M.Sc., BIOTECHNOLOGY (2017 – 2018)

S. No	SEM	Category	Paper Code	Title of the Paper	Maximum Marks			Minimum Marks for Pass			Hours Week	Credits
					CIA	E.E	Total	CIA	E.E	Total		
1.	I	Core	17P1BTC1	Biochemistry	25	75	100	10	30	50	6	5
2.		Core	17P1BTC2	Advances in Microbiology	25	75	100	10	30	50	6	5
3.		Core	17P1BTC3	Environmental Biotechnology	25	75	100	10	30	50	6	5
4.		Core	17P1BTCP1	Practical – I (Biochemistry, Microbial and Environmental Biotechnology)	40	60	100	16	24	50	6	3
5.		Major Elective-I	17P1BTEL1A 17P1BTEL1B 17P1BTEL1C	Immunology and Immuno technology/ Entrepreneur skill Development / Molecular Modeling And Drug Designing	25	75	100	10	30	50	6	4
6.	II	Core	17P2BTC4	Molecular Genetics	25	75	100	10	30	50	4	4
7.		Core	17P2BTC5	Plant and Animal Biotechnology	25	75	100	10	30	50	4	4
8.		Core	17P2BTC6	Enzyme Biotechnology	25	75	100	10	30	50	4	4
9.		Core	17P2BTC7	Nano biotechnology	25	75	100	10	30	50	4	4
10.		Core	17P2BTC8	Genomics and Proteomics	25	75	100	10	30	50	4	4
11.		Core	17P2BTCP2	Practical – II (Molecular Genetics, Plant and Animal Biotechnology, Enzyme Biotechnology and Industrial Biotechnology, Nano biotechnology, Proteomics & Genomics)	40	60	100	16	24	50	6	3
12.		Major Elective-II	17P2BTEL2A 17P2BTEL2B 17P2BTEL2C	Bio-Instrumentation and Biometry / Bio-informatics, IPR & Nanotechnology/ Bio-Informatics, Intellectual Property Rights & Nanotechnology	25	75	100	10	30	50	4	4
13.	III	Core	17P3BTC9	Bio-Process Technology	25	75	100	10	30	50	5	4
14.		Core	17P3BTC10	Clinical biochemistry	25	75	100	10	30	50	5	4
15.		Core	17P3BTC11	Recombinant DNA Technology	25	75	100	10	30	50	5	5
16.		Core	17P3BTC12	Aquatic Biotechnology	25	75	100	10	30	50	5	4
17.		Core	17P3BTCP3	Practical – III (Bioprocess Technology, Recombinant DNA Technology and Clinical Chemistry)	40	60	100	16	24	50	5	4
18.		EDC	17P3BTEDC	Fundamentals of Biotechnology	25	75	100	10	30	50	4	---
			Communicative Skill And Personality Development		-	-	-	-	-	-	1	-
19.	IV	Core	17P4BTC13	Research Methodology	25	75	100	10	30	50	8	5
20.		Core	17P2BTC14	Industrial Biotechnology	25	75	100	10	30	50	8	5
21.		Major Elective-III	17P4BTEL3A 17P4BTEL3B 17P4BTEL3C	Biosafety and Bioethics/ Biodiversity and Bio resources/ Enzymology	25	75	100	10	30	50	8	4
22.		CN	17P4BTCN	Comprehension	-	100	100	-	-	50	5	2
23.		Project	17P4BTPR	Project	40	60	100	16	24	50	---	4
			Communicative Skill and Personality Development								1	
				Total			**2300**				**120**	**90**

M.Sc. BIOTECHNOLOGY (2017 – 2018)

Paper Code	Total No. Of Papers	Total Marks	Total Credits	Classification
Core	17	1700	72	✓
Elective	3	300	12	✓
E.D.C	1	100	---	✓
Project	1	100	4	x
Comprehension	1	100	2	✓
Soft skill using Language lab	--	--	---	X
Total	**23**	**2300**	**90**	

A.VEERIYA VANDAYAR MEMORIAL SRI PUSHPAM COLLEGE (AUTONOMOUS),
POONDI, THANJAVUR DIST.

Question Pattern for UG and PG Programmes for students to be admitted during 2017 – 2018 and afterwards

Total Marks: 75

QUESTION PATTERN

SECTION – A
(Question 1 to 10)

10 x 2 = 20 Marks

1. Short Answer Questions
2. Two Questions from each units (All are answerable)

SECTION – B
(Question 11 to 15)

5 x 5 = 25 Marks

1. 5 Paragraph type questions with "either / or" type choice.
2. One question from each unit of the Syllabus.
3. Answer all the questions.

SECTION – C
(Question 16 to 20)

3 x 10 = 30 Marks

1. 5 Essay type questions – any three are answerable.
2. One questions from each unit of the Syllabus.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
I	**17P1BTC1**	**BIOCHEMISTRY**	**6**	**5**

Objectives:

1. To enable the students to understand the co-valent bonds of Chemicals and Principles of Thermodynamics.
2. To give adequate knowledge on the Chemistry of Proteins, Amino Acids and lipids
3. To familiarize the Separation Technique and purifications of biomolecules.

Unit I **Hrs 18**

Chemical foundations of Biology – pH, Acids, Bases, Buffers, Weak bonds, Covalent bonds. Principles of Thermodynamics – Classes of organic compounds and functional groups–Atomic, Molecular Dimensions, Space filling and Ball and stick models.

Unit II **Hrs 18**

Carbohydrate – Classification and metabolism – Glycolysis, gluconeogenesis, Glycogenolysis, Pyruvate Oxidation, TCA, Electron Transport chain, Oxidative Phosphorylation and Photophosphorylation, Inborn error of carbohydrates metabolism,

Unit III **Hrs 18**

Protein – Structure and Classification – Metabolism. Overview of biosynthesis of non-essential amino acids. Catabolism of amino acid nitrogen transamination, deamination, ammonia formation. The urea cycle and regulation of urogenesis and their inborn error of protein metabolism.

Unit IV **Hrs 18**

Lipids – Classification and metabolism. Lipogenesis – Control of Acetyl CoA carboxylase. Oxidation of fatty acids – α, β and ω. Role of ornithine cycle in the regulation of β-oxidation. Lipid inborn error.

Unit V **Hrs 18**

Nucleic acid metabolism - Purine and pyrimidine – Biosynthesis. Inborn error in metabolism. Heterocyclic compounds and secondary metabolites – prostaglandins, Leukotrienes, Thromboxanes, Interferons, Interleukins, Antibiotics, Alkaloids, Terpenoids and Flavonoids. Pigments and Isoprenoids.

Reference:

1. Principles of Biochemistry by A.L.Lehnignger, D.L.Nelson and M>M. Cox (2002), Worth publishers, New York.
2. Biochemistry by L.Stryer (2000) Freeman & Co. New York.
3. Biochemistry by G. Zubay (2004), Maacmillan Pulishing Co. New York.
4. Harper's Biochemistry by R.K.Murray, P.a. Mayes, D.K. Granne and Vv.W. Rodwell (2002) Lanlge Medical Book.
5. General Chemistry Linus pauling, W.H.Freeman & Company.
6. Biochemical Calulations, Irwin H.Segal, John Wiley and Sons lne.
7. Organic Chemistry, DJCram and GS Hammond, McGraw Hill.
8. Physical Biochemistry Freifilder, Ww.H.Freeman & Company.

Course Outcome:

- To enable the students to understand the co-valent bonds of Chemicals and Principles of Thermodynamics.
- To give adequate knowledge on the Chemistry of Proteins, Amino Acids and lipids
- To familiarize the Separation Technique and purifications of biomolecules.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
I	**17P1BTC2**	**ADVANCES IN MICROBIOLOGY**	**6**	**5**

Objectives:

1. To study the details of various Microbes.
2. To study the diversity of microbes
3. To study the microbial evolution, diseases etc.

Unit I **Hrs 18**

Methods in Microbiology – Pure Culture techniques, theory and practice of sterilization: Principles of microbial nutrition, construction of culture - enrichment culture techniques -isolation of chemoautotrophs, chemoheterotrophs and photosynthetic microorganisms.

Unit II **Hrs18**

Prokaryotic cell – Structure and function – Cell walls of Eubacteria (peptidoglycan related molecules): outer membranes of Gram negative and Gram positive bacteria, cell wall and cell membrane synthesis: flagella and motility: cell inclusions like Endospore.

Unit III **Hrs18**

Systematic and Taxonomy – Characteristics of primary domains, Taxonomy, Nomenclature and Bergey's Manual. Microbial growth – Definition of growth. Mathematical expression of growth. Growth curve, measurement of growth and growth yields, synchronous growth: continuous growth. Growth affected by environmental factors like temperature, acidity, alkalinity, water availability and oxygen, Culture collection and maintenance of culture.

Unit IV **Hrs 18**

Prokaryotic diversity – Purple green bacteria, cyanobacteria, Acetic acid bacteria, budding and appendage bacteria, spirochetes, gliding and sheath bacteria – Pseudomonas, Lactic and Propionic acid bacteria: Endospore forming bacteria, mycobacterium, Rickettsia and Mycoplasma, Archaea. Eukaryotic diversity – Algae, Fungi, Protozoa, Slime mold – Virus.

Unit V **Hrs 18**

Microbial Diseases – Terminology in transmission in disease : Infectious disease Transmission: Respiratory infection caused by Bacteria and Viruses: Tuberculosis : Sexually transmitted disease including AIDS, Disease transmitted by animals (Rabies and Plagues) Insects and Ticks (Rickettsias, Lime disease and Malaria). Food and water Borne diseases, Public Health and Hygeine.

Reference:

1. Microbiology by M.J. Pelzar E.C.S. Chan and N.R. Krieg (2004) McGraw Hill.
2. Microbiology by Dubey and Maheswari (2002).
3. General Microbiology, Stainer RY, Ingra Ham JL, Whellis ML & Painter PR. (2004). Macmillan Education Ltd London.
4. Advances in Applied Microbiology, Parihar, Pradeep (2008).
5. Fungi, Bacteria and Viruses, Dube, H.C. (2008).

Course Outcome:

- To study the details of various Microbes.
- To study the diversity of microbes
- To study the microbial evolution, diseases etc.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
I	**17P1BTC3**	**ENVIRONMENTAL BIOTECHNOLOGY**	**6**	**4**

Objectives:
1. To understand the environment.
2. To study the sources and effect environmental pollution.
3. To study the measures to treat the treatment of environmental pollution.
4. To study the solid waste management.

Unit I **Hrs 18**

Environment – Basic Concepts and Issues. Factor affecting Environment - Environmental Pollution – Types of Pollution, Methods for the measurement of Pollution: Methodology of environmental management – the problem solving approach and its limitation.

