



PSG College of Arts & Science
An Epitome of Quality Learning

M.Sc. BIOTECHNOLOGY

2016 - 2018

Scheme of Examinations
M Sc Biotechnology
(For students admitted from 2014-15 & onwards)

Code No.	Subject	Duration (Hrs)	Max. Marks			Credit Points
			CA	CE	Total	
First Semester						
14BTP01	Cell Dynamics	3	25	75	100	5
14BTP02	Structural Biology and Chemistry of proteins	3	25	75	100	4
14BTP03	Microbial Genetics	3	25	75	100	4
14BTP04	Molecular Genetics	3	25	75	100	5
14BTP05	Immunotechnology	3	25	75	100	4
14BTP06	Basic Biotechniques Practical	6	40	60	100	4
Second Semester						
14BTP07	Recombinant DNA Technology	3	25	75	100	4
14BTP08	Pharmaceutical Biotechnology	3	25	75	100	4
14BTP09	Bioinformatics	3	25	75	100	4
14BTP10	Metabolic Regulation	3	25	75	100	4
14BTP11	rDNA technology, Immunotechnology and Microbial Genetics Practical	6	40	60	100	4
14BTP12A (or) 14BTP12B	<u>Core Elective-I</u> : Bioprocess Technology (OR) Diagnostic Techniques	3	25	75	100	5
14SBP01	<u>Skill Based Subject</u> : Cyber Security	---	100	---	100	2

Since - 1947

Code No.	Subject	Duration (Hrs)	Max. Marks			Credit Points
			CA	CE	Total	
Third Semester						
14BTP 13	Genomics and Proteomics	3	25	75	100	4
14BTP14	Plant Biotechnology	3	25	75	100	4
14BTP15	Nanobiotechnology	3	25	75	100	4
14BTP16	Plant TC, Animal TC, Nanobiotechnology and industrial biotech Practical	6	40	60	100	4
14BTP17A (OR) 14BTP17B	<u>Core Elective-II</u> : Advanced Biotechnology Research* (or) IPR, Biosafety and Publication Ethics	3	25	75	100	5
14BTP18A/ 14BTP18B/ 14BTP18C/	<u>Cluster IDC</u> : Food and Medicinal resources (IDC – BO) (or) Silkworm Rearing (IDC – ZO) (or) Nutrition and life style disorders (IDC – CND)	3	25	75	100	4
Fourth Semester						
14BTP19	Animal Cell Biotechnology	3	25	75	100	4
14BTP20	Project and Viva	--	80	120	200	8
Total						90

Two weeks summer training mandatory during first year summer vacation

CLUSTER IDC Offered by the Department

14BOP16C/14ZOP17C/ 14CNP19C Nutrition)	Foods, Genes and Diseases (for MSc Botany, MSc Zoology & MSc Clinical
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CELL DYNAMICS**Objectives:**

- to appreciate and understand the dynamic nature of cell and cellular processes
- to understand intracellular signaling cascades and their impact on cellular activities
- to understand the mechanism of cell cycle and regulation

Unit I**(10hours)**

Basic Cellular architecture and methods to study cells: Cytoskeletal structure and cell Motility- Dynamics of microtubules, Microfilaments and Intermediate filaments, Molecular Motors and sarcomere regulation, Cellular imaging, , Cell quantification and viability, Cellular tensesgrity, Flow cytometry and cell sorting Methods for disrupting tissues and cells, , organ and tissue slice techniques, cell fixation - fluid fixatives, freezing and section drying, fixation for electron microscopy Analysis of Cellular proteins.

Unit II**(10hours)**

The cell Exterior and Cell- Cell Interaction: Differentiation of cell membrane - microvilli, tight junctions, epithelia, Bell and spot desmosomes - mechanical function, cell-cell interaction, cell adhesion proteins, cell junctions, tight junctions, cell surface of plant cells and cancer cells. Cellular differentiation, manipulating cell differentiation.

Specialized cell dynamics: Muscle cells, Cancer cells and metastasis and Neurons

Unit III**(10hours)**

Membrane architecture and Transport: Cell membranes- structure and models for plasma membrane architecture, Overview of membrane protein - peripheral and integral, molecular model of cell membrane - fluidity, dynamism in proteins and lipids of the membrane, solute transport across membrane - passive transport, active transport by ATP powered pumps, types of transport systems, Na⁺ K⁺ pump, Chloride ion pump, calcium channels, Nerve conduction, Action and resting potential, Neurotransmitters

Unit IV**(10hours)**

Internal Compartmentalization and functions: Nucleus - internal organization, traffic between the nucleus the nucleolus, and cytoplasm, endoplasmic reticulum - protein sorting and transport, golgi apparatus and lysosomes, mitochondria, chloroplasts and peroxisomes, glyoxysomes .

Unit V**(10 hours)**

Cell Division Cycle and Cancer: Cell cycle and checkpoints, Cell cycle events in yeast and Xenopus oocyte, Cell aging and death - necrosis and apoptosis - mitochondrial and death receptor pathway. Quorum sensing, Cell signaling - signaling molecules and their receptors, functions of cell surface receptors and intracellular receptors, pathways of intracellular signal transduction, G protein coupled receptors, receptors tyrosine kinases, ras, MAP kinase pathways, JAK/STAT Pathway, Sensory Signaling, Notch and lipid signaling

References:

1. Bruce Alberts *et.al.*, Molecular Biology of the Cell, 5th Edition, Garland Science
2. Lodish *et.,al*, Molecular Cell Biology, 7th Edition, W H Freeman & Co
3. G M Cooper, The Cell- A Molecular approach, 5th Edition, AS M Press

STRUCTURAL BIOLOGY AND CHEMISTRY OF PROTEINS**Objectives:**

- to understand the structure and chemistry of proteins
- to learn about the various method of protein preparation and identification
- to understand the principles of protein engineering

Unit I**(10hours)**

Protein Structure: Structure of amino acids, bond angles, L&D configuration, Hierarchical organization of protein structure: primary, Secondary (alpha helix, Beta sheets- parallel and anti-parallel, Beta barrel, beta loops), Tertiary(Myoglobin and IgG), Quarternary (hemoglobin), Membrane proteins (bacteriorhodopsin), receptor families, eukaryotic transcription factors

Unit II**(10hours)**

Structural biology of proteins: Ramachandran map and protein conformations, DNA binding proteins- Domains and motifs- HTH, Leucine Zipper, Zinc finger motifs, Greek Key motifs, forces governing protein architecture, hydrophilicity, hydrophobicity and amphipathicity in proteins, structure of chaperones and chaperonins

Unit III**(10hours)**

Preparation and analysis of proteins: protein preparation- centrifugation , chromatography, gel electrophoresis- 1D and 2D, chemical synthesis of proteins, sequencing of proteins- Edman degradation, FDNB method; Protein identification – Peptide Mass Fingerprinting, X ray crystallography, Surface Plasmon Resonance

Unit IV**(10hours)**

Peptides and polypeptides: structure of di peptide, tri peptide, cyclic peptides, and antimicrobial peptides. DNA polymerase-a multifunctional enzyme, Collagen triple helix, Serine proteases- chymotrypsin and subtilisin

Unit V**(10hours)**

Engineering and Design of protein structure: Site Directed Mutagenesis by oligonucleotide mediated method, Combinatorial enzyme engineering, antibody engineering, Engineering of proteins for increased temperature tolerance, better substrate binding, decrease in disulphide bonds, create better active site, engineering of therapeutic proteins, protein engineered biomaterials

References:

1. David E Metzler- Biochemistry: The chemical reaction of living cells, Vol I & II 2nd Edition, 2004, Elsevier Science
2. Geoffrey L Zubay- Biochemistry, 4th Edition, WCB Publishers
3. Thomas E Creighton, Proteins: Structures and Molecular Properties, 2nd Edition, W H Freeman & Co
4. Branden and Tooze-Introduction to protein structure, 2nd Edition, Garland Science

MICROBIAL GENETICS**Objectives:**

- to improve the knowledge on genomic structure of microbes and their gene expression
- to study replication mechanism and mutation in microbes
- to know about the types of plasmids and transposition.

