineuria, tyrosinemia and related disorders, aminoacidurias. Plasma protein disorders. Non protein nitrogenous constituents in blood with reference to urea, uric acid, aminoacid abnormalities including uremia, gout, amino aciduria, phenylketonuria, alkaptonuria, tyrosinosis, maple syrup urine disease.

DISORDERS OF NUCLEIC ACID METABOLISM: purine metabolism, pyrimidine metabolism.

Unit - III

DISORDERS OF CARBOHYDRATE METABOLISM: diabetes mellitus: Insulin receptors and C-peptide, assay of insulin,glycogen storage diseases, galactosemia, Fructosuria, pentosuria, mucopolysaccharides.

Plasma lipids and lipoprotein abnormalities, hypercholesterolemia-Lipidosis and hypolipoproteinemas, Taysach's and Niemann picks diseases.

Unit – IV

Kidney, liver, pancreatic and gastric function tests.

Renal function tests osmolarity and free water clearances, acute and chronic renal failure, glomerulonephrities, nephrotic syndrome, renal hyper tension, urinary calculi, analysis of stones, peritoneal and haemodialysis.

Disorders of erythrocyte metabolism, hemoglobinopathies, thalassemias, and anaemias.

Unit – V

DIAGNOSTIC ENZYMES: Principes of diagnostic enzymology. Tests for the evaluation of endocrine dysfunction, pituitary, thyroid, parathyroid, adrenal cortex, medulla. Detection of inborn errors in foetus and heterozygous carriers by enzyme assay in amniotic fluid. Clinical significance of: aspartate aminotransferase, alanine aminotransferase, creatine kinase, aldolase, lactate dehydrogenase, enzyme tests in determination of mycocardial infarction,

muscle dystrophies and bone disorders. Enzymes of detoxification – polymorphism in drug metabolizing enzymes, Detection of toxic substances by specific procedures.

Subject Code	Title of the subject	Credits			
		L	T	P	C
BCH –C09	IMMUNOLOGY	4	1	-	5

UNIT I

History and Scope of Immunology. Types of Immunity. Cells, Tissues and Organs of Immune System. Hematopoiesis and differentiation, Lymphocyte trafficking, Macrophages, B and T lymphocytes, Dendritic cells, Natural Killer and Lymphokines, activated killer cells; eosinophils, neutrophils and mast cells. Organization and structure of lymphoid organs.

UNIT II

Antigens, nature of antigens. Antigen recognition and presentation, Activation of B and T lymphocytes. Antibodies: Structure, Classification and Functions. Antigen – antibody interactions. Primary and Secondary immune response. Lymphocytes and accessory cells, Humoral and Cell mediated immunity; MHC: mechanism of immune response and generation of immunological diversity. Genetic control of immune response.

UNIT III

Cell – mediated cytotoxicity: Mechanism of T cell and NK cell mediated lysis, Antibody dependant cell mediated cytotoxicity. Biology of complement systems, Complement fixation test, assessment of immune complexes in tissues. Hypersensitivity reactions, Assessment of delayed hypersensitivity reactions; Auto immune disorders, transplantation – MLR, HLA typing, Bone marrow transplantation, organ transplants: Immunosuppressive therapy, Immunity to infectious agents (intracellular parasites, helminthes and viruses).

UNIT IV

Cancer immunity: Tumor antigens, immune response to tumors, cancer Immuno therapy, vaccines. Aids and other immuno deficiencies: Structure of HIV, envelope glycoproteins, Destruction of T cells, immunologic symptoms of AIDS, AIDS vaccines, therapy for treatment. Vaccine technology including DNA vaccines, Identification of B and T epitopes for vaccine development,

Immunotechnology and infectious diseases. Immunoscreening of recombinant library,

UNIT V

Fluroscent Activated cell Sorter (FACS), In situ Characterization of cells from tissues. RIA, ELISA techniques and applications. RID, EID and nephlometry. Plantibody, catalytic antibodies. Immuno diagnosis and applications. Purification of mononuclear cells from peripheral blood; Isolation and charecterization of T cells subsets; B cells and macrophages; Mitogen and antigen induced Lympho - proliferation assay; Macrophage cultures; Assay of Macrophage activation; Isolation of dentritic cells; In situ and In Vivo characterization of cells from tissues. Hybridoma technology.

Subject Code	Title of the subject	Credits			
		L	T	P	C
BCH-P03	LAB. IN CLINICAL BIOCHEMISTRY & IMMUNOLOGY		-	6	2

Clinical Biochemistry

1. Determination of the activity of the following serum enzymes: LDH, phosphatase,

Aspartate amino transferase, Alanine amino transferase, Creatine kinase

2. Determination of the following from the urine and blood: Chloride, Calcium,

Magnesium

3. Estimation of the following from the urine and blood : Urea, uric acid, creatinine and

glucose.

4. Estimation of blood glucose by orthotoludine and glucose oxidase method.

5. Estimation of cholesterol by Zaks method.

6. Estimation of albumin (A/G ratio).

7. Determination of Na+, K+ using flame photometer.

8. Estimation of Cu, Fe by colorimetric method.

Immunology

1. Immuno diffusion – Single radial and double diffusion

2. Immunoelectrophoresis

3. Rocket immunoelectrophoresis

4. Agglutination tests

5. Raising of antibodies – Single soluble and particulate antigen

6.Identifying blood grouping and Rh typing.