Unit II **Hrs18**

Air pollution and it's control through Biotechnology. Water pollution and its control: Water as scarce natural resource, need for water management, Measurement of Water Pollution, Sources of Water Pollution, Waste Water Collection, Treatment – Physical, Chemical, biological treatment process.

Unit III **Hrs18**

Management of waste water, Aerobic Process – Activated sludge process, oxidation ponds, trickling filter, towers, rotating discs, rotating drums, oxidation ditch. Anaerobic process: Anaerobic digestion, anaerobic filters, Up-flow anaerobic sludge blanket reactors. Treatment schemes for waste waters of Dairy, Distillery, Tannery, Sugar and Antibiotic industries.

Unit IV **Hrs 18**

Microbial degradation of xenobiotics in Environment – Ecological consideration, decay behaviour and degradative plastics: Hydrocarbons, substituted hydrocarbon, oil pollution, surfactants, pesticides. Bioremediation of contaminated soils and waste land – Phytoremediation.

Unit V **Hrs 18**

Biopesticides in Integrated Pest Management – Solid waste: Sources and Management (Composting, Vermiculture and methane production). Global environmental problems: ozone depletion, UV-B, Green house effect and Acid rain and their impact - Biotechnological approaches for management.

Reference:

1. Air Environment and Pollution, Purohit, S.S. (2008).
2. Environment Biotechnology – Fundamentals and Application, Parihar and Pradeep (2008).
3. Industrial Waste their disposal and Treatment, Rudolf, W. (2006).
4. Environmental Science A New Approach, Purohit, S.S. (2007).
5. Environmental Awareness and Education, Gupta, D.D. (2008).

Course Outcome:
- To understand the environment.
- To study the sources and effect environmental pollution.
- To study the measures to treat the treatment of environmental pollution.
- To study the solid waste management.

Semester	Subject Code	Title of the Paper	Hours of Teaching /Week	No. of Credits
I	**17P1BTCP1**	**Core – Practicals – I (BIOCHEMISTRY, ADVANCES IN MICROBIOLOGY AND ENVIRONMENTAL BIOTECHNOLOGY)**	**6**	**3**

Objectives:

1. To understand the Chemistry of Proteins, Sugars, Nucleic acids.
2. To study the microbial Techniques.
3. To understand the Biochemistry and advances in Microbiology

Biochemistry

1. Determination of Pka value of buffers by titration
2. Quantification of sugars
3. Isolation and quantification of Proteins
4. Absorption spectra of Proteins and nucleic acids
5. Precipitation Centrifugation of Macromolecules (Proteins and nucleic acids)
6. Thin layer chromatography of pigments and amino acids
7. Ion exchange and gel permeation chromatography of proteins
8. Determination of molecular weight of proteins by means of electrophoresis.
9. Estimation of blood glucose
10. Estimation of Cholesterol.
11. Estimation of purines and pyrimidines

Advances in Microbiology

1. Sterilization techniques
2. Microscopic examination of bacteria, fungi, protozoa and molds.
3. Biochemical characterization of selected Microbes (Klebsiella, E coli, Salmonella, Shigella, Proteus)
4. Preparation of selective & differential medium.
5. Growth: Growth curve, measurement of fungal growth by linear determination and measurement of bacterial growth by turbidity.
6. Effect of temperature and pH on growth.
7. Pure Culture techniques –Streak, Pour & Spread plate.
8. Enumeration of micro organisms from soil and water
9. Antibiotic sensitivity test
10. Isolation of drug resistant auxotrophic mutants.
11. Study of mutation by Ames test.
12. Immobilization of cell Enzymes.
13. Isolation of Phage DNA.

Environmental Biotechnology

1. Waste water monitoring by TDS, DO, BOD, COD.
2. Detection of Coli form to determine water purity using membrane filter method.

Reference:

1. Practical Biochemistry: Principles and techniques by Keith Wilson and John Walker, 5th ed., 2000. Cabridge University Press, UK
2. Analytical biochemistry by Dabid J. Holme and Hazel peck, 3rd Ed. 1998. Pearson Edu. Ltd., England.
3. Principles and Practice of Bioanalysis by Richard F. Venn, 2003, Taylor and Francis, London.
4. Microbiology – A laboratory manual Cappuccino, J.G. and Shjeman, N. Addison Wesley (2004)
5. Diagnostic Microbiology by Betty. A. Forbes, aniel F. Sham, 2002.
6. Biochemical methods by A. Pingoud, C. Urbankse, J. Hoggett, 2002, Weiley – Velt Verlag Garbh.
7. Biochemical Analysis, Lab Manual by Gunasekaran – MKU.
   Dube(Maheswari) Microbial Mannual.

Course Outcome:

- To understand the Chemistry of Proteins, Sugars, Nucleic acids.
- To study the microbial Techniques.
- To understand the Biochemistry and advances in Microbiology

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
I	**17P1BTEL1A**	**Major Elective - I IMMUNOLOGY AND IMMUNOTECHNOLOGY**	**6**	**4**

Objectives:

1. To study the immune system.
2. To study the immunity against invaded micro-organisms.
3. To study the various immunity Technology.
4. To study the Allergic reactions and Auto immune diseases.

Unit I **Hrs18**

Outlines of Immunology

Organs and Cells involved in immune responses–Organs of stem cell origin, primary and secondary lymphoid organs–Haemopoietic stem cells, T-cells, B-cells, Macrophages, Monocytes,Polymorphs and Platelets–Immunological memory–Differentiation of Lymphocytes.

Unit II **Hrs18**

Antigens, Antibodies and Complements

Antigens and antigenicity: Types, structure and requirements for immunogenicity – Antibody specificity – Antigen specific receptor for antibiotics – Regional variation of antigen binding site, Immunoglobulins: Structure, function and biological properties of Ig classes – Organization and expression of Immunoglobulin genes–Ag-Ab reactions: Precipitation, Agglutination, opsonisation and cytolysis. Complementation and its activation, biological role of complement activation – Classical and alternate pathways.

Unit III **Hrs18**

Immune Response, Humoral immune response

Antibody Synthesis–Clonal Selection – Model kinetics of Primary and Secondary responses– Cellular Cooperation–B cell activation for T independent,T- dependent antigens– isotype switching. Cell mediated immune response: Phagocytosis– role of T-cells, macrophages and NK cells subtypes of T-cells and their functions: Cytoxic T-cells, Helper T cells, Suppressor T cells, and Regulatory T cells– Cell mediated Cytotoxicity– Lymphokines and Cytokines – their biological role.

Unit IV **Hrs 18**

Hypersensitivity

Types – disorders, Auto immune disease – Auto antibodies. HLA system – disease association. MHC and significance. Immunotheraphy – Types: Transplantation – Types. Tumours – Tumours Antigens and immunoresponses to tumours.

Unit V **Hrs18**

Immunization – Types, Immunization schedule - Principles and Methods of Polyclonal and Monoclonal antibody productions and their applications. Principle and Methods in vaccine preparation, Vaccines types. Immunotechniques – Principle, Methodology and application of LTT, ELISA, ELISPOT, RIST, RAST and Immunoblotting, FACSCAN, Immunofluorescence and RIA.

Reference:

1. Immunology, An introduction (1984) 6th Edition–Wiley medical publications;New York.
2. Structure and Functions of Antibodies (1977) Glysm, L.Steward M.W. Johy Wily– New York.
3. Immunology – Dubey (2004).
4. Immunology, 5th Edition, Joshi, K.R. (2007).

5. Immunology, I. Kannan, MJP Publishers (2006).
6. Immunology and Serology, Dr. K.R. Joshi and Dr. N.O. Osamo (2008).
7. Immunobiology, M.S. Aslam (2005).

Course Outcome:

- To study the immune system.
- To study the immunity against invaded micro-organisms.
- To study the various immunity Technology.
- To study the Allergic reactions and Auto immune diseases.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
I	**17P1BTEL1C**	**Major Elective - I Molecular Modeling And Drug Designing**	**6**	**4**

Objectives:

1. To study the concept of molecular modeling and Molecular mechanics.
2. To study the Molecular dynamics simulation methods.
3. Recent advances in drug design methodologies.
4. To study the Software tools for modeling bio-molecules.
5. To study the Molecular docking.

Unit I **Hrs18**

Introduction to the concept of molecular modeling, molecular structure and internal energy, applications of molecular graphics, coordinate systems, potential energy surfaces, -local and global energy minima. Molecular mechanics: general features of molecular mechanics- force field, bond stretching, angle bending, torsional terms, non-bonded interactions; force field parametrisation and transferability; energy minimization: derivative and non-derivative methods, applications of energy minimization.

Unit II **Hrs18**

Molecular dynamics simulation methods: molecular dynamics using simple models, molecular dynamics with continuous potential-setting up and running a molecular dynamic simulation, constraint dynamics; Monte Carlo simulation of molecules. Simulation for conformational analysis. Ab initio, dft and semi empirical methods.

Unit III **Hrs18**

Recent advances in drug design methodologies- Biomolecular structure, Structure activity relationship, Pharmacokinetics, Pharmacophoric pattern, ADME Properties, quantitative structure activity relationship, Use of genetic algorithms and principle component analysis in the QSAR equations

Unit IV **Hrs18**

Macromolecular modeling- Software tools for modeling bio-molecules. Molecular electrostatic potentials, charge analyses. Protein conformations, folding and mutation through modeling-design of ligands for known macro molecular target sites. Drug-receptor interaction, classical SAR/QSAR studies and their implications to the 3-D modeler, 2-D and 3-D database searching, pharmacophore identifica tion and novel drug design.

Unit V **Hrs18**

Molecular docking: Docking-Rigid and Flexible Structure-based drug design for all classes of targets- Theories of enzyme inhibition – Enzyme Inhibition strategies.- Enzyme inhibition as a tool for drug development –Examples. Finding new drug targets to treat disease- strategies for target identification and lead design- Use of Genomics and Proteomics for understanding diseases at molecular level- - new targets for anti-cancer drugs, Drugs that rescue mutant p53's.

References:

1. Andrew Leach. 1996. Molecular Modelling: Principles and Applications (2nd Edition), Addison Wesley Longman, Essex, England.
2. Alan Hinchliffe. 2003. Molecular Modelling for Beginners, John-Wiley and Sons New York.
3. Cohen, N. (Ed.).1996. Guide Book on Molecular Modeling in Drug Design, Academic Press, San Diego.
4. Frenkel, D. and B. Smit. 1996. Understanding Molecular Simulations. From Algorithms to Applications. Academic Press, San Diego, California.
5. Rauter, C. and K. Horn. 1984. X-ray crystallography and drug design, Elsevier.
6. Kalos, M. and P. A. Whitlock. 1986. Monte Carlo Methods. John Wiley & Sons, New York,.
7. McCammon, J.A. and S.C. Harvey. 1987. Dynamics of Proteins and Nucleic Acids. Cambridge University Press, Cambridge.
8. Rapaport, . D.C. 2004. The Art of Molecular Dynamics Simulation. Cambridge University Press, Cambridge, England.