Unit I**(10hours)**

Introduction to bacterial molecular genetics: DNA replication: double helical structure, chemistry of components, polymerization, DNA polymerases- mechanisms of DNA replication and replication errors. Chromosomal replication, supercoiling and enzymes; antibiotics that affect DNA replication

Unit II**(10hours)**

Transcription: Structure and function of RNA, RNA polymerization, initiation, elongation of different types of RNA and termination. Ribosomes, tRNA- structure and processing. Regulation of transcription- lac, trp, ara. Partial heterozygotes and problem solving.

Unit III**(10hours)**

Translation: The Genetic Code, deciphering the code, translation initiation, elongation cycle, termination, polycistronic mRNA

Protein folding: Chaperones, protein export, targeting and secretion, protein modification, antibiotics that block transcription and translation

Unit IV**(10hours)**

Mutations- types with examples, reversion and suppression, isolating mutants, replica plating, complementation, Lytic phages and generalized transduction, conjugation and genetic mapping.

Phage Lambda: Lysogeny and specialized transduction. genetics of gene mutations

Transposons and transposon mutagenesis

Unit V**(10hours)**

Site specific recombination, molecular models of recombination, molecular basis for recombination in E.coli, DNA repair mechanism, Nitrogen regulation in regulation of virulence genes, Heat Shock regulation

References:

1. David Friedfelder et al.,2006, 2nd, Jones and Bartlett Publishing, Microbial Genetics –
2. Larry Snyder, 2008, Molecular Genetics of Bacteria, 2nd ed, ASM Press

MOLECULAR GENETICS**Objectives:**

- to provide insight into replication and gene expression
- to study the molecular mechanisms of mutation and repair

Unit I (10hours)

DNA double helix, forms of DNA properties of DNA, supercoiling, complexity of the genome, C Value and Cot curve, interrupted gene, repetitive and non repetitive DNA sequences, organellar DNA, clusters and repeats, gene duplication, pseudogenes. Chromosomes, hetero and eu chromatin, epigenetic effects, banding, centromere, telomere and telomerase

Unit II (10hours)

Chromatin: Nucleosomes, hierarchy in arrangement, histone variants, chromatin remodeling, histone acetylation and deacetylation, phosphorylation, methylation. DNA replication, Replicon, initiation, origin of replication, licensing factor, DNA polymerases, elongation fork and enzymes, termination

Unit III (10hours)

Recombination: Homologous Recombination- single strand annealing mechanism, double strand breaks, Holliday Junctions, site specific recombination; enzymes in recombination. Repair: Excision repair, error prone repair, Translesion synthesis, mismatch repair, recombinant repair, Rec A and SOS

Unit IV (10hours)

Transposons: elements in yeast, P elements in Drosophila, Alu family, LINES as retrotransposons
Transcription: RNA polymerases, initiation by RNA Pol I, II and III, Promoter, activators and enhancers, CpG islands, yeast GAL genes, Processing and RNA splicing reactions: rRNA, tRNA processing, Micro RNA and Si RNA, interference catalytic RNA and RNA editing

Unit V (10hours)

Mobility shift assay and foot printing, Translation: Initiation in eukaryotes, mechanism of elongation, termination, post translation modification, protein cleavage, protein degradation. Lambda genes in lytic and lysogenic cycle
Cancer genes: Onco and antioncogenes: their propertie, BRCA genes, molecular approaches to cancer.

References:

1. Lodish *et.al.*, Molecular Cell Biology –7th edition, W.H. Freeman & co
2. Lewin Genes XI – Krebs et al 2012, Jones and Bartlet

IMMUNOTECHNOLOGY**Objectives:**

- to study the basics of immune response
- to understand the various signaling events in immune system
- to study the application of immunotechnology

Unit I**(10hours)**

Introduction to immune system, organization and evolution of the immune system. Types of Immunity- innate – Cell associated pattern recognition receptors, Toll like receptors and signalling. Innate responses- Leucocyte – endothelial interaction and leukocyte extravasation and inflammation. Overview of acquired immune response. Immunogenicity and antigen structure

Unit II**(10hours)**

Structure and function of Dendritic cells, NK cells, Macrophages and Phagocytosis, oxidative burst, granulocytes and Mast cells. Structure and genome organization of MHC and HLA and its role in immune response. MHC and susceptibility to diseases. HLA typing. Antigen capture and the function of antigen presenting cells, Antigen processing and pathways of presentation. Fcγ receptors. Mucosal immunity.

Unit III**(10hours)**

Molecular genetics of immunoglobulins. B lymphocyte development and biology. B- cell signaling and activation. Generation of antibody diversity. Synthesis, assembly and expression of immunoglobulin molecules. T-cell : types, development and selection. T-cell signalling and activation. T-cell receptor rearrangement. T-cell effector mechanisms and functions of other t cell subsets, T- cell polarization, B - cell effector mechanism. ADCC.

Unit IV**(10hours)**

Cytokines and cytokine family receptors. Jak- stat pathway, Complement proteins and biological significance of complement activation. Regulation of complement proteins. Mechanisms and classification of Hypersensitivity reactions. Regulation of Immune response and tolerance. General features of cancer Immunity and evasion of immune response by cancer. Immunology of transplantation and mechanism of graft rejection. Immunity against virus and bacteria. Autoimmune disorders. B-cell and T-cell Immunodeficiency.

Unit V**(10hours)**

Hybridoma technology and Monoclonal antibody production and applications, Immunotoxins, Chimeric antibodies. Purification of antigen and antibody by affinity chromatography. Vaccines: current vaccines, new approaches to vaccine development and immunization against cancer, T cell and B cell cloning. Immunodetection of antigen in cells and tissues, Microengraving for cell selection, ELISPOT, AlphaLISA, Microfluidic chips and SPR chips immunoassays, multiplex immunoassays.

References:

1. Kauffman Immunology, 2nd edition , 2008, ASM Press
2. Kuby's Immunology, 5th Edition,
3. Ivan Roitt, Immunology, 10th edition , CV Mosby & Co

BASIC BIOTECHNIQUES PRACTICAL

1. Estimation of serum glucose.
2. Estimation of phospholipids in Egg yolk.
3. Extraction of cellular protein by salt precipitation and estimation by Lowry method.
4. Isolation and estimation of chlorophyll and identification of plant pigments by TLC.
5. Extraction, isolation and estimation of genomic DNA by diphenylamine method.
6. Immobilization of enzymes / cells by entrapment in alginate gel
7. Separation of amino acids by paper chromatography.
8. Determination of lipidperoxidation and estimation of vitamin E in goat liver.
9. Enumeration and isolation of bacterial population from soil by spread plate technique.
10. Characterization of the isolate by IMVIC.
11. Bacterial growth curve.
12. Assay of antibiotics by disc diffusion method



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RECOMBINANT DNA TECHNOLOGY**Objectives:**

- to know the principles and methods in Genetic engineering
- to study the construction of vectors for gene transfer

Unit I**(10hours)**

Cutting and joining of DNA molecules: DNA restriction enzymes, DNA Methylases, DNA Ligases- Properties and mechanisms, Kinases, phosphatases, polymerases, topoisomerases, Restriction mapping and Subcloning

Unit II**(10hours)**

Cloning Vectors: Plasmids, phage vectors- Lambda and M13, Cosmids, phagemids, phasmids, Yeast vectors- Constructs, selectable markers, host *E.coli* strains, Broad host range vectors, Cloning in Gram Negative bacteria and Gram positive bacteria, Cloning in *Streptomyces*, YAC, PAC and BAC as vectors