SEMESTER - IV

Subject Code	Title of the subject	Credits			
		L	T	P	C
BCH-C10	**Industrial Microbiology**	4	1	-	5

Unit -I

Microbial Culture Studies: Culturing of different types of microoraganims(bacteria, yeast, fungi) used in the production of commercially important products; Formulation of simple and culture media; Estimation of biomass(dry weight); substrate and product analysis; Study of Growth, substrate utilisation and product formation kinetics, shake-flask cultures.

Unit -II

Fermentation Processes: General requirements of fermentation processes, Basic design and construction of fermentor and ancillaries, Main parameters to be monitored and controlled in fermentation processes, An overview of aerobic and anaerobic fermentation processes and their application in the biotechnology industry, solid-substrate fermentation and its applications.

Unit –III

Media Design And Sterilisation For Fermentation Processes: Medium requirements for fermentation processes, Carbon, nitrogen, minerals, vitamins and other complex nutrients, oxygen requirements, medium formulation of optimal growth and product formation, examples of simple and complex media, design and usage of various commercial media for industrial fermentation, thermal death kinetics of microorganisms, batch and continuous. heat sterilisation of liquid media, filter sterilisation of liquid media. Design of sterilisation equipment.

Unit- IV

Primary Separation And Recovery Processes: Cell distribution methods for intracellular products, removal of insolubles, biomass(and particulate debris) separation techniques, flocculation and sedimentation, centrifugation and filtration methods.

Enrichment Operations: Membrane-based separations(micro and ultrafiltration theory, design and configuration of membrane separation equipment, applications, precipitation methods(with salts, organic solvents, and polymers, extactive separations, aqueous two phase extraction, supercritical extraction) insitu product removal, integrated bioprocessing.

Unit-V

Analysis Of Bioprocesses: Analysis of biomass; measurement of dry weight and biomass compostion; analysis of substrate uptake and product formation rates.

Microbial products and application: Production of protein Native & recombinant in bacteria Vaccines & their production in microbes. Bio insecticide production of bacterial and fungal poly saccharides. Production of antibiotics: source, production, recovery & uses of penicillin & tetracycline. Microbes in mineral recovery, microbial degradation of xenobiotics; Sewage biodegradation. Microbes in the production of Biomass SCP & Ethanol.

ELECTIVES

Subject Code	Title of the subject	Credits			
		L	T	P	C
BCH –E01	MOLECULAR ENDOCRINOLOGY	3	-	-	3

Unit I

Introduction to Endocrinology. Historical aspects. Definition of a hormone . Chemical nature of mammalian hormones. Developmental biology of mammalian endocrine system. Feed back regulation Historical and anatomical aspects of mammalian endocrine system- Hypothalamo – hypophyseal complex, Thyroid parathyroid complex. Gastrointestinal system and pancreas. Adrenal cortex and medulla. Ovary and testis. Pineal.

Unit II

Molecular endocrinology-basic theme. Historical highlights. Concepts of receptors. Pharmacological receptors. Cyclin nucleotides. Protein kinases and phosphatases. Neurotransmitter receptors(cholinergic and adrenergic) Structure-function relationship. Dopamine, Serotonin. Chemistry & Biochemical functions.

Unit III

Peptide hormone action. Structure of receptors. G-Protein coupled receptors, Adenylate cyclases. Selected hormones-GnRH : pituitary trophic hormones: Insulin/glucagon: somatostatin: gastrointestinal peptides oxytocin/ vasopressin-Chemistry& biochemical functions.

Unit IV

Steroid/thyroid hormone, vitamin D and retinoic acids. Structure of receptors: Functional domains DNA binding sites, nuclear transport mechanisms. Transcriptional and post transcriptional control mechanisms. Emphasis on estrogens ,Progesterone androgens, gluco and mineral ocorticoids, Peroxisome. Proliferation factor- Chemistry and biochemical functions.

Unit V

Endocrine dysfunction-Hypophyscal Thyroid, parathyroid adrenal, pancreas, gonads- abnormalities & molecular basis of the diseases. Clinical evaluation of endocrine functions.

Subject Code	Title of the subject	Credits			
		L	T	P	C
BCH –E02	MICROBIAL BIOCHEMISTRY	3	-	-	3

Unit I

General chapter and classification of microorganisms bacteria, fungi and viruses, mycoplasma structure of prokaryotic and eukaryotic cells. Viruses-structure, viral replication and cultivation, staining of bacteria simple staining, gram staining and spore staining.

Unit II

Cultivation and growth of bacteria nutritional types of bacteria, bacteriological media, physical conditions required for growth, bacterial growth curve, and measurement of growth, control of growth, sterilization and disinfection.

Unit III

Microbes as components of the environment-nutrient cycles-carbon-nitrogen, sulphur and phosphorus cycles, Degradation of industrial wastes, petroleum hydrocarbons, pesticides, biofouling and corrosion. Bacterial photosynthesis, symbiotic and non-symbiotic nitrogen fixation.

Unit IV

Microbiology of fermented foods-dairy products, meat and fish, alcoholic beverages-beer, wine etc. Food spoilage and preservation processes. Microbes as source of food. Application of microbes in industries production of amino acids & organic acids, bioconversion process, microbial insecticides.