Course Outcome:

- To study the concept of molecular modeling and Molecular mechanics.
- To study the Molecular dynamics simulation methods.
- Recent advances in drug design methodologies.
- To study the Software tools for modeling bio-molecules.
- To study the Molecular docking.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
II	**17P2BTC4**	**MOLECULAR GENETICS**	**4**	**4**

Objectives:
1. To study the mutation, mutagenesis and genetics of microbes.
2. To study the DNA Replication, Transcription, Translation and Oncogenes.
3. To study the Anti-sense molecules and Ribozyme Technology.

Unit I **Hrs 18**

Introduction to Molecular Biology – Structure and function of DNA, RNA - Mutation and Mutagenesis – Chemical and UV – mutagenesis, types of mutation, Ame's test for mutagenesis, methods of genetic analysis, Bacterial genetic system – Transformation, Conjugation, Transduction, Recombination, Plasmids and Transposons.

Unit II **Hrs18**

DNA – replication – Prokaryotic and Eukaryotic DNA replication, Mechanisms of DNA replication, Enzymes and accessory proteins involved in DNA replication.
DNA repair and Recombination, Homologous recombination – Holiday junction, gene targeting. DNA damage by UV race, alkylating agents, cross links, mechanism of repair – photo reactivation, excision repair, recombinational repair.

Unit III **Hrs18**

Transcription – Prokaryotic and Eukaryotic transcription RNA polymerase, general and specific transcription factors, regulatory elements and mechanisms of transcription regulation, transcriptional and post transcriptional gene silencing modifications in RNA 5' cap formation, transcription, termination 3' end processing and poly – adenylation, spilicing, editing, Nuclear export of mRNA stability.

Unit IV **Hrs 18**

Translation – Prokaryotic and Eukaryotic translation, mechanism, initiation, elongation and Termination regulation of translation. Post translational modifications of proteins – protein localization – synthesis of secretary and membrane proteins import in to nucleus, mitochondria, chloroplast and peroxisomes receptor mediated endocytosis.

Unit V **Hrs 18**

Anti–sense and ribosome technology – molecular mechanism of antisense molecules inhibition of splicing, polyadenylation and translation, disruption of RNA structure and capping biochemistry of Ribozyme. Hammer head, hairpin – and other Ribozymes, strategies for designing ribozymes, application of ribozymes and anti–sense technologies. Molecular mapping of genome – Genetic and physical mapping and map based cloning.

Reference:

1. The Cell and Molecular Biology, Purohit, S.S. (2008).
2. The Gene, Purohit, S.S. (2006).
3. Molecular Biology, P.D. Sharma (2007).
4. Cell and Molecular Biology, Gerald Karp (2004).
5. Gene, Benjamin Lewin (2007).

Course Outcome:

- To study the mutation, mutagenesis and genetics of microbes.
- To study the DNA Replication, Transcription, Translation and Oncogenes.
- To study the Anti-sense molecules and Ribozyme Technology.

Semester	Subject Code	Title of the Paper	Hours of Teaching /Week	No. of Credits
II	**17P2BTC5**	**PLANT AND ANIMAL BIOTECHNOLOGY**	**4**	**4**

Objectives:

1. To understand the Animal and Plant Biotechnology.
2. To study the plant cell & culture aspects.
3. To study the micro propagation of protoplast & culture.
4. To study the mass culture and other Animal cell culture Techniques.

Unit I **Hrs 15**

History of plant cell, tissue and organ culture–laboratory organization–aseptic techniques–nutritional requirements and culture media–Types of cultures–solid–liquid–stationary–agitated–batch cultures–Organogenesis–Callus induction–Caulogenesis–Rhizogenesis–techniques of hairy root production.

Unit II **Hrs15**

Micropropagation–mass production of plantlets–hardening and mist chambers–somatic embryogenesis–embryo rescue – protoplast culture–exploitation of somaclonal.

Unit III **Hrs15**

Mass culture of Cells – manipulation of cell line selection – immobilization of cells and its application – synchronization – Induction of cell line mutants and mutations – cryopreservation – germplasm conservation and establishment of gene banks – Synseed technology.

Unit IV **Hrs 15**

Principle of Cell and Tissue Culture; Advantage and Disadvantages of tissue culture methods – cell markers – types of cells – primary and established cell lines – Kinetics of cell growth – genetics of cultured cells – metabolism – applications of Animal Tissue Cultures.

Unit V **Hrs 15**

Techniques of cell and Tissue Culture: Sources of cells–Mechanical, biochemical cell preparation and types of animals cells –equipment – cell culture media – culture procedures –preparation of animal materials–primary culture, cells lines and cloning somatic cell fusion– Tissue culture methods: Slide and coverslip cultures, washing and feeding, double coverlid cultures, test tube culture–organ culture–whole embryo culture–specialized culture techniques–cell synchronization–measurement of cell death–stemcell culture and transplantation.

Reference:

1. Kalyan Kumar De, 1992, Plant Tissue Culture, New Central Book Agency, Calcutta.
2. Robert, N. Trigiano, Dennis J. Gray, 1996, Plant tissue Culture Cencept and Laboratory Excurses. CRC Press, London.
3. P.S. Srivasta, 1998, Plant Tissue Culture an Molecular Biology, Narosa Publishing Houses, New Delhi.
4. David W. Galbraith, Hand J. Bohnert an Don P.Bourque, 1995, Methods in Plant Cell Biology, Acadmic Press, New York.
5. John H. Dods and Lorrin W. Roberts, 1995, Experiments in Plant Tissue Culture, Cambridge University Press, USA.
6. D.C. Daring and S.J. Morgan, 1994, Animal Cells, Culture and Media, BIOS Scientific Publishers Limited.
7. Jennie P. Mathur and David Barnes, 1998, Methods in Cell Biology, Volume 57 : Animal cell Culture Methods Academic Press.
8. Plant Tissue Culture, S.S. Purohit (2005).
9. Animal Biotechnology, M.M. Ranga (2005).
10. Animal Cell and Tissue Culture, Mathur, Shivangi (2009).

Course Outcome:

- To understand the Animal and Plant Biotechnology.
- To study the plant cell & culture aspects.
- To study the micro propagation of protoplast & culture.
- To study the mass culture and other Animal cell culture Techniques.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
II	**17P2BTC6**	**ENZYME BIOTECHNOLOGY**	**4**	**4**

Objectives:
1. To study the enzymes and their properties.
2. To study the uses and applications of enzymes.

Unit I **Hrs 15**

Enzymes – nomenclature, classification & general properties, Factors, affecting enzyme action, pH, temperature, ions, substrate concentration, inhibitors, Extraction, assay and purification of enzymes, enzyme kinetics of enzyme catalysed reactions – the transition state.

Unit II **Hrs15**

Steady state kinetics – bi-substrate and multi substrate reaction – enzyme catalysed reaction – different types of inhibitors and activators – Machalies menton, Lineweaver and Burke equations, km, kcat and KI value enzyme specificity – absolute and rigid specificity, Nucleophilic & electrophilic attack.

Unit III **Hrs15**

Role of co-enzyme in enzyme catalysis: Co-enzyme regeneration, mechanism of enzyme action eg. lysozyme, chymotrypsin, DNA polymerase, ribonuclease & LDH, zymogen & enzyme activation, allosteric enzymes & metabolic regulations. Clinical & industrial uses of enzymes.

Unit IV **Hrs 15**

Techniques of enzyme immobilization and their application – medical, food, leather, textile and Paper industries. A brief account of modification of enzymes (enzyme engineering) and its products through DNA technology. Biosensors, mechanism of light activation of enzymes.

Unit V **Hrs 15**

Industrial utilization of enzymes, practical aspects of large – scale protein purification, use of soluble enzymes, enzyme reactors, membrane reactors, large scale application of microbial enzymes in food and allied industries. Medical application of enzymes in reverse glycosidase synthetic reaction. Interesterification of lipids, Enzyme theraphy.

Reference:

1. Enzyme Technology, Parihar, Pradeep (2009).
2. Cell and Molecular Biology, Gerald Karp, 4th Edition (2004).
3. The Cell a Molecular Approach, Cooper (2004).
4. Modern Experimental Biochemistry, Boyer (2004).
5. Biochemistry, U.Satyanarayana (2004).
6. Biochemistry, Harper, 25th edition (2002).

Course Outcome:
- To study the enzymes and their properties.
- To study the uses and applications of enzymes.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
II	**17P2BTC7**	**NANOBIOTECHNOLOGY**	**4**	**4**

Objectives:
1. To know about the Nanotechnology.
2. To learn about the nanoparticles and targeted drug delivery.
3. To learn the improved diagnostic products and techniques.
4. To study about the applications of nanomaterials.

UNIT – I

Principles of Nanobiotechnology; Introduction to nanotechnology - History of nanotechnology – Fundamental concept of Nanotechnology – Scope and application of Nanotechnology.

UNIT – II

Nanomaterials - classification of nanomaterials - properties of nanomaterials – Preparation of Nanomaterials – Synthesis of nanomaterials.

UNIT – III

Synthesis of nanoparticles. Using natural sources – nanotubes, carbon nanotubes, Formation of carbon nanotubes – uses of nanotubes – Biological applications of nano tubes.

UNIT – IV

Measuremant techniques for nanomaterials – x-ray crystallography – Atomic force microscope – Electron microscope – SEM, TEM – Flouresence microscope**.**

UNIT – V

Applications of nanomaterials – Present and future nanoparticles in medicine – Introduction of drug delivery in pharmaceutics. Nanoparticles carrier and carrier characteristics.

Reference:

1. Claupdio Nicolini, Nanobiotechnology & Nanobiosciences Pan Stanford Publishing Pte. Ltd.2009.
2. O.Skoseyov, Ilan levy, Nanobiotechnology – BioInspired Devices and Materials of the Future, Humana Press Inc, 2008.
3. N.Yao and Zhong Lin Wang, Handbook of Microscopy for Nanotechnology Kluwer Academic Publishers, 2005.
4. Nanotechnology – N.Arumugam – Saras Publications.
5. Indroduction to Nanotechnology – Neal lane and James .R. Heath.