Unit III**(10hours)**

Genomic libraries- method and vectors- Screening of library, cDNA cloning vectors, cDNA cloning, Screening libraries by oligonucleotide probes, antibody probes, subtracted cDNA probes, cDNA expression library, Gene transfer to animal cells using physical methods. selectable markers in animal vectors, animal viruses and Vectors- SV40, Adenoviruses, Retrovirus, BPV and Vaccinia vectors, E Cells, Gene targeting technology, Cloning of animals, nuclear transfer technology

Unit IV**(10hours)**

Techniques in gene manipulation: Gel electrophoresis, PFGE, hybridization, blotting techniques, RNase protection assay, Design of Primers, PCR- RT PCR, Nested PCR, Real time PCR, RACE and other variants, Subtracting hybridization, Diagnostic applications of PCR, Sequence Tagged Site, DNA Sequencing methods, automated NGS, in vitro mutagenesis and deletion mutagenesis, random point mutagenesis, DNA profiling ,VNTR, STR and application

Unit V**(10hours)**

Application of gene manipulation: Producing therapeutic proteins commercially in plants and animals- as bioreactors. Metabolic engineering for production of molecules, Combinatorial biosynthesis in production, Production of small molecules in cell culture Eg: Vitamin A in cereals, Vitamin E in plants, pharma through milk of farm animals, to study and prevent and cure diseases, DNA vaccines, DNA augmentation therapy, gene therapy

References:

1. Winnackeer, E.L., 1987. From Genes to Clones, VCH Publications
2. Primrose,S.B., Twyman, R.M. ., 9th ed 2010 Principles of gene manipulation and Genomics
3. Sambrook, Fritsch, Maniatis,1989, Molecular cloning Vol 1, 2 and 3, CSHL Press
4. Glick B.R., Pasternack J.J., 3rd Ed, 2001, Molecular Biotechnology, ASM Press

PHARMACEUTICAL BIOTECHNOLOGY**Objectives:**

- to have a knowledge and understanding of pharmacology and its action on CNS.
- to have an insight into Herbal medicine.

UNIT I**(9hours)**

Pharmacological profile of drugs-drug classification, pharmacokinetics and pharmacodynamics. Of drugs ,routes of drug administration, types of drug preparation and sources for drug preparation. Toxicity study of drugs - acute toxicity, short-term toxicity study. Preclinical study .Clinical trials and research design.(preparation and submission of a case study on drug trial research for evaluation by each student.)

UNIT II**(9hours)**

Drug delivery system: controlled drug delivery systems (oral, parenteral ,dental, colon specific drug delivery), Transdermal drug delivery system (TDDS), Liposomal and targeted drug delivery system.

UNIT III**(9hours)**

Drug interaction : Genotoxicity screening, drug absorption and metabolism, the toxicity of the drug's metabolites in liver and kidney. Detoxification mechanism by liver. Drug resistance (MDR) assessment and management of drug resistance.

UNIT IV**(9hours)**

Drug response on CNS: :Anatomy of the brain. Biomembranes,- Types of Membranes, Anatomy of blood-brain barrier,Differences between BMEC and normal endothelial cells, mechanisms of biotransport, mechanisms of biotransport. Neurotransmitters- types of neurotransmitters and their mode of action. Types of Drug-Receptor Interactions

UNIT V**(9hours)**

Phytopharmaceuticals: Advent of herbal drugs and their formulation. : Herbal medicines utilised for psychoactive and psychotropic properties. Immunomodulatory roles of Ocimum and Emblica.

References:

1. Guyton and Hall Textbook of Medical Physiology, 12th Edition By John E. Hall, PhD .
2. Ram I. Mahato- Pharmaceutical Dosage Forms and Drug Delivery. 10th edition
3. David E Golan -Principles of Pharmacology: The Pathophysiologic Basis of Drug Therapy III

BIOINFORMATICS**Objectives:**

- to make possible the current revolution in modern biology by understanding and wisely using computing resource
- to keep current with ever increasing body of literature

UNIT I**(9hours)**

Genomic Data Mining: Database management system- RDBMS. Genome and protein databases- Information retrieval. Sequence submission and file formats. Mark up languages and scripting languages. Databases and data resources, EST, STS, GSS, and HSS. Genome data visualization, ENSEMBL, MAP Viewer. Tools for data mining. Patterns, Profiles and HMM.

Exercise: 1. Retrieval of sequences from nucleic acid databases and comparison of outputs- ENTREZ, SRS, DBGet.

2. Retrieval of protein sequences from UniPROT

UNIT II**(9hours)**

Advanced Techniques for sequence analysis : Sequence profile; Similarity searching matrices. algorithms and program-substitution matrices-PAM and BLOSUM. BLAST and FastA- output, scoring word and filters. PSI and PHI BLAST. Phylogenetic analysis –simple and multiple sequence analysis UPG MA, Neighbour relation. Phylip, PAUP.

Exercise: 1. Similarity search using BLAST

2. MSA using Clustal and phylogenetic analysis.

UNIT III**(9hours)**

Genome Mapping Databases: Genome annotation.- analysis of regulatory regions in genome- promoters, splice site, termination signals ORF prediction UTRS algorithms for gene prediction. Gene modeling. Identification of disease gene. High throughput data analysis microarray.

Mapping databases. Tools for restriction mapping, PCR primer and probe design. Vector screening (VecScreen).

Exercise: 1. Gene finding, RNA secondary structure.

2. Restriction mapping, PCR Primer design.

UNIT IV**(9hours)**

Functional genomics: Protein structure – levels, secondary structures. Structure data bases – PDB, secondary data bases, - SCOP, CATH, FSSP, DALI, MMDB. Protein sequence analysis, physical properties, identification. Protein –Protein interaction networks DIP, MINT, GRID.

Structure prediction- homology modeling, threading (folds), ab initio prediction and tools. Molecular visualization tools- Ras Mol, Chime, Cn3D, SPDV. DNA and Protein array

Exercise 1. ExPASY on analysis of properties protein structure prediction

2. Secondary structure prediction of proteins and 3D structure prediction of protein- Homology Modelling

UNIT V**(9hours)**

System biology and Synthetic Biology: Medical informatics-bioinformatics resources for human disease resources for human diseases-MedLine, OMIM, mutation databases. SNPs and

disease detection. Metabolomics- pathway databases, network analysis. E cell, V cell and M cell

Structure based drug design, target- identification, validation; ligands, docking.

QSAR, Neuro bioinformatics , Pharmo bioinformatics, Vaccines and Drug. Toxicity testing and ADMET modeling. Genome databases of model organisms- *E.coli*, *Saccharomyces cerevisiae*, *Arabidopsis thaliana* and *C. elegans*. IPR in bioinformatics.

Exercise: 1. Protein-ligand docking
2. ADMET modelling

References:

1. Stan Tsai., 2004, *An Introduction to Computational Biochemistry*, John Wiley and Sons.
2. Baxevanis, Andreas and B.F. Francis Ouellette (eds) 2005, *Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins*, 3rd edn, John Wiley.
3. Mount, David W. 2001, *Bioinformatics: Sequence and Genome analysis*, Cold Spring Harbor Labaratory.
4. Arthur M. Lesk 2002, *Introduction to Bioinformatics*, Oxford University Press, India.



METABOLIC REGULATION**Objectives:**

- to provide biochemical aspects of cellular function
- to understand metabolic reactions in a living system

UNIT I**(10hours)**

Introduction to metabolic concepts– energetics of metabolic cycle- ATP hydrolysis (energy yielding and energy requiring reactions), activated carriers, enzymes and their catalytic activities, types of regulation of metabolism - feed back inhibition and feed forward stimulation

Hormonal regulation of metabolism-Role of Insulin, glucagon, epinephrine-: Cyclic AMP-dependent protein kinase; Cyclic GMP-dependent protein kinase; Protein kinase C; Ca²⁺-calmodulin-dependent protein kinases; AMP-dependent protein kinases.