Unit V

Production of antibiotics - Source, production, recovery and uses of penicillin, tetracycline, amoxycillin. Bioinsecticides - Bacteria and fungi, production of bacterial and fungal polysaccharides, Antimicrobial agents-structure of antibiotics, antibacterial and antiviral (function & mechanism of action).

Subject Code	Title of the subject	Credits			
		L	T	P	C
BCH –E03	**BIOPHYSICS, BIOSTATISTICS & BIOINFORMATICS**	3	-	-	3

UNIT – I

Acids and bases, buffers, pH measurements including glass electrodes, Buffer system in body fluids, pH maintenance. Acid base balance by kidney & lungs. Fluid compartments, specialized body fluids and control of pH. Osmotic Pressure, Osmolarity of body fluids and electrolyte balance, Donnon Membrane equilibriurn, dialysis, surface tension and Viscosity of blood ; Conservation of energy Entropy, enthalpy and free energy changes in chemical reactions.

UNIT II

Nucleic acids: Transitional angles and the ranges. Sugar puckering models; the pseudorotation cycle, syn-anti orientation about the c-o and p-o ester bonds. Correlated rotations of torsion angles in nucleotides and in nucleic acids. Detailed geometrics of Watson-Crick and Hoogsteen Base pairs . Nucleic Acids: Structure of dsDNA - B, A, C, D, T, U, Z DNA, physical properties of dsDNA. DNA bending - Wedge model and junction model, protein - induced DNA bending. Supercoiled forms of DNA - Heterogenecity in DNA, DNA knots and catenanes.

UNIT III

Proteins: Amino acids- classification, structure, conformations. phi, psi angles. Ramachandran plot, peptide-peptide bond isomerisation, primary-secondary (alpha helix and beta sheet), tertiary, quaternary structure of protein molecules. Disulphide bonds, short-range repulsion, electrostatic forces, vanderwaals interaction, hydrogen bonds. Three-dimensional structure by X-diffraction. Protein structure by NMR. hydrophobic interactions, - intramolecular interactions.

UNIT-IV

Biostatistics: Definitions – scope of biostatistics, probability analysis-variables in biology, collection, classification and tabulation of data. Calculation of mean, median, mode in series of individual observations, discrete series, continuous and open classes. Scatter plot, correlation coefficient (r), properties (without proof), Interpretation of r, linear regression. Fitting of lines of regression, regression coefficient, coefficient of determination.

UNIT V

3-D structural analysis of biomolecules - molecular visualization tools - RasMol, Chime, WebLab viewer, Deep view, ISIS draw, Chem draw, MolMol, etc. Homology modeling proteins - homology modeling, threading tools – Ramachandran plot. Microarrays - DNA microarray, structure based drug design, Pharmacogenomics. Genetic network analysis - Functional genomics, Metabolomics, Medical informatics.

Subject Code	Title of the subject	Credits			
		L	T	P	C
BCH –E04	**NEUROBIOCHEMISTRY**	3	-	-	3

Unit - I

Neuromorphology and Neurocellular Anatomy : Central Nervous system – General features of Neurons, Cellular organization of neurons Dendrites and Axons, neurotubules, neurofilaments, synapse neuralgia, astrocytes, oligodendrocyte, ependymal cells, schwan cells.

PERIPHERAL NERVOUS SYSTEM (PNS): Muscle, nerve endings, sensory receptors and effector endings; peripheral nerves, spinal and cranial nerves; plexuses ganglia, afferent pathways and sense organs.

SPINAL CORD: Topographical anatomy,spinal nerves, spinal meninges, joint reflexes, gray and white matter of spinal cord.

Unit-II

NEUROPHYSIOLOGY: Neuronal membrane, excitability, ion channels and transport of ions.

NERVE AND SYNAPSE STRUCTURES: Structure function correlation at the synapse. Transmission across the synapse: membrane potential in the steady state action potential generation and propagation.

Unit -III

CHEMICAL COMPOSITION OF BRAIN : Formation, structure and biochemistry of myelin, chemistry of major brain lipids, developmental changes, lipid composition, biosynthesis and catabolism of major lipids, characteristics of brain lipids, regional variations.

NEUROTRANSMITTER : Chemistry, synthesis, storage and release of nervous neurotransmitters, transmitter action, synaptic modulation and mechanism of neuroinal integration.

Unit-IV

SYNAPTIC TRANSMISSION : Structure of the synapse, correlation of structure and function at the synapse, transmission across the synapse, pre and post synaptic events, membrane potential in the steady state action, action potential and propagation of nerve impulse. cAMP in hormone action.

BLOOD BRAIN CSF BARRIERS :Characteristics of blood CSF barrier, composition of CSF, formation of CSF, active transport from CSF to brain CSF brain interface.

Unit – V

NEUROPEPTIDES – Classes of neuropeptides, mode of action, role of neuropeptides in obesity and pain neuropeptide receptors, coexistence of neuropeptides with other neurotransmitters in "Dorsomedial Hypothalamic Nucleus".

DEVELOPMENTAL NEUROBIOLOGY: Organogenesis and neuronal multiplication, axonal and dendritic growth, glial multiplication and myelination, growth in size, regeneration and repair mechanisms, plasticity.