Course Outcome:
- To know about the Nanotechnology.
- To learn about the nanoparticles and targeted drug delivery.
- To learn the improved diagnostic products and techniques.
- To study about the applications of nanomaterials.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
III	**17P3BTC8**	**GENOMICS AND PROTEOMICS**	**4**	**4**

Objectives:

1. To learn the Genome mapping, assembly and comparison
2. To understand, Sequence based approaches and Microarray based approaches
3. A thorough study on Proteomics
4. To understand, Protein-protein interactions and Applications of proteomics.

UNIT- I **Hrs 18**

Introduction to Genomics:

Applications Structural Genomics, Genome mapping – Genetic mapping, Physical mapping and resolution of mapping - Genome sequencing, Genome sequence assembly: Base calling and assembly programs, Automated genome annotation, Annotation of hypothetical proteins and Genome economy. Comparative genomics: Whole genome alignment, Finding a minimal genome, Lateral gene transfer, Within-genome approach and Gene order comparison

UNIT -II **Hrs 18**

Functional Genomics.

Sequence based approaches: EST, EST index construction and SAGE. Microarray based approaches: Oligonucleotide design, Data collection, Image processing, Data transformation and normalization. Comparison of SAGE and DNA Microarrays

UNIT - III **Hrs 18**

Proteomics

Introduction to proteomics and applications, Strategies in Proteomics 2D-PAGE, Mass spectrometry, protein identification through database searching, Differential in-gel electrophoresis and Protein Microarrays. Post translational modification: Prediction of disulphide bridges and Identification of posttranslational modifications in proteomics analysis. Protein sorting

UNIT- IV **Hrs 18**

Protein-protein interactions.

Prediction of protein-protein interactions: prediction interactions based on domain fusion, predicting interactions based on gene neighbors, predicting interactions based on sequence homology, predicting interactions based on phylogenetic information and prediction interactions using hybrid methods.

Unit V **Hrs 18**

Applications of proteomics.

Medical proteomics-disease diagnosis: Biomarkers, Biomarker discovery using 2DGE and mass spectrometry and Biomarker discovery and pattern profiling using protein chips. Pharmaceutical proteomics-drug development: The role of proteomics in target identification, Proteomics and target validation, Proteomics in the development of lead compounds and clinical development. Proteomics for the identification and characterization of novel proteins.

References:

1. Necia Grant Cooper; (Ed.) 1994.The Human Genome Project; Deciphering the blueprint of heredity University Science books, CA, USA.
2. Gary zweiger, 2003. Transducing the Genome; Information, Anarchy and Revolution in Biomedical Sciences.. Tata McGraw-Hill Publishers, New Delhi.
3. Howard L McLeod1 and William E Evans. 2001. PHARMACOGENOMICS: Unlocking the Human Genome for Better Drug Therapy. Annu. Rev. Pharmacol. Toxicol. 41:101–121.
4. Evans W.E. and Relling, M.V. 1999. Pharmacogenomics: translating functional genomics into rational therapeutics. Science 286:487
5. Satoskar, R.S., Bhandarkar, S.D and Annapure, S.S. 1999. Pharmacology and Pharmacotherapeutics, Popular Prakashan, Mumbai.
6. Branden, C and J.Troze, 1999. Introduction to Protein Structure. Second Edition.Garland Publishing, New Delhi.
7. Baxevanis, A.D and Ouellette, B.F.F. Eds. 2001. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins. Wiley Interscience. New York.
8. Higgins, D and Taylor, W (Eds). 2000. Bioinformatics: Sequence, Structure and Databnks.Oxford University Press, Oxford.

Course Outcome:

- To learn the Genome mapping, assembly and comparison
- To understand, Sequence based approaches and Microarray based approaches
- A thorough study on Proteomics.
- To understand, Protein-protein interactions and Applications of proteomics.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
II	**17P2BTCP2**	**Core – Practical – II – Molecular Genetics, Plant and Animal Biotechnology,Enzyme Biotechnology, Nanobiotechnology and Proteomics & Genomics**	**6**	**3**

Objectives:

1. To study the Isolation of DNA, Electrophoresis and GUS Assay.
2. To study the Tissue Culture methods.

Molecular Genetics

1. Plasmid extraction : Alkaline lysis, Mini preparation.
2. Chromosomal DNA isolation (Animal tissue, plants, bacteria and fungi)
3. Quantification of DNA & RNA
4. Electrophoresis of DNA & RNA
5. Bacterial transformation
6. Isolation of drug resistant autotrophic mutants.
7. Study of mutation by Ames test.

Plant and Animal Biotechnology

1. Preparation of Tissue Culture medium for plant and animals.
2. Micro propagation of shoot tip & seed culture.
3. Preparation of single cell suspension from spleen and thymus.
4. Cell counting and cell viability
5. Macrophage monolayer from PBMC and measurement of Phagocyte activity
6. Macrophage monolayer and subcultruing
7. Cryopreservation and Thawing
8. Measurement of doubling time
9. Isolation of DNA and demonstration of apoptosis of DNA laddering.
10. MTT assay for cell viability and growth
11. Cell fusion with PEG.

Enzyme Biotechnology

1. ELISA
2. Immobilization of enzymes.
3. Effect of pH & temperature on enzyme activity.

Genomics and Proteomics

1. Sequence alligenment- Local and Global allignment.
2. Sequence retrieval from biological databases- NCBI, EMBL, DDBJ, SWISSPROT.
3. Protein structure visualization- Rasmol.

Nanobiotechnology

1. Synthesis of Nanoparticles.
2. Metal microbes interactions.
3. Nanoparicles for diagnosis and treatment.

Reference:

1. Genetic Transformation of plants (Molecular Methods of Plant Analysis 2003 Publisher : Springer)
2. Plant Tissue Culture by S.S. Purohit, 2004, Mrs. Saraswati Purohit for Student edition.
3. Animal Cell Culture – Practical approach, Ed. Martin Clynes, Springer.
4. Animal Cell Culture Techniques. Ed. Martin Clyines, Springer.
5. Culture of Animal Cells, 3rd End, R.Ian Freshney, Wiley Liss.
6. Animal Cell Culture – Practical Approach, Ed. John R.W. Masters, Oxford.
7. Animal Cells : Culture and Media : Essential Data (Essential Data Series) by D.C. Darling, S.J. Morgan, 195, John Wiley and Sons Ltd.
8. Priniciples of Tissue Englineering by: Rovert P. Lanza, Robert Langer, Joseph P. Vacanti, 2000 Academic Press.
9. Handbook of Industrial Cell Culture: Mammalian, Microbial, and Plant Cells 2002.

Course Outcome:

- To study the Isolation of DNA, Electrophoresis and GUS Assay.
- To study the Tissue Culture methods.

Semester	Subject Code	Title of the Paper	Hours of Teaching /Week	No. of Credits
II	**17P2BTEL2A**	**Major Elective – II BIOINSTRUMENTATION AND BIOMETRY**	**4**	**4**

Objectives:

1. To enrich the knowledge of students on Bio-instrumentation.
2. To enhance the knowledge on Biometry.
3. To know about chromatography, PCR, ELISA and Electrophoresis.

Unit I **Hrs12**

Microscope – Types of microscope, Light, phase contrast, Fluorescent, Bright field, Dark field, Electron microscope – Principles and applications – Histological preparation of tissues for SEM and TEM.

Unit II **Hrs12**

pH meter – Principles, applications. Centrifuge: Types of centrifuge – Ultra centrifuge and cooling centrifuge, Spectrophotometer. Colorimeter, U-V and Atomic Colorimeter, principles and applications.

Unit III **Hrs12**

Chromatography – Principles, types and applications G.M. Counter, Scintillation counter – Principle and their application. NMR principles and applications.

Unit IV **Hrs 12**

PCR – Principles types and applications – Gel documentation – Immunological Techniques – Immuno electrophoresis – ELISA.

Unit V **Hrs12**

Micrometry – Principles and applications – Measures of central tendency, measures of dispersion – correlation and regression.

Reference:

1. Step Guide to Photography, Ebury, Press – London.
2. Practical methods in Electron Microscopy – Glamet (2000). Vol.3 North Holl and Publishing Co.
3. Hand book of Immunodiffusion and Immuno Electrophoresis, Ann-Arbor Science Publishers – Michigan.
4. Principles of Biochemistry, Lehninger (2006).
5. Basic Biophysics of Biologist, Daniel (2007).
6. Biostatistics and Biometry, Parihar, P. (2009).
7. Biochemistry: Fundamental and Application, Purohit, S.S. (2009).

Course Outcome:

- To enrich the knowledge of students on Bio-instrumentation.
- To enhance the knowledge on Biometry.
- To know about chromatography, PCR, ELISA and Electrophoresis.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
II	**17P2BTEL2B**	**Major Elective – II OCCUPATIONAL HEALTH AND INDUSTRIAL SAFETY**	**4**	**4**

Objectives:
To impart knowledge on various occupational health hazards and also safety measures to be taken in the work place.

Unit I **Hrs 12**

Parameters of safety - Factors affecting the conditions of occupational and Industrial safety - Concept of safety organization and Management - Safety Regulations.Definition and Role of Ergonomics in Designing Work-Place

Unit II **Hrs12**

Work Environment - Effects of Light, Ventilation, Vibration, Noise etc - The Work Physiology and their Relevance to Safety - Performance Evaluation of Man - Environment systems.

Unit III **Hrs12**

Occupational Health and Safety – Occupational Health and Hazards – Physical, Chemical and Biological hazards. Occupational Diseases and their Prevention and Control. Health Protection Measures for Workers. Principles of Arthropod Control

Unit IV **Hrs 12**

Health Education Medical First-Aid and Management of Medical EmergenciesIndustrial Safety management Techniques - Industrial Safety Standards. Accidents-Definition, Frequency Rate, Prevention and Control. Work Study - Method of Study and Measurement. Measurement of Skills. Safety - Cost of Expenses

Unit V **Hrs 12**

Principles of Functions in Safety Management Case Study - Visit to an Industry - Preparation of report on safety measures followed in Airport/Industry.

Reference:

1. Environmental Strategies–Hand Book, Kolluru R. V, (1994) Mc Graw Hill Inc., New York.
2. A B C of Industrial Safety, Walsh, W and Russell, L, (1984) Pitma Publishing United Kingdom (1984)
3. Environmental and Industrial Safety, (1989) Hommadi, A. H (1989). I.B.B Publication, New Delhi (1989)

Course Outcome:

- To impart knowledge on various occupational health hazards and also safety measures to be taken in the work place.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
II	**17P2BTEL2C**	**Major Elective – II Bio-Informatics, Intellectual Property Rights and Nanotechnology**	**4**	**4**

Objectives:

1. To know the ultra structure of Prokaryotic and Eukaryotic cellular organisms.
2. With the help of instruments, to know the basic principles of protein.
3. To know the internet and E-mail.
4. General aspects of patenting.
5. To know about Nanotechnology.

