

Sem.	Course Code	Core I:	Total Marks: 100		Hours / Week	Credits
I	21PBFCT101	Biopolymers	CIA: 50	ESE: 50	5	4

Course Objectives:

1. To provide an overview of the macromolecules those are key to all living system.
2. To develop sufficient knowledge about higher order structures i.e. Polysaccharides, Proteins, Lipids, Nucleic acids and Natural Products.
3. At the end of this course students will be able to obtain a keen knowledge on the characterization of biological macromolecules.

Course Outcomes (CO): On completion of the course, students should be able to

CO 1	Recognize the Biomolecules at structural level	K1 - K4
CO 2	Classify the Biopolymers present in nature.	
CO 3	Distinguish the properties and importance of various Biopolymers.	
CO 4	Compare and contrast the structure and function of Biopolymers and where they are found	
CO 5	Discuss current environmental issues with a focus on the material's impact in relation to the sustainable development objectives set by the community.	

K1: Remember; K2: Understand; K3: Apply; K4: Analyze; K5: Evaluate; K6: Create

Unit - I Polysaccharides

Homoglycans: Occurrence, Structure, Properties and Functions of Starch, Glycogen, Cellulose, Dextrin, Inulin, Chitins, Xylans, Arabinans, Galactans

Heteroglycans: Occurrence, Structure, Properties and Functions of Bacterial cell wall polysaccharides, Glycosaminoglycan, Agar, Alginic acid, Pectins, Deoxy sugars, Blood group substances and Sialic acid. Glycoproteins: Chemistry and Biological applications. Lectins: Structure and functions

Unit - II Proteins

Classification of Proteins: On the basis of solubility and shape, Structure and Biological functions, Isolation, fractionation and purification of proteins.

Primary structure: Peptide Bond, Determination of Amino acid sequence of proteins.

Secondary structure: Weak interactions involved, Pauling and Corey model for fibrous proteins. Collagen triple helix, Super secondary structures, Ramachandran plot.

Tertiary structure: Bonds involved in stabilizing Tertiary structure (Myoglobin).

Quaternary structure: Structure and Biological functions of Hemoglobin.



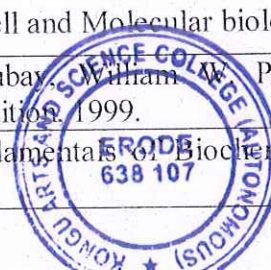
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Unit - III	Lipids
<p>Classification of lipids: Simple lipids & Phospholipids - Structure and functions. Glycolipids & Lipoproteins. Eicosanoids: Structure and functions of Prostaglandin, Thromboxane, Leukotriene. Lipoaminoacids: Animal cells (N- acyl glycine and N-arachidonyl serine) and Bacteria (N-acyl-L-homoserine lactones and N-acyl ornithine). Plant and Animal Steroids: Structure and biological significance. (Stigmasterol, Ergosterol and Cholesterol) Statin drugs: Properties and Functions.</p>	
Unit - IV	Nucleic acids
<p>Secondary structure of DNA: Watson and Crick Model; Forms of DNA; Properties of DNA - Buoyant density, Viscosity, Denaturation and Renaturation; Cot curve analysis and Hypochromic effect Classes of RNA: Structure and biological functions of mRNA, rRNA, tRNA. DNA binding motifs in proteins: Helix Loop Helix (HLH) motif, Zinc finger motif and Leucine zipper motif; DNA-Protein interactions. Techniques of Nucleic acid-Protein complex: Gel retardation assay and DNase I foot printing.</p>	
Unit - V	Natural products
<p>Carbohydrates and derived products: Synthesis, Properties and Biological importance of Drugs containing Glycosides, Tannins, Volatile oils, Terpenoids, Alkaloids and Flavonoids. Chemistry and potential uses of Quinone derivatives Heterocyclic compounds – Definition, synthesis and applications of Porphyrin.</p>	

Skill Development Activities	Max. Marks (10)
e-Content Creation	3
Group Discussion	3
Case study	3
Punctuality	1

TEXT BOOKS	
1	S.C. Rastogi, Cell and Molecular biology, New Age International Publishers, 4 th Edition, 2020
2	Geoffrey L. Zubay, William Parson, Dennis E. Vance, Biochemistry, Mc-Graw Hill Education, 4 th edition, 1999.
3	A.C. Deb, Fundamentals of Biochemistry, New Central Agency, Calcutta, 10 th edition, 2011