UNIT II**(10hours)****Regulation of carbohydrate metabolism**

Glycolysis and its regulation by enzymes phosphofructose kinase as rate limiting enzyme in glycolysis, regulation of hexokinase and pyruvate kinase, Gluconeogenesis, tissues involved in gluconeogenesis and regulation. reciprocal regulation of glycolysis and gluconeogenesis Glycogen metabolism- synthesis and breakdown- Role of enzymes in reversible covalent modification for control of glycogen phosphorylase and synthase, role of protein phosphatase.; TCA cycle- enzymes involved in regulation of TCA cycle.. Hormonal regulation of carbohydrate metabolism. (All cycles should be learnt with structures)

UNIT III**(10hours)**

Fatty acid metabolism: lipogenesis of palmitic acid, triacyl glycerol and membrane phospholipids, role of acetyl coA carboxylase in fatty acid synthesis and degradation. Cholesterol biosynthesis and regulation of cholesterol metabolism. oxidation of fatty acids– β- oxidation and regulation, ketogenesis and its control. (All cycles should be learnt with structures)

UNIT IV**(10hours)**

Oxidative degradation of amino acids : Proteolysis, transamination, oxidative Deamination of amino acids(tryptophan, methionine and valine), and decarboxylation, urea cycle and regulation. Biosynthesis, degradation and salvage of purine and pyrimidine nucleotides. (No Structures only cycles)

UNIT V**(10hours)**

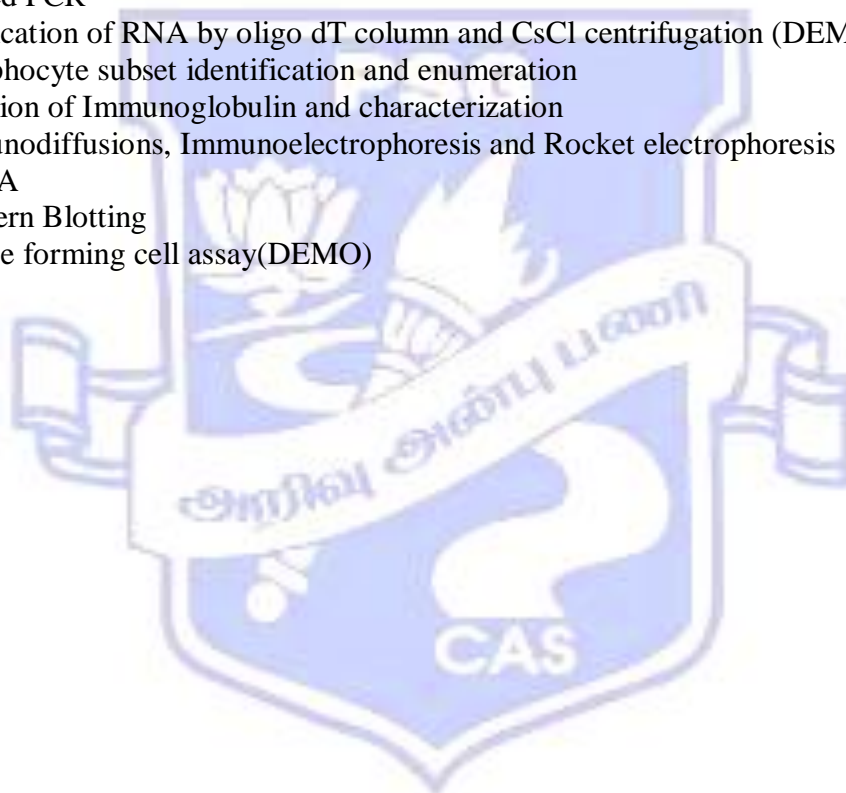
Integration of metabolism & key junctions–control of metabolism by compartmentation; metabolic specialization of organs; glucose 6-phosphate, pyruvate and acetyl coA as key junctions in metabolism – metabolic profiles of kidneys and muscle-metabolic adaptations in prolonged starvation, diabetes, role of ethanol in energy metabolism in liver .

References:

1. Lubert Stryer Biochemistry –6th edition (2007), W.H Freeman and company
2. Lehninger, Principles of Biochemistry, Fourth Edition by David L.Nelson Michael. M Cox Fourth Edition, W.H.Freeman
3. Biochemistry [with CDrom](2004) by Donald Voet, Judith G Voet Publisher: John Wiley & Sons Inc

**rDNA TECHNOLOGY, IMMUNOTECHNOLOGY AND MICROBIAL GENETICS
PRACTICAL**

1. Single colony isolation and checking for auxotrophic and prototrophic markers
2. Isolation of T even phage and One step growth curve of T even phage
3. Conjugation Mapping
4. Isolation of Plasmid DNA
5. Restriction Digestion of DNA and generation of a restriction map
6. Ligation of restricted DNA
7. Preparation of Competent cells and transformation
8. Nested PCR
9. Purification of RNA by oligo dT column and CsCl centrifugation (DEMO)
10. Lymphocyte subset identification and enumeration
11. Isolation of Immunoglobulin and characterization
12. Immunodiffusions, Immunoelectrophoresis and Rocket electrophoresis
13. ELISA
14. Western Blotting
15. Plaque forming cell assay(DEMO)



Since - 1947

**Core Elective-I :
BIOPROCESSTECHNOLOGY***

Objectives:

- to Provide knowledge on bioprocess engineering and technology

Unit I**(9hours)**

Introduction to microbial technology:- Concept of fermentor designing and types of fermentor (STB,Airlift, tower, and deep jet).Process optimization- mass transfer, heat transfer, mixing, rheology of fermentation fluids, turbidostatic and chemostatic control. Basic principles of scale up.

Strain development-use of genetic methods, preservation of microorganisms,

Sterilization techniques in fermentation, formulation and substrates for industrial fermentation. Antifoam agents.

Unit II**(9hours)**

Microbial growth kinetics- Kinetics of batch ,fed batch and continuous process, thermal death kinetics. Comparison of batch ,fed batch and continuous process .

Downstream processing: Removal of microbial cells and solid matter.– foam separation, precipitation, centrifugation, drying and crystallization. Product recovery and yield

Unit III**(9hours)**

Microbial production of organic acids- citric acid, gluconic acids

Production of amino acids- glutamic acid, lysine and tryptophan.

Production of vitamins- Vitamin B2, B12,

Microbial polysaccharides

Production of solvents- ethanol and acetone

Unit IV**(9hours)**

Microbial production of enzymes- pectinases, lipases, lactases and their applications.

Immobilisation of enzyme and industrial application of enzymes.

Microbial production of antibiotics- penicillin, cephalosporins, amino acid and peptide antibiotics, tetracyclines, nucleoside antibiotics.

Unit V**(9hours)**

Production of alkaloids- ergot alkaloids, regulation of alkaloid production in cultures.

Microbial transformation- types of bioconversion reactions, procedures for bio transformation, applications of bioconversions, transformation of steroids, non steroid compounds, pesticides transformation. Bioremediation and its application.

References:

1. T.D. Brock,. Biotechnology: A Text Book of Industrial Microbiology: Smaeur Associates,
2. 1990.
3. L.E. Casida Industrial Microbiology:, Willey Eastern Ltd., 1989.
4. Prescott & Dunn Industrial Microbiology:, CBS Publishers, 1987.
5. Stanbury et al., Principles of Fermentation technology
6. W. Crueger and A. Crueger Biotechnology - a handbook of industrial microbiology:.
7. Pepler and Pearlman Microbial technology –, Academic Press.