Unit I **Hrs18**

Cell structure, Ultra structure of Prokaryotes and Eukaryotes Cellular Organisms.

Reference:

1. Biotechnology Fundamentals and Application – S.S.Purohit, Agrobios, India.

Unit II **Hrs18**

Protein confirmation – Predication of Protein structure – fold recognition, comparative modelling (homology), Basic principles of X – ray diffraction studies, NMR, Mass spectroscope in identifying protein confirmation.

Reference:

1. Sequence Analysisprimer by M Gribskov, J. Devercux (1989) Stockton Press.
2. Nucleic acid and protein sequence analysis, A practical approach by MJ Bishop and C.J. Ramslings (1987) IRL Press.
3. Information theory and living system by L.I. Garfield, (1992), Columbia University Press.

Unit III **Hrs18**

Basic concepts of Bioinformatics, sequence Databases, sequence formats – Gene basic -Networking – Network access, Internet, E – mail servers – use of databases biology, Sequence databases, Sequence Analysis – Protein and Nucleic acids, Structural comparisons.

Reference:

1. Molecular databases for for protein and structure studies by Sillince, J.A. and Sillince M (1991) Springer Verlag.

Unit IV **Hrs18**

A general account of patenting, Artificial intelligence, Biosafety and Bioethics.

Reference:

1. Information of Biostatitics by Sokal and Rhld (1973) Toppan Company, Japan.

Unit V **Hrs18**

Nanobiotechnology – Basic principles and scope of Nanotechnology – Structural and Brownian assembly – Important characteristies – Molecular manufacturing – Decisive military capabilities – Molecular mills – in the fields of agriculture, Medicine, future perspedives of Nanotechnology in Life Sciences -Applications of Nanotechnology.

Reference:

1. Glossary of Biotechnology and Nanobiotechnology – Narendhra Publications.
2. Nanotechnology – A gentle introduction to the next big idea, Ratner – Tamil Nadu Book House.

Course Outcome:

- To know the ultra structure of Prokaryotic and Eukaryotic cellular organisms.
- With the help of instruments, to know the basic principles of protein.
- To know the internet and E-mail.
- General aspects of patenting.
- To know about Nanotechnology.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
III	**17P3BTC9**	**BIO-PROCESS TECHNOLOGY**	**5**	**4**

Objectives:
1. To study the Bioprocess engineering.
2. To study the microbial strain involved in Bioprocess.
3. To study the food processing.

Unit I **Hrs15**

Introduction and scope of Bioprocess engineering. Microbial growth kinetics, Biomass production. Thermodynamics – energy balance in microbial – metabolic heat generation. Advantages of Bioprocess over chemical process.

Unit II **Hrs15**

Microbial strain improvement, increased yield. Upstream processing – Effect of pH, Temperature, Media formulation, carbon source, Nitrogen, vitamin, minerals, inducers, precursors, inhibitors and growth factors.

Unit III **Hrs15**

Downstream Processing – Biomass removal and distruption. Removal of microbial cells: and solid matter, centrifugation, sedimentation, Flocculation, microfiltration, sonication, Bead mills, Homogenizer, Chemical lysis, enzymatic lysis. Membrane based Purification – Ultrafiltration; Reverse osmosis, dialysis Pervapouration, Perstraction, absorption and chromatography. Precipitation, Biological affinity. Electrophoresis. Extraction (solvent aqueous two phase, super critical) Drying and crystallization.

Hrs15

Unit IV

Fermentation products: Bread, Cheese, fermented milk products. Beverages: Beer, Wine. Fermented vegetables.

Unit V **Hrs15**

Food processing technology – canning, packing, sterilization, pasteurization, food spoilage, food preservation – modern methods of preservation of Milk, Fruit, Food product, meat and other animal products.

Reference:

1. Bioprocess Technology: Fundamentals and Applications, KTH, Stockholm.
2. Jackson, A.T., Process Engineering in Biotechnology, Prentice Hall, Angelwood Cliffs.
3. Shuler, M.L. and Kargi, F., Bioprocess Engineering: Basic Concepts, Prentice Hall, Engelwood Cliffs.
4. Stanbury, P.F. and A. Whitaker, 1995, Principles of Fermentation Technology, Pergamon Press, Oxford
5. Wulf Crueger and Anneliese Crueger, 2000, A Text Book of Industrial Microbiology, Panima Publishing Corporation, New Delhi.
6. Pharmaceutical Biotechnology, Purohit, S.S. (2009).
7. Pharmaceutical Microbiology, Purohit, S.S. (2008).

Course Outcome:

- To study the Bioprocess engineering.
- To study the microbial strain involved in Bioprocess.
- To study the food processing.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
III	**17P3BTC10**	**CLINICAL BIOCHEMISTRY**	**5**	**4**

Objectives:

1. To study the lab setup and safety measures
2. To learn about the metabolic disorders
3. To study about the disorders of kidney and liver
4. To know about drug design and their types

UNIT I: LABORATORY SETUP AND SAFETY **Hrs 15**

Requirements of setting up of clinical laboratory, SI units in clinical laboratory, Collection preparation, preservation, and handling of clinical samples, quality control, Safety measures in clinical laboratory. Formulation of clinical and diagnostic kits, Safety aspects

UNIT II: METABOLIC DISORDERS **Hrs 15**

Disorders of Carbohydrate Metabolism – Diabetes mellitus, glucose and galactose tolerance tests, sugar levels in blood, renal threshold for glucose, factors influencing blood glucose level, glycogen storage diseases, pentosuria, galactosemia.

Disorders of Lipid metabolism – Plasma lipoproteins, cholesterol, triglycerides & phospholipids in health and diseases - hyperlipidemia, hyperlipoproteinemia, Gaucher's disease, Tay-Sach's and Niemann-Pick disease, ketone bodies, Abetalipoproteinemia.

UNIT III **Hrs 15**

NEUROLOGICAL AND PSYCHIATRIC DISORDERS: Schizophrenia – types, symptoms, antipsychotic drugs - Affective disorders - Unipolar and bipolar disorders, antidepressants , Alzeimer's disease, Wernicke-Korsakoff syndrome, dementia, Wilson's disease

Ageing- Physiological and biochemical changes in ageing. Different theories of ageing, importance of superoxide dismutase in ageing, plasticity and regeneration

UNIT IV **Hrs 15**

Disorders of liver and kidney – Jaundice, fatty liver,normal and abnormal functions of liver and kidney. Inulin and urea clearance. Digestive diseases – Maldigestion, malabsorption, creatorrhoea, diarrhoea and steatorrhoea- Electrolytes and acid-base balance – Regulation of electrolyte content of body fluids and maintenance of pH. Disorders of acid-base balance and their respiratory and renal mechanisms

UNIT V **Hrs 15**

Inborn errors of Metabolism- Disorders of amino acid metabolism – Phenylalanaemia, homocystinuria, tyrosinemia; Disorders of nucleic acid metabolism- Disorders in purine and pyrimidine metabolism Hormonal imbalances: Protein hormones, steroid hormones.

Reference:

1. Burger, A., Med. Chem.
2. Wilson and Gisvold, Organic Med. Pharmaceutical Chem.
3. Ariens, Drug Design, Academic press, NY,1975.

Course Outcome:

- To study the lab setup and safety measures
- To learn about the metabolic disorders
- To study about the disorders of kidney and liver
- To know about drug design and their types

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
III	**17P3BTC11**	**RECOMBINANT DNA TECHNOLOGY**	**5**	**5**

Objectives:
1. To study about the techniques in gene manipulation.
2. To study the cloning strategies, DNA Amplification.
3. To study the PCR and other Techniques.

Unit I **Hrs 15**

Techniques in gene manipulation, cutting and joining of DNA, introduction of DNA into cell.

Unit II **Hrs 15**

Cloning strategies, construction of genomic libraries and DNA libraries, probe construction recombinant selection and screening, molecular cloning.

Unit III **Hrs 15**

Analysis expression. Analysis of recombinant DNA, sequencing, autogenesis, altered expression and engineering genes, site directed mutagenesis.

Unit IV **Hrs 15**

DNA amplification using polymerase chain reaction (PCR). Key concepts. Analysis of amplified products. Applications of PCR: Ligase chain reaction: RFLP, RAPD, DNA finger printing.

Unit V **Hrs 15**

Expression systems and their application. E.coli, Bacillus, streptomyces, yeast, Baculovirus and animal cells as cloning hosts, yeast shuttle vectors cosmids, production of antibodies and vaccines.

Reference:

1. Molecular cloning "a Laboratory manual Vol. – III by Sambrook et al., (1989) Cold spring Harbor Laboratory.
2. PCR Protocols by John M.S. Barlett, David Sterling 2003, Humana press Inc.
3. RNA Methodologies, 2nd Edn, by Robert E. Farrell Jr. 1996, Academic Press, Inc.
4. Short Protocols in Molecular Biology Vol I & II, 5th Edn. By Frederick M.Ausubel. Roger Breut, 2002, John Wiley & Sons, Inc.,
5. Genetic Engineering and its applications, Joshi, P. (2007).
6. Recombinant DNA Technology and Biotechnology – Guide for Student, Kruzer (2003).
7. Cell and Molecular Biology, 4th Edition, Gerald Karp (2004).

Course Outcome:
- To study about the techniques in gene manipulation.
- To study the cloning strategies, DNA Amplification.
- To study the PCR and other Techniques

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
III	**17P3BTC12**	**AQUATIC BIOTECHNOLOGY**	**5**	**4**

Objectives

1. To study the scope of aquaculture.
2. To know about the disease management of aquatic organism.
3. To know about the cryopreservation techniques in aquatic organism.
4. To study about the transgenic fishes.

UNIT – I **Hrs 12**

Scope of Aquaculture – Aquaculture in India – Types of aquaculture – Culture practices in India – Culturable organisms: Fin fishes, Shell fishes – water quality management & aquatic pollutions.

UNIT – II **Hrs 12**

Construction of Fish pond – Fresh water aquaculture– Types of Culture – Extensive, Semi intensive, Intensive culture, Mono culture, Monosex culture, Poly culture, Cage culture, Pen culture. Integrated fish farm. Role of probionts in aquaculture.

UNIT – III **Hrs 12**

Diseases of aquaculture organisms – Ectoparasites and Endoparasites – Bacterial, Viral and Fungal diseases. Preservation of fishes – PCR and applications**.**

UNIT – IV **Hrs 12**

Crypreservation of gametes – Implication of cryopreservation in Aquaculture – Hypophysation – Principles, Prodecures of hypophysations – mechanism of pituitary action – Ovaprim – Advantages of hypophysations. Southern blotting & DNA Finger printing.