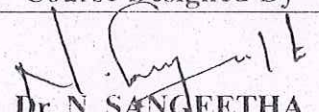
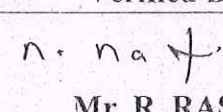
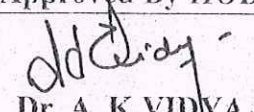
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REFERENCE BOOKS

1	Lehninger, A.L., Nelson, D.L., Cox, M.M., Principles of Biochemistry, W H Freeman Publishers, 7th Edition, 2017.
2	Lubert stryer, Biochemistry, Freeman and company, 9th Edition, 2019
3	Donald Voet, Charlotte W Pratt and Judith G Voet, Fundamentals of Biochemistry, John Wiley & Sons Publisher, 4 th Edition, 2012
4	Reginald H.Garrette & Charles M.Grisham, Biochemistry, Saunders College Publishing Co, 6 th Edition, 2016.
5	Robert N Trigiano, Dennis J Gray, Plant Tissue Culture Concepts and Laboratory Exercises, CRC Press, 2 nd Edition, 1999

WEB RESOURCES

1	https://epgp.inflibnet.ac.in/
2	https://www.chemistrylearner.com/biopolymer.html

Course Designed By	Verified By	Approved By HOD
 Dr. N. SANGEETHA	 Mr. R. RASU	 Dr. A. K. VIDYA

QUESTION PAPER PATTERN

Time: 3 hours		Max. Marks: 50
SECTION-A (10 X 1 = 10 Marks) Answer ALL the questions Choose the correct answer	SECTION-B (5 X 3 = 15 Marks) Answer ALL the questions Either or type Two questions from each unit	SECTION-C (5 X 5 = 25 Marks) Answer ALL questions Question Number: 16 to 19 (Either or type) Question Number 20 is Compulsory - Case Study

Mapping of COs with POs and PSOs:

PO/PSO CO	PO							PSO				
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	S	M	M	M	S	M	M	S	S	S	M	M
CO 2	S	M	M	M	S	M	M	M	M	S	M	S
CO 3	S	M	M	M	M	M	M	S	S	S	M	S
CO 4	S	M	M	M	S	M	M	S	S	S	M	S
CO 5	S	S	S	S	S	S	S	M	S	M	S	S

S - Strong, M - Medium, L - Low



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Sem.	Course Code	Core II - Advanced Bioanalytical Techniques and Bioinformatics	Total Marks: 100		Hours / Week	Credits
I	21PBFCT102		CIA: 50	ESE: 50	5	4

Course Objectives:

1. To have a basic understanding of the theoretical principles involved in Bioinstrumentation
2. To become competent in the basic experimental techniques of biochemistry
3. To gain knowledge on how to acquire information and compare sequence and structure information, search databases and interpret protein structure.

Course Outcomes (CO): On completion of the course, students should be able to

CO 1	Compile the basic principles and applications of analytical techniques	K1 - K4
CO 2	Discuss the different methodologies of biochemical techniques	
CO 3	Illustrate the instrumental set up of various Bioanalytical techniques	
CO 4	Practice the biological databases and Operate various tools in Sequence alignment methods.	
CO 5	Illustrate the methods of Protein prediction and Drug designing.	

K1: Remember; K2: Understand; K3: Apply; K4: Analyze; K5: Evaluate; K6: Create

Unit - I | Chromatography and Electrophoresis

Chromatography: Principle, Instrumentation and Applications of Thin Layer, Ion-exchange, Affinity Chromatography, GLC, HPLC, HPTLC, Flow Cytometry, DNA Microarray.

Electrophoresis: Principle, Techniques and Applications of Agarose Gel Electrophoresis, SDS-PAGE, Isoelectric focusing, Capillary electrophoresis.

Principle and Applications of KASPar assay.

Unit - II | Centrifugation and Spectrophotometer

Preparative Ultracentrifuge: Differential centrifugation and Density gradient centrifugation

Analytical Ultracentrifuge: Instrumental Set-up, applications

Spectrophotometer: Principle, Techniques and Applications of UV-Visible Spectrometer, Flame Photometry, Fluorimeter, Mass Spectrometer and X-ray Diffraction technique.

Principle and Applications of GC-MS and LC-MS.