Core Elective-I : DIAGNOSTIC TECHNIQUES**Objectives:**

- to understand the basic mechanism and components of diagnostic systems
- to study about the genetic markers and diagnosis

Unit I (9hours)

Basic components of biomedical systems: transducers, Sensors, gas analyzers, electrochemical sensors, Therapeutic equipments: Pace makers, artificial lungs, dialysis

Unit II (9hours)

Medical imaging and measurements: Radiographic and fluoroscopic techniques, X ray CT (CAT scan), ultra sound imaging, Biometric systems, Endoscopy, ECG, EEG and ERG artificial heart valves

Unit III (9hours)

Non electrical parameters for measurement: Hematology, Serum biomarkers for Hepatitis B, HIV, cardiac biomarkers, pH of blood, measurement of blood pCO₂ and pO₂, ESR, GSR and CSF, Urine, bile, biopsy, blood banking procedures

Unit IV (9hours)

Instrumentation : HPLC, GC, GC MS, FTIR, AAS, Spectroscopy, Fluorimetry, flame photometer, NMR, ORD, CD, Radioactive tracers and applications in medicine

Unit V (9hours)

Genetic markers and Diagnostics: PCR based detection, RIA, ELISA, HLA tissue typing, Diagnostic microarrays, SMART diagnosis for cancer, karyotyping, FISH, prenatal diagnosis, DNA profiling and fingerprinting

References:

1. Carl A Burtis, Edward R Ashwood, Teitz- Textbook of Clinical Chemistry Harcourt Brace & Company Asia
2. Snustad, Principles of Genetics, Wiley Publishers
3. Ronald J Trent- Molecular Medicine An Introductory Text, 3rd Edition, 2005, Elsevier

GENOMICS AND PROTEOMICS**Objectives:**

- to understand the information on genome organization, mapping and sequencing
- to study the principle of proteomics and metabolomics

Unit I (10hours)

Genomics: Organization and structure of eukaryotic genomes, organellar and nuclear DNA, tandem repeats, dispersed repeats by transposons and retrotransposons, pseudogenes and duplication of genes, human Y chromosome, centromere repeats, telomeres, mapping and sequencing genomes, DNA polymorphisms- RFLP map, SNP, AFLP, physical markers for cytogenetic maps, RH mapping, HAPPY mapping

Unit II (10hours)

Sequencing genomes: High throughput sequencing, Shotgun sequencing- gaps in sequences, comparative genomics of bacteria and eukaryotes. Large scale mutagenesis and RNA interference, analysis of transcriptome, DNA Microarray, expression profiling

Unit III (10hours)

Proteomics : 2D electrophoresis , multiplexed analysis for protein expression profiles, multidimensional liquid chromatography, Mass Spectrophotometry for protein annotation , Protein microarrays, Antibody arrays, antigen arrays, protein arrays and expression profiling

Unit IV (10hours)

Structural Proteomics: X ray crystallography and NMR spectroscopy, annotation of proteins, solution of protein structures on a large scale e cell, Protein interaction based on comparative genomics, library based screening for large scale analysis, yeast 2 hybrid system, random library methods, affinity purification and mass spectrophotometry

Unit V (10hours)

Metabolomics and biochemical network analysis, M Cell, application of genomics based on genetic diseases, QTL in inbred population- factors that influence QTL, gene expression and QTL, Knock out library, Pharmacogenomics- genetic variation accounts for differential response of individuals to drugs, personalized medicine to match genotypes to therapy

References:

1. S B Primrose and R M Twyman_ Principles of Gene Manipulation and Genomics, 7th Edition, Blackwell Publishing
2. Tom Strachan and Andrwe Read- Human Molecular Genetics, 4th Edition, Garland Science

PLANT BIOTECHNOLOGY**Objectives:**

- to understand the plant cell genome organization
- to learn the techniques in tissue culture
- to study transformation techniques and applications

Unit I**(9hours)**

Genome organization and expression- Organisation of nuclear DNA, Nucleus and Chromatin organization, Structure and expression of plastome – Chloroplast DNA, chloroplast, ribosomes and protein synthesis, protein transport in chloroplast. Plant mitochondrial DNA- size and composition, promiscuous DNA mitochondrial DNA and cytoplasmic male sterility

Unit II**(9hours)**

Plant tissue culture technique and approach-Aseptic techniques, Culture media, cellular totipotency, role of hormones. Callus culture, Cell culture, somatic embryogenesis, isolation of single cells, suspension culture

Micropropagation- Automation and commercial aspects of PTC., Hardening of plants.

Protoplast Isolation and Fusion- somatic hybridization, selection of hybrids, cybridisation, somaclonal and gametogonial variation, In vitro pollination.

Germplasm – genebank-conservation and in vitro applications

Unit III**(9hours)**

Plant Metabolic Engineering.: The concept of secondary metabolites, importance of secondary metabolites in medicine and agriculture, Various pathways- Flavanoid pathway, Terpenoid pathway. plant cell culture for secondary metabolite, extraction and scale up using bioreactor. . Synthetic seeds, and Phytochemicals.

Unit IV**(9hours)**

Transformation techniques-Gene constructs, marker genes for selection of transformants, transgene integration, expression and gene silencing.

Transformation techniques - Agrobacterium, Binary and co integrative vectors. Particle bombardment method. Transgenic plants- disease resistance- Bacterial, viral and fungal. Herbicide resistance(round up Ready Soya), Abiotic stress, Pest resistance(Bt Cotton), Herbicide tolerance (PRS)

Unit V**(8hours)**

Transgenic expression of foreign proteins using viral vectors (Gemini and CaM virus) RNAi technology and its application. Plant molecular markers and their application in QTL mapping. DNA Bar coding in plants. Use of remote sensing and GIS for crop production.

References:

- 1 .S.S. Bhojwani , Plant Tissue Culture: Applications and Limitations. Elsevier, Amsterdam.
2. P.C. Debergh and R.H. Zimmerman , Micropropagation: Kluwer Academic Publ.Dordrecht.

3. A. Slatter et al Plant Biotechnology: the Genetic manipulation of plants, , Oxford University Press.
4. P.K.Gupta. Plant Biotechnology , Rastogi publications



NANOBIOTECHNOLOGY**Objectives:**

- to learn about the basics of nanoparticle types and characterization
- to learn about bioinspiration and use biomolecules at the nano level
- to study the application of nanoparticles in biology

Unit I**(10hours)**

Introduction to Nanotechnology: Types of Nanotechnology and Nanomachines –top down and bottom up. Self assembly, CNT, Fullerene, Dendrimers, Quantum Dots, Nanocapsules_ properties and applications, Magnetosomes, gold nanoparticles- preparation and application, Microscopy – Scanning Electron Microscopy – Transmission Electron Microscopy - Atomic Force Microscopy – Scanning Tunneling Microscopy, Confocal Microscopy, photolithography, e-beam writing, Dip Pen lithography

Unit II**(10hours)**

Biology inspired concepts – biological networks - biological neurons - function of neuronal cell - biological neuronal cells on silicon modeling of neuronal cells by NLSI circuits – bioelectronics - molecular processor – DNA analyzer as biochip – molecular electronics. Natural Nanocomposites – Introduction – natural nano composite materials - biologically synthesized nanostructures - biologically derived synthetic nanocomposites- protein based nanostructure formation – biologically inspired nanocomposites – nanotechnology in Agriculture and food preservation. DNA Computer – Information Processing with Chemical reactions

Unit III**(10hours)**

Topographic properties of Proteins and DNA – using protein in nanodevices – antibodies in sensing – antibody in nano particle conjugates – enzymes in sensing – enzyme nanoparticle hybrid sensors – Motor proteins in sensing – transmembrane sensors – Nanosensors based on Nucleotides and DNA – Structure of DNA – DNA decoders and microarrays – DNA protein conjugate based sensors – Bioelectronic sensors – DNA sequencing with nanopores – sensors based on molecules with dendritic architectures – biomagnetic sensors.