UNIT – V **Hrs 12**

Transgenic fish – Candidate genes for transfer – Making gene construction – Mechanism of gene transfer – Characterization of transgenic fish – Potential hazards and benefits.

Reference:

1. Hackett, P.B. 1993. The molecular biology of transgenic fish. In: Biochemistry and Molecular Biology of Fish, (Eds. Hochachka, P., Mommsen, T.) Vol.2, Elsevier Science Publishers, Amsterdam, pp.207 – 240.
2. Leung, L.K.P. and Jamieson, B.G.M.1991. Live preservation of fish gametes. In: Fish Evolution and Systematics: Evidence from spermatozoa (Ed.Jamieson,B.G.M) pp.245-295, Cambridge University Press.
3. Old, R.W. and Primrose, S.B. 1994. Principles of gene manipulation: An introduction to genetic engineering, Blackwell Scientific Publications, Oxford.
4. Balasubramanyam, D.et.al. 1998. Concepts in Biotechnology, University Press.
5. Ranga, M.M.1999. Animal Biotechnology, Agrobios, Jodhpur, New Delhi.
6. Karunasagar, Aquaculture and Biotechnology (for chapters 11 & 14).
7. Ranga and Shammi. 1999. Fish Biotechnology.

Course Outcome:

- To study the scope of aquaculture.
- To know about the disease management of aquatic organism.
- To know about the cryopreservation techniques in aquatic organism.
- To study about the transgenic fishes.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
III	**17P3BTCP3**	**Core – Practical – III – BIO-PROCESS TECHNOLOGY, RECOMBINANT DNA TECHNOLOGY, CLINICAL BIOCHEMISTRY & AQUATIC BIOTECHNOLOGY**	**5**	**4**

Objectives:

1. To know the r-DNA Technology.
2. To know the Bioprocess Technology.
3. To know the Biodiversity.

Bio-Process Technology

1. Isolation of industrially important microorganisms (Amylase, Pectinase, Cellulase) for microbial process.
2. Study of optimal culture conditions for the production of Amylase, Pectinase and cellulose in a bioreactor.
3. Production of amylase, cellulase, pectinase, wine and beer in a bioreactor.
4. Determination of thermal death point and thermal death time of microorganisms for design of a sterilizer.
5. Microbial production of citric acid using *Aspergillus niger*.
6. Microbial production of Penicillin, (Biosynthesis of Antibiotics).
7. Production and Estimation of Alkaline Phosphatase.
8. Identification of micro organisms in preserved food product (Milk, Fruit juice, animal meat).

Recombinant DNA Technology

1. Restriction analysis of plasmid (PBR322, PUC)
2. Selection methods (Blue white screening, Insertional inactivation).
3. Primer design and PCR amplification of Beta galactosidase.
4. Cloning of PCR product into PBR.
5. Introduction of cloned genes and analysis by SDS – PAGE.
6. SOUTHERN BLOTTING of Beta galactosidase.
7. Reporter gene assay (GUS/beta galactosidase).
8. Isolation of phage DNA.
9. RFLP analysis of 18s r-DNA of genome.
10. Genetic diversity of Pseudomonas by RAPD.

Clinical Biochemistry

1. Estimation of Haemoglobin in blood samples
2. Estimation of Bile pigments
3. Estimation of Creatinine
4. Estimation of triglycerides, steroids

Aquatic Biotechnology

1. Estimation of O_2 consumption by fish.
2. Estimation of Salinity in given water samples.
3. Isolation of microbes from the digestive track of fish.
4. Cryopreservation

References

1. Short Protocols in Protein Science – A Compodium Methods from Current Protocols in Protein Science by John E. Coligan, Ben M. Dunn, 2003, John Wiley and Sons Ltd.
2. Enzymes, Biochemistry, Biotechnology, Clinical Chemistry, Trevor Palmer, Horwood Publishing, Chichester, 2001.
3. Analytical Biochemistry by David J. Holme and Hazel Peck, 3rd ed., 1998, Pearson Education Ltd., England.
4. Principles and Practice of Bioanalysis by Richard F. Venn, 2003. Taylor and Francis, London.
5. Biochemical Methods by A. Pingoud, C. Urbanke, J. Hoggett, 2002. Weiley-Velt Verlag Garbh.
6. Molecular Cloning, A Laboratory Manual, Vol.I-III by Sambrook et al. (1989), Cold Spring Harbor Laboratory.
7. Genetic Analysis of Bacteria by Stanley R. Maloy, Valley J. Stewart, 1996, Cold Spring Harbor Laboratory Press.
8. PCR Protocols by John M.S. Barlett, David Stirling, 2003, Humana Press Inc.
9. RNA Methodologies, 2nd Edn. by Robert E. Farrel Jr. 1996, Academic Press Inc.
10. Short Protocols in Molecular Biology, Vol.I & II, 5th Edn., by Frederick M. Ausubel, Roger Breuyt, 2002, John Wiley & Sons, Inc.
11. PCR Strategies by Mixchael, A. Immis, David, II. Gelfand, 1995, Academic Press, Inc.
12. Bio-chemical method by A.PINGOUD, C. URBANKE, J.HOGGETT, 2002 – Weily – Valt Verlag Garbh.

Course Outcome:

- To know the r-DNA Technology.
- To know the Bioprocess Technology.
- To know the Biodiversity.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
IV	**17P4BTC13**	**RESEARCH METHODOLOGY**	**8**	**5**

Objectives:

1. The Paper aims to train students in the statistical analysis and presentation of the data.
2. To write the report/thesis/dissertation and or for publications in appropriate research journals,
3. The aim of the Paper thus is to lay a strong foundation for the student for thesis writing, editing, analysis and interpretation of the generated data with hands on experience with model sums.

Unit I **Hrs12**

Research: Selection of problem – stages in the execution of research: choosing a topic to publication – preparation of manuscript – report writing – format of journals – proof reading – sources of information : journals, reviews, books, monographs etc – How to write thesis and their standard format – standard organization of bibliography. Planning of research: Research proposals, time scheduling of research, available sources and generation of funds and facilities.

Unit II **Hrs12**

Journals: Standard of research journals – paid and refereed journals – impact factor, citation index, H-index. Choice of journals for publication. Information retrieval: access to archives and databases, search engines: Google, Pubmed, NCBI, etc.,National Informatic Center - Online data base library.

Unit III **Hrs12**

Collection of data- diagrammatic representation :Bar, Pie diagrams; graphic representation-Histogram, frequency polygon; Measures of central tendency: Arithmetic mean, median & mode(direct methods and model sums) Measures of dispersion – sampling methods: random sampling, stratified random sampling– standard deviation – standard error – coefficient of variation: elucidation with model sums.

Unit IV **Hrs12**

Bivariate relationship: Types of Correlation and Karl Pearson's correlation coefficient: model sums with elucidation – Regression analysis: Components of regression equation – Confidence intervals of regression line. Fitting simple regression lines: model sums, calculations of equation and fitting of regression line, estimated and calculated Y. Comparison between correlation and regression.

Unit V **Hrs12**

Probability-Theorems: Addition and Multiplication–Patterns of distributions: Poisson, Normal and Binomial; Test of significance - Comparison of means: Chi square test, student t test, ANOVA, model sums on one way ANOVA with interpretation of data – Introduction to MANIVA AND STASTICA - Use of statistical softwares.

Reference:

1. Davis, G.B. and C.A. Parkar 1997, Writing the doctoral dissertation. Barons Educational series, 2nd edition. Pp 160. ISBN: 0812098005.
2. Duncary, P.2003. Authoring a Ph.D. thesis: how to plan, draft, write and finish a doctoral dissertation. Plagrave Macmillan, Pp 256. ISBN 1403905843.
3. Saxena, S. 2001, MS office, Vikas Publishing House Pvt. Ltd. New Delhi 110014.
4. Snedecor, G.W. and W.G. Cocharn, 1978. Statistical methods. Oxford and IBH Publishing Co Pvt. Ltd.
5. Sokal, R.R. and F.J. Rohif, 1981. Biometry. W.H. Frecman, New York.
6. Zar.J.H.1996.Biostatistical analysis. Prentice Hall, Uppar Saddle River,NewJersey, USA.
7. Biostatisitcal Analysis, Zar (2004).

Course Outcome:

- The Paper aims to train students in the statistical analysis and presentation of the data.
- To write the report/thesis/dissertation and or for publications in appropriate research journals,
- The aim of the Paper thus is to lay a strong foundation for the student for thesis writing, editing, analysis and interpretation of the generated data with hands on experience with model sums.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
IV	**17P4BTC14**	**INDUSTRIAL BIOTECHNOLOGY**	**8**	**5**

Objectives:

1. To know the Biology of Industrially important organisms.
2. To know the commercial production of Humilin, Ethanol, citric acid etc.
3. To know the Enzyme Technology and other microbial products.

Unit I **Hrs 18**

Isolation, preservation and maintenance of industrial microorganisms. Innoculum development – Development of innocula for yeast, bacteria and mycelium. Aseptic inoculation of the fermenter – sterilization techniques.

Unit II **Hrs 18**

Fermentation technology: Bioreactors – designs – types - Airlift, stirred tank bioreactor. Specialised bioreactor (Pulsed, Fluidized, Photobioreactor), Fermentation: Batch, Fed batch and continuous – solid state – submerged.

Unit III **Hrs 18**

Industrial production of organic acids - citric acid, lactic acid, Acetic acid. organic solvents – glycerol, Antibiotics – Pencillium, streptomycin, Chloroamphenicol. Amino acids – glutamic acid, lysine, isoleucine, Aspartic acid and proline. Production of SCP. Biomining and oil recovery.

Unit IV **Hrs 18**

Enzymes – Production and Purification: Amylase, Pectinase and Cellulase. Protein engineering and its Applications.

Unit V **Hrs 18**

Fuel Biotechnology – Bioethanol, biobutanol, biodiesel. Production of biogas – methane, biohydrogen. Commercailization of microbial products: Objectives, market potential, Economics of microbial products (cost of equipments, raw materials, labour recovery, packaging and marketing).

Reference:

1. Bacterial physiology and metabolism by Sala Tch. R., Academic Press, New York.
2. Comprehensive Bio-Technology V.M. moo-young, Pergamm press, oxford.
3. Environmental chemistry – A-K-De. Wiley Eastern Ltd. New Delhi.
4. Waste water Engineering, treatment, disposal and reuse – Metcal and Eddy. The Tata Mc-Graw Hill, New Delhi.
5. Industrial Microbiology, Prescott, S.C. (2009).
6. Industrial Microbiology: Fundamentals and Applications, Agarwal, A.K.
7. Fermentation Technology, Purohit, S.S. (2008).
8. Dairy Microbiology, Parihar, P. (2008).