Subject Code	Title of the subject	Credits			
		L	T	P	C
BCH –E05	**Cancer Biology**	3	-	-	3

Unit –I

CANCER BIOLOGY

Overview: Introduction, historical perspective. Carcinogenesis; cancer initiation, promotion and progression. Cellular Differentiation, Malignant Behavior. Different forms of cancers, Phenotypic characteristics of cancer cells, Clinical features & pathology of cancer, Diet and cancer.

Unit –II

CANCER RELATED GENES

A. ONCOGENES

Overview: Retroviral oncogenes, Cellular proto-oncogenes, Oncogene Activation, Growth Factors and Receptors, Signal Transduction, Transcription Factors.

B. TUMOR SUPPRESSOR GENES / CELL CYCLE REGULATORS

Tumor suppressor genes, DNA Viruses and human cancer. Telomerase and cell immortalization , Cell:cell interactions; cell adhesion; invasion and metastasis, DNA methylation; epigenetic silencing of suppressor genes, Apoptosis in cancer biology

Unit –III

PRINCIPLES OF CANCER METASTASIS: Clinical significances of invasion, hetrogeneity of metastatic phenotype, Metastatic cascade, Basement Membrane distruption, Three step theory of Invasion, Proteinases and tumour cell invasion.

Unit –IV

UNDERSTANDING CANCER AS A DISEASE
Free radicals, antioxidants and cancer, Aberrant metabolism during cancer development. Paraneoplastic syndromes; cancer endocrinology, Epidemiology of cancers, Gene rearrangements; detecting oncogene abnormalities in clinical specimens, prediction of aggressiveness of Cancer.

Unit –V

NEW MOLECULES FOR CANCER THERAPY: Different forms of therapy, Chemotherapy, radiation therapy. Translating therapies from the laboratory to the clinic, Strategies of anticancer drug therapy, Mechanisms of cytotoxic drug action, Strategies of anticancer immunotherapy.

Subject Code	Title of the subject	Credits			
		L	T	P	C
BCH –E06	**Chromatographic separations**	3	-	-	3

Unit-I
Introduction: Analytical separation techniques and their importance in various fields of science and industry. Classification of analytical separation techniques: chromatographic and electrokinetic methods. Historical background.

Chromatographic separation methods: Definition of chromatography. Discovery of chromatography, its advantages. Classification of chromatographic methods: gas chromatography (GC), liquid chromatography (LC), supercritical fluid chromatography (SFC), capillary electrochromatography (CEC), Components of a chromatographic system. Mechanisms of chromatographic separation at the molecular level.

Unit-II
Fundamental concepts of chromatography: Adsorption, sorption, partition, partition coefficient, elution, chromatographic peak, Gaussian distribution. Retention time (t_R), adjusted retention time (t'_R), retention volume (V_R), adjusted

retention volume (V'_R), mobile phase hold-up time (t_M), retention factor (k), separation factor (α), column efficiency/theoretical plate number (N), theoretical plate height (H), reduced plate height (h), reduced velocity (*v*), resolution (R_s).

Unit-III

Liquid chromatography (LC): high performance liquid chromatography (HPLC), normal phase and reversed-phase HPLC; mobile phases in LC, role of the mobile phase in LC separations, column types in HPLC, column packing methods in HPLC; column evaluation and test methods; Retention mechanism(s) and band broadening in HPLC, hydrophobic interaction chromatography, ion-pair chromatography, ion-exchange chromatography, size exclusion chromatography, advantages and drawbacks of HPLC methods, mobile phase selection, isocratic and gradient elution in HPLC. Instrumental aspects of HPLC, HPLC pumping systems, sample introduction systems in HPLC, detection techniques in HPLC. Applications of HPLC in science and industry.

Unit-IV

Gas chromatography (GC): Background information, mobile and stationary phases in GC, solute retention in GC, temperature programming. Column technology: Open tubular (capillary), packed, and packed capillary columns; deactivation, static and dynamic coating; stationary phase immobilization, evaluation of a chromatographic column performance, chromatographic band broadening in GC, factors affecting band broadening in a GC column, stationary phases in GC, stationary phase polarity, characterization of GC stationary phase polarities, Sample introduction in GC, GC detectors: flame ionization detector (FID), thermal conductivity detector (TCD), electron capture detector(ECD), nitrogen-phosphorus detector (NPD), flame photometric detector (FPD). Applications of GC

Unit-V

Supercritical fluid chromatography (SFC): Definition of a supercritical fluid, advantages of using a supercritical fluid as a mobile phase in chromatography, supercritical fluids used in SFC, organic modifiers, stationary phases in SFC, separation mechanism(s) in SFC, SFC detectors, selectivity and resolution in SFC, programming techniques in SFC, areas of SFC applications.

Capillary Electrophoresis (CE): Migration of charged particles (ions) in an electric field, electrophoretic mobility, theoretical aspects of electrophoretic separation, advantages and drawbacks of CE as a separation technique, electrical double layer at the silica/aqueous electrolyte solution interface, band broadening in capillary electrophoresis, origin and nature of electroosmotic flow (EOF).

Subject Code	Title of the subject	Credits			
		L	T	P	C
BCH-E07	GENETICS FOR BIOLOGISTS	3	-	-	3

UNIT I

Mendelion Genetics; Mendel's works – Mendel's methods Laws, terminology, Rack /Test cross – problems. Mendel's law are not Universal – Modifications – Complete & incomplete dominance. Co dominance - Lethal factor, Non allelic gene Interactions – Complementary genes, supplementary genes – inhibitory genes – Epistasis – Biochemical aspects – duplicating genes – Pleotrophism – Problems.