Unit IV**(10hours)**

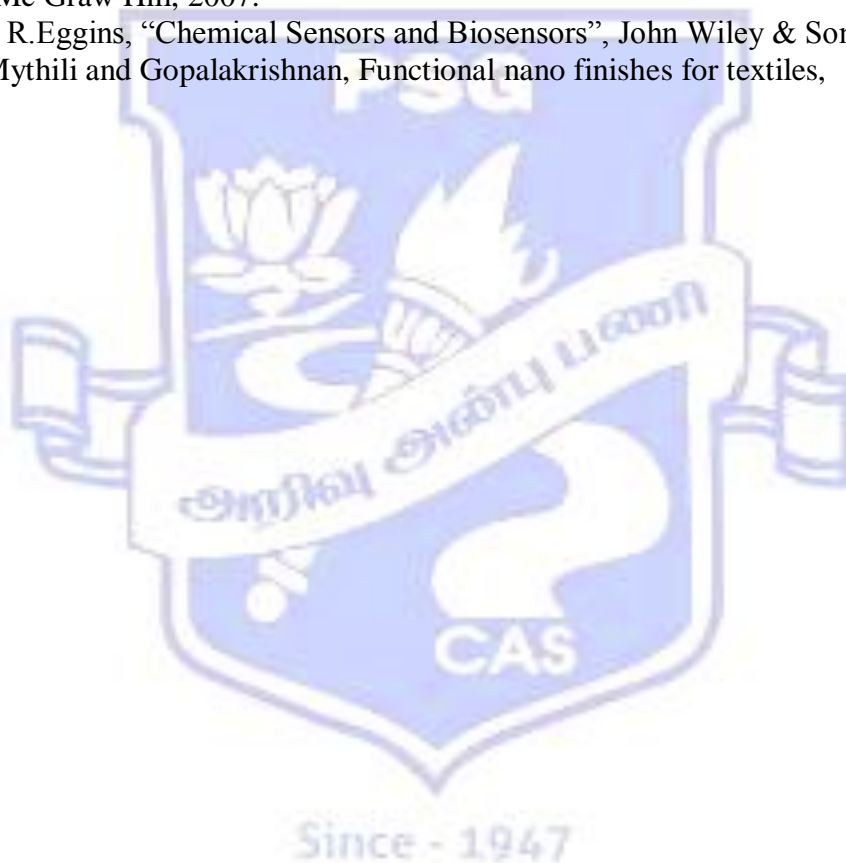
Understanding of antibody based diagnostic techniques (immunoassay) - micro and nano immunosensors - Bio-Barcode Assay - use of magnets, gold, DNA and antibodies - therapies and diagnostics for cancer and central nervous system disorders. Improved diagnostic products and techniques - *in vivo* imaging capabilities by enabling the detection of tumors, plaque, genetic defects and other disease states - ability to control or manipulate on the atomic scale- Nanobot medical devices - logic and intelligence embedded into medical devices- standalone sensing and computing devices. DNA Profiling - Cantilever Sensors - Targeted Drug Delivery - Magnetic Nanoparticles - Cancer cell targeting - Stem Cell Scaffolds - Electrochemical Impedance Spectroscopy (EIS) - Tethered Lipid Membranes.

Unit V**(10hours)**

Electrospinning of Nano fibers - Continuous yarns from electrospun nanofibers- Controlling the morphologies of electrospun nanofibers- Producing nanofiber structures by electrospinning for tissue engineering Nano Finishing in Textiles: UV resistant, antibacterial, hydrophilic, self-cleaning, flame retardant finishes. Nanosensors for pollution monitoring.

References:

1. Charles P.Poole Jr and. Frank J.Owens, "Introduction to Nanotechnology", Wiley Interscience, 2003.
2. C.M. Niemeyer and C.A. Mirkin, "Nanobiotechnology, Concepts, Applications and perspectives", WILEY-VCH, 2004.
3. G.M.Chow and K.E.Gonsalves, "Nanotechnology - Molecularly Designed Materials", American chemical society Symposium series 622, 1996.
4. T.Pradeep, "Nano: The essentials, understanding Nanoscience and Nanotechnology", Tata Mc Graw Hill, 2007.
5. Brian R.Eggins, "Chemical Sensors and Biosensors", John Wiley & Sons, 2002.
6. KG Mythili and Gopalakrishnan, Functional nano finishes for textiles,



PLANT TC, ANIMAL TC, NANOBIO TECHNOLOGY, INDUSTRIAL BIOTECH PRACTICAL

1. Micropropagation
2. Callus induction and suspension cultures
3. Agrobacterium Mediated transformation and extraction of DNA from transformed tissues
4. Microprojectile Bombardment (DEMO)
5. Preparation of Chick Embryo Fibroblast and Passaging
6. Cell Synchronization and enumeration of cells
7. Cytotoxicity testing in cell culture- Trypan blue test and MTT assay
8. Genotoxicity testing by Micronucleus test
9. Chemical and Biological synthesis of Silver and Zinc Oxide Nanoparticle and characterization by FTIR and UV Vis Spectroscopy
10. HRTEM, AFM and SEM(DEMO)
11. Isolation and characterization of Industrially important microorganisms
12. Production and estimation of biomass
13. Production and partial purification of amylase
14. Production of antibiotic- Penicillin and testing for antibacterial effect



Since - 1947

Core Elective – II :
ADVANCES IN BIOTECHNOLOGY RESEARCH*

Objectives:

- To develop skills of ICT in teaching, learning and research
- To put the contents across to targeted audience
- To understand ethical practices in research

Unit I**(10hours)**

Introduction to research methodology, Types of research, significance of research, criteria of a good research, problems encountered by researchers, selecting a research topic/problem. Techniques involved in a problem. Method of data collection- observation , interview, questionnaire, schedules. Collection of secondary data and selection of an appropriate method for data collection

Unit II**(10hours)**

Research Design and sampling design: Meaning of research design, need for a design, features of a good design, types of research design, illustration of a experimental design using animals for testing. Census and sampling, Characteristics of a sampling procedure and good sampling, types of sample design

Unit III**(10hours)**

Statistical Population, sampling, probability, distributions; Tests of significance, F test and T test, Theory of errors, error of function, rejection of observation, correlation and regression, prolit and logit analysis, ANOVA, AMOVA, DMRT, Multivariate analysis: Principal Component Analysis (PCA), Discriminant Function analysis, Cluster analysis

Unit IV**(10hours)**

Presentation Skills: Presentations using power point, viva voce and defending interrogation, scientific poster presentation, participation in group discussion. Computer mediated presentation: Multimedia, E- content, Edusat and ETV
Technical Writing skills: writing scientific reports and publication for journals, technical papers, peer reviewed and e journals, Citation index, impact factor. Conflict of interest and publication ethics. Writing a thesis- components. Collection from internet- index cards and arrangement of reference collected. Funding and writing for grants. Funding agencies

Unit V**(10hours)**

Research Ethics: Good clinical practice and clinical trials, informed consent, ethics for animal research, GMO's- horizontal gene transfer, terminator technology, animal cloning, human cloning.

References:

1. Research Methodology Methods and techniques by C R Kothari, 1st Edition, New Age International Publishers
2. Statistics by P K Gupta Narosa publications
3. How to write and publish a scientific paper, 4th edition, Robert A Day, Cambridge publishers

Core Elective - II:
IPR, BIOSAFETY AND PUBLICATION ETHICS

Objectives:

- to learn about IPR, IPP and patents and case studies
- to understand the principles of Biosafety, bio hazards and risk management

Unit I (10hours)

Introduction to Intellectual Property: IPR types, Patents, IPP, trademarks, Copyrights
Biotechnology and International trade, IP as a factor in research
IP's- Case studies, Introduction to GATT, WIPO, TRIPS and WTO

Unit II (10hours)

Geographical Indications- Neem, Basmati, Pashmina wool, Darjeeling tea, Channapatna toys & doll, Coimbatore wet grinder,
Patent databases, USPTO, EPO, IPO, Herbal wealth of India, protection of traditional knowledge

Unit III (10hours)

Patent application, guidelines, fee, patent application-tyoes, PCT, International patenting, their requirement and procedure- US, China and India. Patenting formality in research, benefit sharing by workers, patent laws, litigation with case studies

Unit IV (10hours)

Biosafety and Biohazards: Introduction to biosafety cabinets, primary containment for biohazards, biosafety levels, biosafety levels for specific microorganisms, recommended biosafety levels for infectious agents and infected animals.
Biosafety guidelines: definition of GMO's and LMO's, roles of Institutional Biosafety Committee, RCGM, MEC, GEAC.