Course Outcome:

- To know the Biology of Industrially important organisms.
- To know the commercial production of Humilin, Ethanol, citric acid etc.
- To know the Enzyme Technology and other microbial products.

Semester	Subject Code	Title of the Paper	Hours of Teaching /Week	No. of Credits
IV	**17P4BTEL3A**	**Major Elective - III BIOSAFETY AND BIOETHICS**	**8**	**4**

Objectives:
1. To study the Biosafety and its guidelines.
2. To study the IPR and patents.
3. To study the Agreement and Treaties.

Unit I **Hrs 18**

Biosafety: Introduction: Biosafety issues in biotechnology – historical background: Introduction to biological safety cabinets: Primary containment for bio hazards: Biosafety levels: Biosafety levels of specific micro organisms: Recommended Biosafety levels for infections agents and infected animals.

Unit II **Hrs18**

Biosafety Guidelines: Biosafety guidelines and regulations (National and international) – operation of biosafety guidelines and regulations of government of India: Definition of GMOs & LMOs: Roles of institutional Biosafety committee, RCGM, GEAC etc. GMO applications in food and agriculture: Environmental release of GMOs: Risk Analysis: Risk Assessment: Risk management and communication: Overview of National Regulations and relevant International Agreements including cartegana protocol.

Unit III **Hrs18**

Introduction of Intellectual Property: Types of IP patents, Trademarks, Copyright & Related rights. Industrial design, Traditional Knowledge. Geographical indications – Importance of IPR – Patentable and non-Patentable – Patenting life – legal protection of biotechnological inventions – world intellectual property rights organization (WIPO).

Unit IV **Hrs 18**

Basics of patents and concept of Prior Art: Introduction to patents: Types of patent applications: Ordinary, PCT, Conventional, divisional and patent of Addition: Specifications. Provisional and complete: Forms and fees invention in context of "Prior art". Patent database searching. International databases. Country wise patent (USPTO, esp@ ce net CEPo), PATENT scope (WIPo), IPO.

Unit V **Hrs 18**

Agreements and Treaties: History of GATT & TRIPS Agreement : Madrid, Agreement : Hague Agreement : WIPO Treaties : Budapest Treaty : PCT Indian Patent Act 1970 and recent amendments.

Reference:

1. Biotechnology and Safety Assessment, Thomas (2003).
2. Environmental Health Hazards, Kumar (2004).
3. Progress in Bioethics, Jonathan *et al.*, 2010.
4. The Ethics of Protocells – Mark 2009.
5. Design and Destiny – Ronald and Turner, 2008.

Course Outcome:

- To study the Biosafety and its guidelines.
- To study the IPR and patents.
- To study the Agreement and Treaties.

Semester	Subject Code	Title of the Paper	Hours of Teaching /Week	No. of Credits
IV	**17P4BTEL3B**	**Major Elective - III BIODIVERSITY AND BIORESOURCES**	**8**	**4**

Objectives:

1. To study the diversity of genes, species of eco system.
2. To study the Loss, uses, values, of conservation of Bio-diverting.

Unit I **Hrs 18**

Biodiversity – Definition – Types – Terrestrial, Aquatic and arborial biodiversity - genetic diversity - Species (species diversity) and ecosystems diversity. Genetic Diversity – Nature and origin of Genetic Variation – Measuring Genetic variation Allyozyme, RFLP, RAPD, DNA sequencing and the polymerase chain reaction (PCR) techniques. (Elementary account on each one of these only) – The need for wild relatives of cultivated plants / animals / microbes. Centres of origin of cultivated plants and domesticated animals. Species Diversity – Measurement – Concepts of species richness, abundance, and turnover species / area relationship, global distribution of species richness – centres of species diversity (CUP) – megadiversity centres – Hot spot analysis. A general account on Ecosystem diversity.

Unit II **Hrs18**

Loss of Biodiversity

Species extinction – Fundamentals causes – Deterministic and stochastic processes – current and future extinction rates - methods of estimating loss of biodiversity – threatened species – The IUCN threat categories (extinct, Endangered, Vulnerable, Rare. Intermediate and insufficiently known). The threat factors (Habital loss, over – exploitation for uses introduction of Exotics, Diseases, habitat fragmentation etc.) – common threat plant and animal taxa of India Red Books.

Unit III **Hrs18**

Uses and values of Biodiversity

Uses of Bioresources – plant uses: Food, timber, medicinal ornamental and other uses – animals uses food animals (terrestrial and aquatis) Domestic livestock – uses of microbes.

Valuing Biodiversity – Instrumental (Goods, services, information and psychospiritual values) and Inherent or Intrinsic values ethical and aesthetic values – An outline account on methods of valuing biodiversity.

Unit IV **Hrs 18**

Conservation and sustainable management of Biodiversity and Bioresources – National policies and Instruments relating the protection of the wild / domesticated flora and fauna as well as habitats – International policies and Instruments – A general account on multilateral treaties – the role of CBD, IUCN, GEF, IBPGR, NBPGR, WWF, FAO, UNESCO and CITES – Bioresources, Biotechnology and Intellectual property rights. Biopyracy right of farmers, breeders and indigenous people – An elementary on biodiversity bioresources data bases.

Unit V **Hrs 18**

Social issues and the Environment

Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns, Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, Wasteland reclamation – Consumerism and waste products – Environment Production Act – Air (Prevention and Control of Pollution) Act – Water (Prevention and Control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

Reference:

1. Biodiversity Conservation in Managed and Forests and Protected Areas, Kotwal, P.C. (2009).
2. Biodiversity: Assessment and Conservation, Trivedi, A.C. (2006).
3. Biodiversity: Principles and Conservation (2nd Ed.).
4. Trends in Wild Life Biodiversity Conservation and Management in 2 Vols.
5. Groombridge, B (Ed.) 1992. Global Biodiversity – Status of the Earth's Living Resources. Chapman & Hall, London.
6. UNEP, 1995, Global Biodiversity Assessment, Cambridge Univ. Press, Cambridge.
7. Virchow, D. 1998. Conservation & Genetic Resources, Springer – Verlag, Berlin.

Course Outcome:

- To study the diversity of genes, species of eco system.
- To study the Loss, uses, values, of conservation of Bio-diverting.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
IV	**17P4BTEL3C**	**Major Elective – III ENZYMOLOGY**	**8**	**4**

Objectives:

1. To learn the Classification, nomenclature & general properties.
2. To study the Enzyme kinetics.
3. To understand the Techniques of enzyme immobilization & their applications.
4. To study the Industrial utilization of enzymes and Enzyme therapy

Unit I **Hrs18**

Classification, nomenclature & general properties, Factors, affecting enzyme action pH, temperature, ions, substrate concentration, enzyme concentration, inhibitors, Extraction, assay and purification of enzymes units of activity and kinetics of enzyme catalysed reactions – the transition state.

Unit II **Hrs18**

Steady state kinetics – bisubstrate and multisubstrate reaction – enzyme catalysed reaction – different types of inhibitors and activators – Machalies Menton, Lineweaver and Burke equations, Km, Kcat and KI value Enzyme specificity – absolute and rigid specificity, Nucleophilic & electrophilic attack

Unit III **Hrs18**

Role of co-enzyme in enzyme catalysis: Co-enzyme regeneration, Mechanism of enzyme action eg., lysozyme, chymotrypsin, DNA polymerase, ribonuclease & LDH, zymogen & enzyme activation, allosteric enzymes & metabolic regulations. Clinical & industrial uses of enzymes.

Unit IV **Hrs18**

Techniques of enzyme immobilization & their applications – medical, food, leather, textile and Paper industries. A brief account of modification of enzymes (enzyme engineering) and its products through r-DNA technology. Biosensors, Mechanism of light activation of enzymes.

Unit V **Hrs18**

Industrial utilization of enzymes, practical aspects of large-scale protein purification, use of soluble enzymes, enzyme reactors, membrane reactors, continuous flow, packed bed reactors, large-scale application of microbial enzymes in food and allied industries. Antibiotics production, medical application of enzymes in reverse glycosidase synthetic reaction. Interesterification of lipids, Enzyme therapy.

References:

1. Blazej, A. & Zemek.J. 1987: Interbiotech, 87, Enzyme Technologies, Elsevier
2. Murray Moo–Young 1988 Bioreactor immobilized enzyme and cells.Fundamentals and applications, Elseyler, Applied Science
3. Rehm, H.J. and Reed G. 1988, Biotechnology, Vol 7a, Enzyme Technology, Elsevier
4. Terrance G. Cooper 1977. The tools of Biopchemistry, John Wiley & Son
5. William, b. Jakoby, 1984 Methods in Enzymology, Vol.104, enzyme purification and related techniques.

Course Outcome:

- To learn the Classification, nomenclature & general properties.
- To study the Enzyme kinetics.
- To understand the Techniques of enzyme immobilization & their applications.
- To study the Industrial utilization of enzymes and Enzyme therapy

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
IV	**17P4BTPR**	**PROJECT WORK**	**---**	**4**

A - PROJECT WORK

Aim:

(a) Identification of real time problem and addressing through Biotechnological approach

(b) Building the research potential by enriching science and technological knowledge and skill.

Topic of dissertation may be chosen from the broad area of biology 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.

B - BIOTECHNOLOGICAL RESEARCH CENTRES VISIT REPORT

A report on Biotechnological research laboratory and industries (CMFRI, EMPDA, CIFT & Rajiv Gandhi Centre for Biotechnology) should be maintained and submitted at the time of Viva-voce examination for valuation.

Course Outcome:

- Undertake problem identification, formulation and solution.
- Demonstrate the knowledge, skills and attitudes.

CORE OPATION

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
I		**Core Option -CANCER AND STEM CELL BIOLOGY**		

Objectives:

1. To know the regulation of eukaryotic cell cycle.
2. To know the cancer biomarkers
3. To study the cell signaling in cancer cell lines.
4. To know diagnosis and treatment.
5. To know the concept of stem cells and treatment.

UNIT I **Hrs 18**

Regulation of the Eukaryotic cell cycle, Cell birth, Lineage and cell death. Cancer/ oncogenes, Cancer biomarkers, Cellular morphology, Primary and established cell lines, Kinetics of Cancer cell growth, Genetics of cancer cells. Cancer stem cell culture and their applications. Cell culture based vaccines. Cancer proteomics.

UNIT II **Hrs 18**

Cell Signalling in Cancer Cell lines: Cancer cell lines : MCF-7, HeLa, HepG2, A549 and ZR771. Signaling at the cell surface, Types of signaling pathways that control gene activity, Integration of signals and gene controls. Moving proteins into membranes and organelles,
Vascular traffic, secretion and endocytosis, Metabolism and movement of lipids.