UNIT II

Para sexual process, in bacteria; Significance. Transformation, Transduction, Transfection and Conjugal gene transfer – the phenomena, mechanism and applications, kinetics of mating & transfer. Recombination – Models & mechanisms.

UNIT III

Gene linkage and chromosome mapping, Crossing over, three point cross, tetrad analysis, Complementation Organization of chromosomes, Specialised chromosomes. Chromosome abnormalities, Sex – linked heredity & Quantitative inheritance. Gene conservation and genetic load.

UNIT IV

Genetic Counseling; Possible approaches for tackling genetic disorders; Diagnosis of genetic defects; Positive eugenics; Negative eugenics, counseling antenatal diagnosis; fetus sexing. Principles of Plant / animal breeding. Techniques of plant breeding ; Goal and objects of plant / plant breeding ; Methods of Crop & livestock improvement.

UNIT V

Population genetics ; Gene pool, gene frequency, Hardy – Weinberg law, non – random mating, Factors influencing allele frequency. Heretability,genetic variation at the molecular level – Polymorphism Paternity testing; use of VNTR. Human genome organization; Human genome mapping. The Human Genome Project.

Subject Code	Title of the subject	Credits			
		L	T	P	C
BCH-E08	**Genomics and Proteomics**	3	-	-	3

Unit – I

Overview : Genomes of bacteria, archaea and eucarya ; chromatin , supercoiling and packaging; study of genomes – mapping, genetic and physical mapping, single nucleotide polymorphisms and RFLPs.

Unit – II

Genome sequencing; chain termination and automated DNA sequencing; shotgun and gene cloning strategies; library construction; sequence assembly and gap closure; genome resources – NCBI Map viewer, ORF finder, Locuslink.

Unit – III

Gene finding and functional annotation: sequence annotation and bioinformatics tools for genomics and genome comparison; Analyzing gene expression – DNA microarrays – design, analysis and visualization of data. RNA data handling/manipulation; using gene expression arrays for disease profiling.

Unit-IV

Protein structure and function – methods to quantitate proteins; densitometry and classical methods: proteomics methods; two dimensional gel electrophoresis. Mass spectrometry. Protein expression profiling, protein-protein interactions; RNA interference.

Unit – V

Genome mapping projects – human genome projects – methods and insights obtained; transcriptome analysis of *E. coli* and *S. cerevisiae*. Biochemical pathway databases – WIT and KEGG.

Subject Code	Title of the subject	Credits			
		L	T	P	C
BCH –E09	**PLANT BIOTECHNOLOGY**	2	-	-	2

UNIT I

Genome organization: Plant genome, Mitochondrial genome and Plastid genome. Mitochondrial genes and cytoplasmic male sterility. Targeting of proteins to mitochondria and chloroplast. Intergenomic interactions. Marker Aided Selection: RFLP maps, linkage analysis, RAPD markers, STS, microsatellites, SCAR (sequence characterized amplified regions), SSCP (Single Strand Conformational polymorphism), AFLP, map based cloning.

UNIT II

Cell and Tissue culture in plants; Tissue culture media (composition and preparation), Primary culture cell line; cell clones; callus and suspension culture. Somaclonal variation; Micropropagation; organogenesis; Somatic embryogenesis; transfer and establishment of whole plants in soil.Embryo culture and embryo rescue. Protoplast fusion and somatic hybridization. Cybrids.

UNIT III

Plant transformation technology: Features of Ti and Ri plasmids, Use of Ti and Ri as vectors, binary vectors, Use of promoters for foreign gene expression in plants, genetic markers, use of reporter genes, receptor gene with intron, use of scaffold attachment regions, methods of nuclear transformation viral vectors and their applications. Gene transfer methods in plants: multiple gene transfers, vector-less or direct DNA transfer.

UNIT IV

Application of plant transformation for productivity and performance Herbicide resistance: phosphoinothricin glyphosate, sufonyl urea, atrazine. Insect resistance: Bt genes, Non-Bt like protease inhibitors, alpha amylase inhibitor. Virus resistance, coat protein mediated nucleocapsid gene, Disease resistance: PR proteins, Bacterial resistance, Nematode resistance. Long shelf life of fruits and flowers, use of ACC synthase, polygalacturonase, ACC oxidase, Male sterile lines, Bar and Barnase systems.

UNIT V

Metabolic engineering and industrial products Plant secondary metabolites, control mechanisms and manipulation of phenylproponoid pathway, shikimate pathway; alkaloids, industrial enzymes. Biodegradable plastics, polyhydroxybutyrate, therapeutic proteins, lysosomal enzymes, antibodies, edible vaccines, Purification strategies, oleosin partitioning technology.

SUPPORTIVE

Subject Code	Title of the subject	Credits			
		L	T	P	C
BCH –S01	**Introduction to Biochemistry**	3	-	-	3

UNIT-I

Structure of atoms, molecules and chemical bonds. Principles of physical chemistry: thermodynamics, kinetics, dissociation and association constants. Chemical foundations of Biology-pH, pK, acids, bases and buffers, Covalent and Noncovalent interactions-van der waals, Electrostatic, Hydrogen bonding and hydrophobic interactions.