Unit V (10hours)

Risk Management: Risk analysis, Lab work risk assessment, Risk assessment protocol, safety hazards, chemical hazards, biological hazards, physical hazards, MSDS data sheet, controls for risk minimization , Cartagena Protocol.

References:

1. NS Goplakrishnan & T.G Agitha, Principles of Intellectual Property – Eastern Book Co/, Lucknow (2009)
2. www. Ipr – helpdesk.org
3. www. Bangalore bio. Com / govt info / ipr. htm

14BTP18A

**FOOD AND MEDICINAL RESOURCES
CLUSTER IDC**

45 hours

Aim: To gain the knowledge of morphology, distribution, active principles, and therapeutic uses of indigenous medicinal plants.

Unit-I

Conservation of Food Crops and Medicinal Plants, Assessment of Best Germplasms. Germplasm Multiplication. Botanical Status, Distribution, Mode of Consumption, Proximate Composition, Nutritional and Antinutritional factors of less known Pulses - *Bauhinia vahli* and *Mucuna pruriens*. **9 hours**

Unit-II

Botanical Status, Distribution, Mode of Consumption, Proximate Composition, Nutritional and Antinutritional Components of less known -
Millets – *Elucine indica*.
Vegetables - *Canavalia gladiata*. **9 hours**

Unit – III

Traditional Systems of Medicines, Classification of Medicinal Plants, Collection and Preparation of Natural Drugs for Marketing. Adulterants and Substitutions in Medicinal Plants. **9 hours**

Unit – IV

A General Account of Bioactive Substances - Basic Structural and Functional Aspects of Digestive and Cardiovascular Systems of Man. Botanical Identity, Distribution, Active Principle and Therapeutic uses of
Carminative and Gastro Intestinal Tract Regulators – *Coriandrum sativum* and *Piper nigrum*.
Cardiotonics and Antihypertensives – *Digitalis purpurea* and *Terminalia arjuna* **9 hours**

Unit – V

Basic Structural and Functional Features of Respiratory System and Urino Genital System of Human Beings. Botanical Identity, Distribution and Therapeutic uses of
Antitussives and Expectorants – *Justicia adhatoda* and *Ocimum sanctum*,
Diuretics – *Tribulus terrestris* and *Boerhaavia diffusa*.
Antidiabetics – *Gymnema sylvestre* and *Cassia auriculata*. **9 hours**

REFERENCE / TEXT BOOKS

1. Trease and Evans (1978) Pharmacognosy, Cassell & Collier Macmillan publications, New Delhi.
2. Kumar, N.C An introduction to Medicinal Botany and Pharmacognosy. Emkay publications, New Delhi.
3. Gokhalae, S.B, Kokate, C.K and Purohit, A (2000). Pharmacognosy, Nirali prakhasam, Pune.
4. Atal C.K and B.M Kapur (1982). Cultivation and Utilization of Medicinal plants, RRL (SIR), Jammu Tawi.
5. Jain. J.L (1992) Fundamentals of Biochemistry. S. Chand & Co, New Delhi.
6. Stryer – Biochemistry- W.H. Freeman Company.

OBJECTIVES: To acquire knowledge about the biology of silkworm and the various rearing techniques. To know above the various techniques of propagating mulberry plants and to know about the various disease of mulberry and silkworms.

UNIT – I**(9 hours)**

Scope and importance of sericulture – species of silkworm – Description of mulberry plant- Propagation of mulberry plant-A brief account of mulberry varieties and planting methods, Irrigation methods.

UNIT – II**(9 hours)**

Macro, micro and bionutrients of mulberry- Deficiency diseases with particular reference to N, P, K, Fe and Bo.
Mulberry disease and Pests: Causative agents, symptoms and management of Root-rot, Powdery mildew, Tukra and Leaf miner.

UNIT – III**(9 hours)**

Morphology of mulberry silkworm: Egg, larva, pupa and adult.
Structure of silk gland and silk proteins.
Life –cycle of silkworm.

UNIT – IV**(9 hours)**

Silkworm seed production and incubation.
Rearing: Model rearing house, rearing appliances and mountage.
Rearing young age silkworm. Rearing Late-age silkworms.

UNIT – V**(9 hours)**

Disinfection of rearing house and equipments.
Silkworm diseases: Pebrine, Flacherie and Grasserie.
Silkworm: A brief account of life-cycle and management.
Cocoon types. Shell-ratio, Renditta and price fixation.
Cocoon marketing. A brief account on reeling process
By-products of sericulture.

REFERENCES:

1. Krishnasamy, S. New Technology of silkworm rearing. Central Sericulture Research and Training Institute, Mysore.
2. Krishnamsamy, S. Mulberry Cultivation in South India. Central Sericulture Research and Training Institute, Mysore.
3. Madan Mohan Rao, 1978. A Text Book of Sericulture. B.S. Publishers. Hyderabad.
Yoshemaro Tanaka, Sericology, Central Sericulture Research and Training Institute, Mumbai

14BTP18C

**Cluster IDC
Nutrition for Life Style Disorders**

(4 hrs / week)

Objectives

To enable the students to

1. Study the importance of lifestyle disorders
2. Know the causative factors of lifestyle disorders and
3. Learn the importance of nutrition for prevention and management of lifestyle disorders

UNIT 1 - NUTRITION AND LIFESTYLE DISORDERS (12 hours)

Definition of Nutrition, balanced diet, Nutritional status, assessment of body composition, biology of adiposity, nature of foods, nutrients, RDA, energy balance, foods that lead to life style disorders.

UNIT 11 - NUTRITION AND WEIGHT MANAGEMENT (12 hours)

Malnutrition- Under weight and Obesity- Nutrients for Underweight conditions, Nutrition for management of obesity, Anorexia Nervosa and Bulimia nervosa, Hazards of Obesity, Obesity in Children, Strategies to overcome Obesity.

UNIT 111 - NUTRITION AND CARDIOVASCULAR DISEASES (12 hours)

Cardiovascular diseases- Atherosclerosis, Coronary Heart Diseases and Congestive Heart Failure, Hypertension, Hyperlipidemia and Dyslipidemia- Role of antioxidants, nutraceuticals and functional foods in cardiovascular diseases. Dietary management of cardiovascular diseases.

UNIT 1V - NUTRITION AND DIABETES MELLITUS (12 hours)

Definition of Diabetes Mellitus- Types- Etiological factors, Diagnosis and Complication of Diabetes Mellitus. Role of Nutraceuticals and functional foods in of Diabetes Mellitus. Dietary management of Diabetes Mellitus.