UNIT III **Hrs 18**

Etiology, epidemiology, diagnosis and treatment of Breast, Lung, colo-rectal, blood, endocrine cancers. Current scenario of RNAi technology in cancer medicine. Role of gene therapy in cancer treatment.

UNIT IV **Hrs 18**

Stem cell concept – Properties of stem cell – Types of stem cell embryonic stem cell – Adult stem cells – Problem of differentiation.Differentiation status of cells – Primordial germ cell - Skin cell - Gastrointestinal cells – Embryonic stem cell differentiation as a model to study
haematopoietic and endothelial cell development.

UNIT V **Hrs 18**

Stem cell location and Classification – Neural stem cells – Stem cell niches – Germ line
Epithelial and Epidermal and neural niches. Uses of Stem cells - Human stem cells – Renewal of
stem cells- Stem cells and Tissue engineering – Embryonic stem cells and Gene therapy -
Therapeutic cloning. Ethical and Social consideration of Stem cell research.

REFERENCE BOOKS:

1. Kursad Turksen 2002. Embryonic Stem Cells Method and Protocols. Humana press.
2. Russell Korobkin and Stephen R. Munzer 2007. Stem Cell Century, Law and Policy for a
Breakthrough Technology, Yale University Press.
3. Robert Lanza 2005. Essential of Stem cell Biology. Elsevier press.
4. Robert Lanza, 2004. Hand Book of Stem Cells Volume 1&2, Elsevier press.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
II		**Core Option – TOXICOLOGY**		

Objectives:

1. To know the scope of toxicology
2. To study the classification of toxicology.
3. To know the toxicological testing methods.
4. To know the environmental toxicology
5. To know the biomonitoring of toxic chemicals

Unit- I Introduction and scope Hrs 18

Introduction – Scope of Toxicology. Disciplines of Toxicology. Goals of Toxicology.

Unit II Toxicological testing methods & classification of toxicants Hrs18

Acute and chronic , Risk and Hazard, Bioassays. Determination of LC50. Pesticides- Types – Uses – Contamination to Environment. Heavy metals. Radioactive substances.

Unit III Route of exposure & persistence of toxicants Hrs 18

Absorption – Distribution – Excretion . Factors affecting toxicity of Xenobiotic chemicals. Fate of Pesticide residues. Fate of heavy metals. Fate of toxicants in the atmosphere

Unit IV Environmental toxicology & effect of xenobiotics Hrs 18

Toxicants in the Environment – Atmosphere- Ozone Depletion- Photochemical smog, Acid rain, Global warming- Hydrosphere- Eutrophication- Lithosphere- Biodegradable wastes. Mechanism of action of Toxicants. Bioaccumulation. Biotransformation and Biomagnifications

Unit V Biomonitoring of toxic chemicals & safety evaluation of toxicants Hrs18

Biological monitoring programme. Bioindicators- microbialsystem, plants, animals and human systems. Risk management- Risk assessment- Creteria for Safety Evaluation. Upper and lower confidence limits – Cumulative toxicity. Calculation of safe level.

References

1. Regulatory Toxicology- Shayne C Gad
2. Goodman and Gilman's : The Pharmcological Basis of Therapeutics, edited by Alfred Goodman Gilman, Theodore W. Rall, Alan S Nies, and Palmar Taylor
3. Clinical Pharmcology by D.R. Laurence and P.N. Benett
4. The toxicologist's pocket handbook, Michael J derelanko 2nd Ed, 2008, CRCpress
5. Relevant OECD, ICH, SCHEDULE Y guidelines
6. Modern Medical Toxicology-VV Pillay, Jaypee Publishers, 4th Ed.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
III		**Core Option – ENDOCRINOLOGY**		

Objectives:

1. To make the students to learn the objectives and scope of comparative Endocrinology.
2. To know the anatomy, morphology and histology of endocrine tissues of vertebrates, crustacean and insect endocrine organs and their functions.

UNIT-I: Introduction to endocrinology **Hrs 18**

Introduction, objectives and scope of endocrinology - modern concepts and problems in Endocrinology - endocrine glands in crustaceans, insects and vertebrates. Experimental methods of hormone research - general classes of chemical messengers.

UNIT-II: Pituitary and thyroid glands **Hrs 18**

Pituitary gland - characteristics, structural organization - hormone secretion and its functions - Hypothalamic control. Thyroid gland - structural organizations, metabolic effects of thryroid - effects on reproduction - parathyroid its structure and functions.

UNIT-III: Pancreas and adrenal glands **Hrs 18**

Structure of pancreas, pancreatic hormones and their functions. Structural organizations of adrenals, functions of cortical and medullary hormones.

UNIT-IV: Insects and crustacean endocrinology **Hrs 18**

Concepts of neurosecretions - endocrine systems in crustaceans - endocrine control of moulting and metamorphosis - neuroendocrine system in insects - endocrine control of moulting - metamorphosis and reproduction.

UNIT-V: Veratebrate reproductive endocrinology **Hrs 18**

Structure of mammalian testis and ovary - male and female sex accessory organs - hormones of testis and ovary - estrous and menstrual cycle - hormones of pregnancy - parturition - hormonal control of lactation. Hormonal control of metamorphosis in an anuran amphibian.

Reference

1. Haris, G.W. and B.T. Donovan. 1968. The Pituitory Gland. S. Chand and Co.,
2. Bentley, P.J. 1985. Comparative vertebrate endocrinology, Second Edition, Cambridge University Press. Cambridge.
3. Mac Hadley. 1992. Endocrinology, 3rd Edition. Prentice - Hall Inc. A Simon & Schuster Company, Englewood Cliffs, New Jersey. USA.
4. Ingleton, P.M. and J.T. Bangara. 1986. Fundamentals of comparative vertebrate endocrinology, Kluwer Academic Publishers. .

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
IV		**Core Option - PHARMACOLOGY**		

Objectives:

1. This subject will provide an opportunity for the student to learn about the drug with regard to classification, pharmacodynamic and pharmacokinetic aspects, adverse effects, uses, dose, route of administration, precautions, contraindications and interaction with other drugs.
2. In this subject, apart from general pharmacology, drugs acting on autonomic nervous system, cardiovascular system, central nervous system, blood and blood forming agents and renal system will be taught. In addition to theoretical knowledge, the basic practical knowledge relevant to therapeutics will be imparted.

UNIT I **Hrs 18**

Drugs acting at Synaptic and neuro effector junctional sites. Autonomic & Somatic nervous systems. . Muscarinic receptor agonists & antagonists. Anticholinesterases. Agents acting at Neuro Muscular Junction and autonomic ganglia.. Sympathomimetic drugs, Catecholamines and Adrenergic antagonists.

UNIT II **Hrs 18**

Drugs acting on the Central Nervous System. Neurotransmission and CNS. Drugs used in the treatment of Anxiety & Psychosis , Depression &Mania , Epilepsy , Migraine , CNS degenerative disorders , Parkinson's Disease and Pain ; Drug addiction,dependence and abuse.

UNIT III **Hrs 18**

Drugs affecting renal and cardiovascular function. Diuretics ,Drugs used in the treatment of Myocardial Ischemia - Hypertension - CHF - Hyperlipidemia - Arrhythmias

UNIT IV **Hrs 18**

Drugs acting on the blood & blood forming organs. a. Hemopoietics & plasma expanders, Anticoagulants, Thrombolytics & antiplatelet drugs.

UNIT V **Hrs 18**

Dermatological pharmacology,Vitamins & Chelating agents Pharmacogenetics: Inter racial and individual variability in drug metabolism.

References

1. Regulatory Toxicology- Shayne C Gad
2. Goodman and Gilman's: The Pharmcological Basis of Therapeutics, edited by Alfred Goodman Gilman, Theodore W. Rall, Alan S Nies, and Palmar Taylor
3. Clinical Pharmcology by D.R. Laurence and P.N. Benett
4. The toxicologist's pocket handbook, Michael J derelanko 2nd Ed, 2008, CRCpress
5. Relevant OECD, ICH, SCHEDULE Y guidelines
6. Modern Medical Toxicology-VV Pillay, Jaypee Publishers, 4th Ed.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
III	**17P3BTEDC**	**Extra Disciplinary Course – Fundamentals of Biotechnology**	**4**	**-**

Objectives:

1. To study the concept and scope of Biotechnology.
2. To Understand r-DNA Technology.
3. To aware the programmes of cell culture, preparations of hormones and vaccines, transgenic animals and human genome project.
4. To study the Bioprocess technology and their applications.
5. To study the Environment Biotechnology and aware the biodiversity and their conservation.

Unit I **Hrs12**

Biotechnology – Introduction and Scope of Biotechnology – Gene Cloning – Hormone production – DNA fingerprinting – Applications – The Future of Biotechnology.

Unit II **Hrs12**

Transgenic animal – mice, fish and its applications. – Transgenic Plants: herbicide resistant plant and insect resistant plant and edible vaccine.

Unit III **Hrs12**

Bioprocess technology – Scope – Fermentor – Aerobic and Anaerobic Fermentation –Bioprocess products: Biofuel , SCP, antibiotics and Fermented food.

Unit IV **Hrs12**

Biopolymer and its Application – Biosensor and its application – Bioleaching – Biomining – Biotechnology in oil recovery – Bioremediation of Xenobiotics – Superbug – its application.

Unit V **Hrs12**

Regulations of Biosafety: possible dangers of GEO, Biohazards of rDNA technology.National and International biosafety guidelines, Primary and secondary containments and implementation.

Reference:

1. Dubey, R.C. – A Text Book of Biotechnology, S. Chand & Co., Ltd, New Delhi, 1996.
2. Gupta, P.K. – Elements of Biotechnology, Rastogi and Co., Meerut, 1994.
3. Kumar, H.F. A text book on Biotechnology, Affiliated East & West Press Pvt., Ltd, N-Delhi.
4. D.Balasubramanian et. al., - Concepts in Biotechnology.
5. Singh, R.S. – Introductory Biotechnology, Central book deport, Allahabad.
6. Primrose, R. – Molecular Biotechnolgoy, ASM Press.
7. Lick, E.R. and Pastenak – J.J. Molecular Biotechnology.
8. Ignachimuthu – Plant biotechnology, Oxford IBH Publishers, New Delhi.
9. Ranga – Fishery Biotechnology.
10. Primrose, R. – Molecular Biotechnology, ASM Press.
11. Purohit – A Text Book of Biotechnology, Agrobions, Jodhpur.

Course Outcome:

- Differentiate the organisms by its cell structure.
- Explain the arrangement of Genes and their intraction.