UNIT-II

Amino acids and peptides-classification, chemical reactions and physical properties. Lipids-classification, structure and functions. Carbohydrates classification and reactions, Structural features of polysaccharides and methods for compositional analysis. Sequencing of proteins and nucleic acids.

UNIT-III

Structure of DNA, different forms of DNA and RNA, secondary structure in single stranded nucleic acids. Replication, models, DNA binding proteins Transcription, role of rho factors Translation, codon usage, inhibitors of transcription and translation.

UNIT-IV

Conformation of proteins and polypeptides (secondary, tertiary, quaternary and domain structure), Ramachandran plot. Enzyme catalysis - Acid base catalysis, electrostatic, covalent catalysis. Mechanism of reaction catalyzed by enzymes - lysozyme and chymotrypsin. Metal activated enzymes and metallo enzyme. Coenzymes and cofactors in enzyme catalysed reaction.

UNIT-V

Biosyntheses and degradation of amino acids, peptides and proteins; Biosyntheses and degradation of fatty acids and cholesterol, Biosyntheses and degradation of Purines, pyrimidines.

Subject Code	Title of the subject	Credits			
		L	T	P	C
BCH –S-02	**Tools and Techniques in Bioscience**	3	-	-	3

Unit-I

General scheme for purification of bio-components. Methods for studying cells and organelles. Sub-cellular fractionation and marker enzymes. Methods for lysis of plant, animal and microbial cell. Ultrafiltration, freeze drying and fractional precipitation. Use of detergents in isolation of membrane proteins.

Unit-II

CHROMATOGRAPHY:Basic principles and applications of ion-exchange, gel filtration, partition, affinity, HPLC and reverse phase chromatography, gas chromatography, TLC, Paper chromatography. Chromatofocussing.

CENTRIFUGATION: Ultracentrifugation - velocity and buoyant density determination. density gradient centrifugation, molecular weight determination.

Unit-III

ELECTROPHORESIS: Basic techniques, poly acrylamide/ starch/ agarose gel electrophoresis, use of SDS/urea, isoelectric focusing, capillary electrophoresis. Pulse field gel electrophoresis.

TRACER TECHNIQUES: Principles and applications of tracer techniques in biology, Measurement of alpha, beta and gamma radiations. Radiation dosimetry, Radioactive isotopes and half life of isotopes, Autoradiography, Liquid Scintillation spectrometry.

Unit-IV

DETERMINATION OF BIOPOLYMER STRUCTURE:(Principles and applications): X-ray diffraction, fluorescence, UV, visible, CD/ORD, NMR and Mass spectroscopy, atomic absorption spectroscopy.

MICROSCOPY: Principles and application of light phase contrast, fluorescence, scanning and transmission electron microscopy.

Unit-V

BIOINFORMATICS

Introduction to Bioinformatics, Databank search- Data mining, Data management and interpretation, BLAST, Multiple sequence alignment, Protein Modeling, Protein structure Analysis, Docking, Genes, Primer designing, Phylogenetic Analysis, Genomics and Proteomics.

Subject Code	Title of the subject	Credits			
		L	T	P	C
BCH –S03	**BIODIVERSITY**	3	-	-	3

UNIT-I

Definition. Types of biodiversity-genetic, species diversity- species concept, ecosystem diversity-measures of diversity-alpha, beta and gamma. Threats to biodiversity.

UNIT-II

Convention of Biological diversity-Earth summit-objectives. Values of biodiversity, Biological uses and social uses.

UNIT-III

Natural resources: Definition, classification, conservation and management of natural resources-land and water pollution.

UNIT-IV

Forestry: Importance of forest, management of forests.

UNIT-V

Plant diversity: Role of wild life sanctuaries, national parks, and sacred grooves in

plant diversity conservation. Conservation strategies- ex and in situ. Wild life-Importance: -Wild life management-objectives.

Subject Code	Title of the subject	Credits			
		L	T	P	C
BCH-S04	METHODS IN MOLECULAR BIOLOGY	3	-	-	3

Unit- I

Rapid DNA sequencing techniques and strategies details of a range of methodologies, e.g. plus and minus, dideoxynecleotide, partial ribosubstitution, Maxam and Gibert. Use of thin gels, resolution etc. Interpretation of DNA sequences.

Classes of DNA sequences: Zero-order bending, highly repetitive, unique. Methods of distinguishing double and single stranded DNA.

Re-association kinetics: Cot values, experimental procedure, qualitative significance, use of Ag* cesium sulphate.

Unit- I

Physical properties of RNA: Classes of RNA, rRNA, tRNA, mRNA, HnRNA etc. Structure and methods of isolation and fractionation, gel electrophoresis and Dnases, Rnases, Phosphodiesterases.

Rapid RNA sequencing techniques: plus and minus, dideoxy-nucleotide, Zimmern and Kaesberg, Peattie, Simoncsits *et al.*, method etc. Interpretation of RNA sequence.

Unit-III

Strategies for cloning in plasmid vectors, features of commonly used vectors, their purification and characterization. Identification of bacterial colonies that contain recombinant plasmids. Bacteriophage λ vectors, growth, purification. Cloning in Bacteriophage λ vectors.

Cloning in cosmid vectors. Construction of Genomic DNA libraries in cosmid vectors.