UNIT V - NUTRITION IN CANCER (12 hours)

Definition of Cancer- Types- Causative factors, Nutrients and Cancer- Detection and Treatment of Cancer- Role of antioxidants, Nutraceuticals and Functional foods in Cancer. Dietary treatment in cancer

References

1. **L. Kathleen Mahan, Sylvid Escott- Stump:** Karause's Food, Nutrition and Diet therapy, 2000, 10th edition, W.B.Saunders Company.
2. **Laura E. Matarese, Michele M. Gottschlich,** Contemporary nutrition support practice: a clinical guide, 2003, I edition, Saunders Elsviers Science, Missouri
3. **Scott A. Shikora, George L. Blackburn,** Nutrition Support: Theory and Therapeutics, 1996, I edition, International Thomas Publishing (ITP) online publishing –thomson.com
4. **NIN,** RDA for Indians, 2001
5. **NIN,** Nutritive value of Indian foods, 2001
6. **Shills E. M., Olseon J.A and Skike M.,** Modern nutrition in health and disease, vol. I & II, 1994 and Febiger.
7. **Antia F.P,** Clinical nutrition and dietetics, 1997, Oxford University press.
8. **Michele M. Gottschlich,** The Science And Practice Of Nutrition Support: A Case-Based Core Curriculum, 2007, I edition, American Society of Parenteral and enteral Nutrition (aspen)

9. Annalynn Skipper, Dietitian's Handbook of Enteral and Parenteral Nutrition, 1996, I edition, An ASPEN Publication

14BTP19

IV Semester
4hrs/week

ANIMAL CELL BIOTECHNOLOGY

Objectives

- to provide basic knowledge in culturing animal cells
- to study about manipulation of animal cells and stem cell technology

Unit I

History and development of animal cell culture, Introduction to equipment, supplies and aseptic technique. Culture media, Balanced salt solutions and growth media constitution. Physical, chemical and metabolic functions of different constituents of growth media like carbon di oxide, Hepes, growth factors, serum, amino acids and hormones. Serum free and serum containing media

Unit II

Types of cell culture- Primary and established, subculturing and maintenance of cell lines. Specialized cell culture: for biomedical application, hepatocytes, islets, skin cells, vascular endothelial cells. Organ culture, scale up of cell culture

Unit III

Cell cloning, cell counting, cell sorting, cell synchronization, cryopreservation and revival of cell lines. Cell banking procedure. Biology, characterization and selection of cell lines. Role of feeder layers in cell culture. Behaviour of transformed cells.

Unit IV

Application of Genetic Engineering: Transformation of animal cells, viral vectors for gene transformation, selection of recombinants. Production of recombinant proteins, vaccines and hormones in cell culture. Pharming- phage display library technology, Biotechnology of aquaculture(fishes and shrimps). Transgenic animals. In vitro fertilization and embryo transfer.

Unit V

Apoptosis pathways, methods of studying apoptosis, cytotoxicity assays. Stem cell technology, Cord blood stem cell and fetal stem cell and their applications. Differentiation of stem cells. Bone marrow transplantation. Tissue engineering: bone tissue engineering and skin engineering

References:

1. Ian Frehsney, Culture of animal Cells- Wiley & Co
2. Grietje Molema and Dirk K. F. Meijer(2002), Drug Targeting Organ-Specific Strategies Wiley-VCH.
3. Sudha Gangal, 2nd Ed, Principles and practice of Animal Tissue Culture, University Press

PROJECT AND VIVA**Objectives:**

- to inculcate research attitude
- to plan, design and execute experiments
- to analyze and interpret the results

Work Instructions:

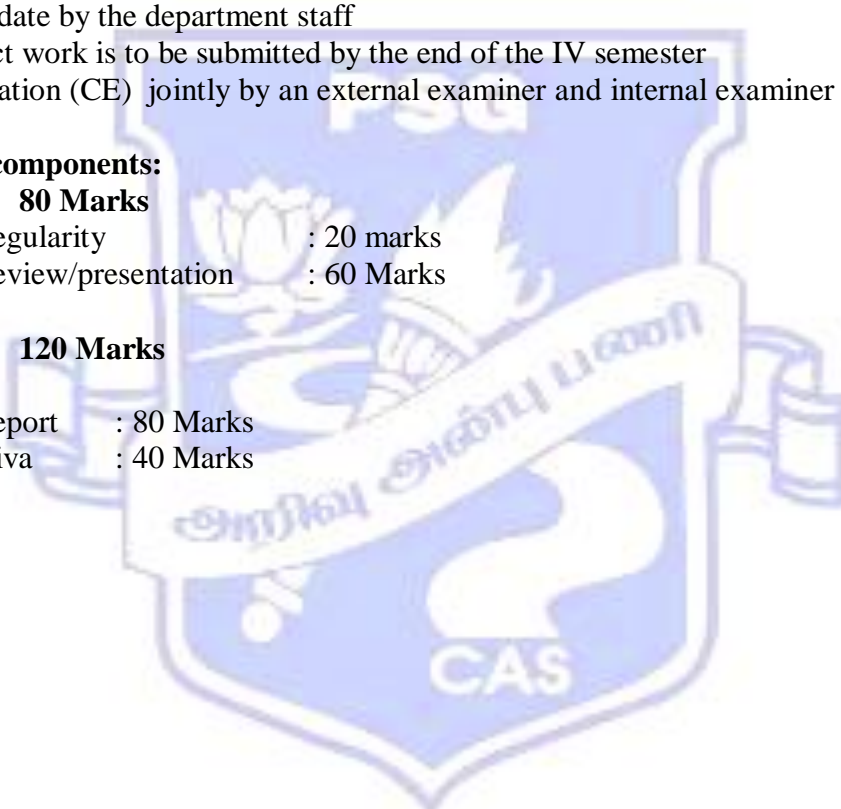
- At least 50% Wet lab in biotechnology and or related fields is compulsory
- Monitoring continuously by submission of report on progression of the project to the guide whether work done on campus or off campus
- Evaluation of CA(Max.80) by the department staff
- Review of project will be done by the department through pre viva presentation on the fixed date by the department staff
- Project work is to be submitted by the end of the IV semester
- Evaluation (CE) jointly by an external examiner and internal examiner for 120 marks

Breakup of components:**CA 80 Marks**

- i. Regularity : 20 marks
- ii. Review/presentation : 60 Marks

CE 120 Marks

- i. Report : 80 Marks
- ii. Viva : 40 Marks



Since - 1947

FOODS, GENES AND DISEASES
(For MSc Botany, Zoology and Clinical Nutrition)

Objectives:

- to study the relationship between food and health
- to understand the role of common dietary compounds on gene expression
- to understand dietary intervention based on knowledge of nutritional requirement, nutritional status, and genotype

Unit I**(9hours)**

Foods and genes: Genetics and epigenetic of bioactive foods, conventional and Indian traditional foods and food components, vitamins and minerals- antioxidant potentials; their role in preventing diseases, incidence of diet related diseases, influence of genes on dietary preference and tolerance, mucosal tolerance, Role of Selenium in oxidant and inflammatory process

Unit II**(9hours)**

Health Biomarkers: Identification and validation of compounds in tissues, blood and fluids; genetic screening for predisposition and occurrence in inflammatory diseases; genetic markers associated with increased risk for chronic disease, metabolic dysfunction.
Case Study: IGF rs680 polymorphisms in height variation in preadolescent children

Unit III**(9hours)**

Gene approaches for diseases: Nutrigenetics of myocardial infarction, Nutrient regulation of insulin gene, genetics in Crohn's disease, genetics and nutritional control of lipid metabolism, nutrigenetic approach to study obesity

Unit IV**(9hours)**

Diagnostics for diseases: Nutrigenomics for cancer detection, nutrigenomics in ageing, DNA polymorphisms, Microarrays to study gene expression, gene-nutrient interaction, Dietary signatures

Unit V**(9hours)**

Personalized medicine: Dietary indications for population health and wellness, vitamin and supplement products, genetic counseling, clinical trials to test food effects to demonstrate efficacy of food-health claims

Reference:

1. Nutritional Genomics: Discovering the path to personalized nutrition, Edited by Jim Kaput, 2013, Wiley
2. Nutrigenomics and Nutrigenetics in functional foods and personalized nutrition, Edited by Lynnette R Ferguson, 2013, CRC Press
3. Genomics and proteomics in nutrition Edited by Carolyn D Berdeiner and Namia Moustaid Moussa, 2004, CRC Press
4. Dietary modulation of Cell Signaling pathways by Zigang Dong and Young Joon Surh, 2008, CRC Press