Unit-IV

Agarose gel and polyacrylamide gel electrophoresis, detection and extraction of DNA from gels. Construction and analysis of c-DNA; protocols and strategies for c-DNA cloniong. Analysis of Genomic DNA by Southern Hybridization. Amplification of DNA by the polymerase chain reaction. Preparation of radiolabeled DNA and RNA probes. Synthetic oligonucleotides probes.

Unit V

Safety guidelines of creating recombinant DNA research, restriction enzymes and mapping of plasmid DNA. Site-directed mutagenesis. Methods of gene transfer: To plant-agrobacterium mediated, using gene gun. To animals-embryo transfer, eg. Dolly. Applications of recombinant technology in agriculture, pharmaceutical industry and medicine.

PERIYAR UNIVERSITY
SUGGESTED READINGS FOR M.SC. BIOCHEMISTRY (CBCS)

CORE PAPERS

BIOMOLECULES

- Lehninger's Principles of Biochemistry (2000) by Nelson, David L.and Cox, M.M. Macmillan / worth,.NY
- Fundamentals of Biochemistry (1999) by Donald Voet, Judith G.Voet and Charlotte W Pratt, John Wiley & Sons, NY
- Outlines of Biochemistry (1987) by Eric E.Conn,P.K.Stumpf, G. Bruening and Ray H.Doi, John Wiley & Sons, NY
- Biochemistry 3rd (1994) by Lubert Stryer, WH Freeman and Co., Sen Francisco
- Text Book of Biochemistry – (1997) fourth edition, Thomas M.Devlin,A.John Wiley, Inc.Publication New york
- Biochemistry 4th ed., (1988) by Zubay G.L., W M.C.Brown Publishers
- Principles of Biochemistry (1994), Garrette and Grisham, Saunders College Publishing.

CELL BIOLOGY

- Molecular Cell Biology 3rd., (1995) by Lodish H. Baltimove and others Scientific American Book.
- Molecular Biology of cells by Alberts
- Cell biology by ES Saedava,
- Cell and molecular Biology by EDP deRobertis and EMF de Robertis
- Principles of cell biology by Klein smith and M .Kish.

ADVANCED ENZYMOLOGY

- Enzymes by Dixon, E.C. Webb, CJR Thorne and K.F.Tipton, Longmans, London.
- Fundamentals of Enzymology 2nd ed., (1998) by Nicholas C. Price, Lewis Stevans, Oxford University Press.
- Enzyme technology, M.F.Chapline and C.Buke, Cambridge University Press, First Edition, 1990.
- Understanding enzymes, Trevor Palmer, Ellis Horwood Limited, Third Edition,1991.
- Protein Biotechnology, Gary Walsh and Denis Headon, John Wiley and Sons,1994..
- Proteins Biochemistry and Biotechnology, Gary Walsh, John Wiley & Sons Ltd.2002.

LAB. IN ENZYMOLOGY

- Biochemical Methods. Sadasivam.S and Manickam,A. II Edition. New Age International Private Ltd. Publishers.
- Laboratory techniques in Biochemistry and Molecular Biology, Work and Work.

- A Biologist's Guide to Principles and Techniques of Practical Biochemistry, K.Wilson and K.H.Goulding, ELBS Edition, 1986.
- Modern Experimental Biochemistry Boyer, R, , III edition, Benjamin Cummings Publishers.
- A Textbook of Practical Biochemistry by David Plummer.
- Enzyme structure and mechanism, Aln Fersht (1997), Reading, USA.

ADVANCED MOLECULAR BIOLOGY

- Molecular Cloning: a Laboratory Manual, J.Sambrook, E.F.Fritsch and T.Maniatis, Cold Spring Harbor Laboratory Press, New York, 2000.
- Genes VII Benjamin Lewin (2000) Oxford Univ, Press London
- Cell and Molecular Biology, 3rd ed., Gerald Karp (2002) John Wiley & Sons Inc.
- Molecular Biology by David Freifelder (1995) Narosa Publishing house. NewDelhi.
- Molecular Cell Biology 3rd., (1995) by Lodish H. Baltimove and others Scientific American Book.
- Molecular biology, (1999) Weaver R. F. WCB McGraw-Hill companies, Inc, New York.
- Brown T A (1995) Essential molecular biology, vol. I, A practical approach, IRL press, Oxford.

GENETIC ENGINEERING

- Molecular and cellular methods in Biology and Medicine, P.B. Kaufman, W.Wu, D.Kim and L.J: Cseke, CRC Press, Florida, 1995
- Genomes, T.A.Brown, John Wiley and Sons Pvt. Ltd., 1999.
- Recombinant DNA, James D. Watson et.al., Scientific American Books. Second Edition, 1998.
- DNA Science, A First Course in Recombinant Technology, D.A.Mickloss and G.A.Freyar, Cold Spring Harbor Laboratory Press, New York, 1990.
- Molecular Biotechnology (2nd Edition)d, S.B.Primrose, Blackwell Scientific Publishers, Oxford, 1994.
- Gene Cloning, An introduction, T.A. Brown.Chapman and Hall, Third Edition, 1995.
- Genetic Engineering. An introduction to gene analysis and exploitation in Eukaryotes, S.M. Kingsman and A.J. Kingsman, Blackwell Scientific Publications, Oxford, 1998
- Molecular Biology, Bernard Glick and Jack J.Pasternack ,ASM Press, Second Edition, 1998.
- Genes VII Benjamin Lewin (2000) Oxford Univ, Press London
- Molecular Biology by David Freifelder (1995) Narosa Publishing house. NewDelhi.

BIOENERGETICS AND INTERMEDIARY METABOLISM

- Lehniger's Priniples of Biochemistry (2nd edn, 2000) by D.L.Nelson and M.M. Cox, Macmillan, Worth Pub Inc., NY.
- Biochemistry (4th edn. 1992) by Lubert Stryer WH Freeman & Co., NY

- Harper's Biochemistry (25th ed) by R.K. Murray and others, Appleton and Lange, Stanford.
- Fundamentals of Biochemistry (1999) by Donalt Voet, Judith G Voet and Charlotte W Pratt, John Wiley & Sons, NY
- Regulation in Metabolism by E.A.Newshome ,C. Start, John wiley & Sons.
- Biochemistry 4th ed., (1988) by Zubay G.L., W M.C.Brown Publishers.

LAB. IN GENETIC ENGINEERING & MOLECULAR BIOLOGY

- Molecular Cloning: a Laboratory Manual, J.Sambrook, E.F.Fritsch and T.Maniatis, Cold Spring Harbor Laboratory Press, New York, 2000.
- Applied Molecular genetics, Roge L Miesfeld, John Wiley & sons, Inc. Publications, 1999.
- Recombinanat DNA principles and Methodologies, James J. Greene, Venigalla B. Rao, Marcel Dekkar Publications. 1998.
- DNA cloning a practical approach, D.M.Glover and B.D.Hames, IRL Press, Oxford 1995.
- Molecular and Cellular methods in Biology and Medicine, P.B.Kaufman, W.Wu, D.Kim and L.J.Cseke, CEC Press, Florida 1995.
- Introduction to Practical Molecular Biology, P.D.Dabre, John Wiley& Sons Ltd., New York, 1998.
- Molecular Biology LabFax, I.A.Brown (Ed), Bios Scientific Publishers Ltd., Oxford,1991.

PLANT BIOCHEMISTRY

- Introduction to plant biochemistry (1983) T.W.Goodwin and E.I. Mercer, Pergaman Press, Oxford, NY, Toronto, Sydney, Paris, Frankfurt.
- Plant Biochemistry by P.M. Dey and J.B.Harborne. Harcourt Asia PTE Ltd. Singapore
- Methods in Plant Biochemistry and Molecular Biology (1997) by William V.Dashek, CRC Press.
- Plant Biochemistry and Molecular Biology , 2nd ed., (1999) by Peter J.Lea, Richard C.Leegood, John Wiley & Sons.
- Plant Biochemistry and Microbiology by William V.Dashek (1997)

ADVANCED CLINICAL BIOCHEMISTRY

- Tietz Fundamentals of Clinical Chemistry – (5th edn.) C.A.Burtis, E.R. Ashwood (eds.) Saunders WB Co.
- Text Book of Medical Physiology (10th ed. 2000) by A.C. Guyton & J.E. Hall, Harcourt Asia
- Fundamentals of Clinical Chemistry, N.W.Teitz, W.B. Saunders Company, 1994.Second Edition.
- Clinical Chemistry in diagnosis and treatment, Philip. D.Mayne, ELBS Publications, Sixth Edition, 1994.

- Practical Clinical Biochemistry, Volume I and II – Harold Varley, et al., CBS Publishers, Fifth Edition, 1980
- Clinical Biochemistry– Metabolic and Clinical aspects,William J Marshall and Stephen K Bangert, Pearson professional Ltd. 1995.

IMMUNOLOGY

- Immunology (4th edn. 1998) by Ivan Roitt, J. Brostoff and David Mole (4th edn) Mosby Times Mirror Int. Pub. Ltd.
- Essential Immunology (9th ed. 1997)by Ivan Roitt Blackwell Science Led.
- Immunology (1992) by Janis Kuby W.H. Freeman and Co. Ltd . USA
- Immuno biology 5th ed.,by Charles A. Janeway . Jr.Paul TraversMark Walport, and Mark J.Shlomick (2001). Churchill Livingstone Garland Publishing Company.
- Cellular and molecular immunology by Abbas. Lightman and Pober. W.B.Sajnders 2nd ed., 1994.
- Basic and clinical Immunology 6th ed,. By Stites D.p.Stobo, J.D.Fundanberg H.A.and Wells,J.V.(1990) Los Atlas Appleton Lange.
- Practical Immunology 4th ed., by Frank C. Hay Olywn M.R.Westwood (2002) Blackwell Science Ltd.,
- Immunology, An Introduction, (1995)I.R.Tizard, 4th edition – Saunder's.

LAB. IN CLINICAL BIOCHEMISTRY & IMMUNOLOGY

- Practical Clinical Biochemistry, Volume I and II – Harold Varley, et al., CBS Publishers, Fifth Edition, 1980
- Practical Immunology 4th ed., by Frank C. Hay Olywn M.R.Westwood (2002) Blackwell Science Ltd.,
- Laboratory techniques in Biochemistry and Molecular Biology, Work and Work.
- A Biologist's Guide to Principles and Techniques of Practical Biochemistry, K.Wilson and K.H.Goulding, ELBS Edition, 1986.
- Modern Experimental Biochemistry Boyer, R, , III edition, Benjamin Cummings Publishers.
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