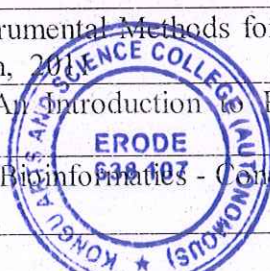


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Unit - III	Cytotoxicity Assays and Radioactivity
<p>Cytotoxicity Assay: Procedure and Applications of Comet and MTT Assay.</p> <p>Radioactivity: Types of radioactive decay - Alpha, Gamma & Beta emission; Principle, Techniques and Applications of GM Counter, Scintillation Counter and Autoradiography. Radiopharmaceuticals. Radioactive and Non-radioactive labeling, Applications of Radioisotopes in Biology.</p>	
Unit - IV	Biological Databases and Sequence Alignment
<p>Bioinformatics: Definition, Objectives, Scope and Applications of Bioinformatics</p> <p>Biological Databases: Primary, Secondary and Composite Databases</p> <p>Sequence Alignment: Local and Global Alignments; Needleman-Wunsch Algorithm and Smith-Waterman Algorithm, Scoring Matrices (PAM and BLOSUM), Similarity Search Tool (FASTA and BLAST), Multiple Sequence Alignment (CLUSTALW) and Phylogenetic Analysis (PHYLIP)</p>	
Unit - V	Protein structure prediction and CADD
<p>Secondary structure prediction: Chou-Fasman Method, Nearest Neighbor method, Neural Network method.</p> <p>Tertiary structure prediction: Ab initio method and threading method.</p> <p>Proteomics: Types; Tools (ExpASY) and Applications of Proteomics</p> <p>Computer Aided Drug Designing: Stages and applications of Molecular docking.</p>	

Skill Development Activities	Max. Marks (10)
Assignment	3
e-Content Creation	3
Case Study	3
Punctuality	1

TEXT BOOKS	
1	P. Asokan, Analytical Biochemistry, China Publications, 3 rd Edition, 2006.
2	A.Upadhyay, K.Upadhyay, N.Nath, Biophysical Chemistry - Principles and Techniques, Himalaya Publishing House Pvt. Ltd, 4 th Edition, 2016.
3	B. K. Sharma, Instrumental Methods for Chemical Analysis, Krishna Prakashan Media Pvt Ltd, 11 th Edition, 2016.
4	D. T. Plummer, An Introduction to Practical Biochemistry, McGraw Hill Education, 3 rd Edition, 2017.
5	S.C. Rastogi <i>et al.</i> , Bioinformatics - Concepts, Skills and Applications, CBS publishers, 1 st Edition, 2003.



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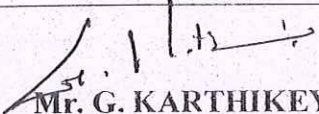

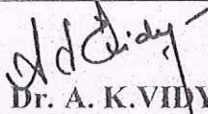
6	K. Mani and N. Vijayaraj. Bioinformatics for Beginners, Kalaikathir Achagam, Coimbatore, 1 st Edition, 2002.
7	Ambika Shanmugam, Fundamentals of Biochemistry for Medical Students, Published by the Author, 7 th edition, 2008

REFERENCE BOOKS

1	Keith Wilson and John Walker. Principles and Techniques of Biochemistry and Molecular Biology, Cambridge University Press, 6 th Edition, 2007.
2	A. Douglas, Skoog, M. Donald West, F. James Holler, Stanley R. Crouch, Fundamentals of Analytical Chemistry, Barkha Nath Printers, 9 th edition, 2008.
3	S. Sundararajan and R. Balaji, Introduction to Bioinformatics, Himalaya publishing house, 1 st Edition, 2002

WEB RESOURCES

1	https://microbenotes.com/category/instrumentation/
2	https://www.onlinebiologynotes.com/electrophoresis-principle-affecting-factors-and-types/
3	https://www.biologydiscussion.com/biodiversity/bioinformatics/notes-on-bioinformatics-genetics/38224

Course Designed By	Verified By	Approved By HOD
 Mr. G. KARTHIKEYAN	 Mrs. T. RADHA	 Dr. A. K. VIDYA

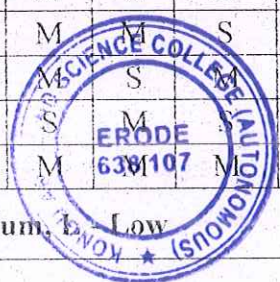
QUESTION PAPER PATTERN

Time: 3 hours	Max. Marks: 50	
SECTION-A (10 X 1 = 10 Marks) Answer ALL the questions Choose the correct answer	SECTION-B (5 X 3 = 15 Marks) Answer ALL the questions Either or type Two questions from each unit	SECTION-C (5 X 5 = 25 Marks) Answer ALL questions Question Number: 16 to 19 (Either or type) Question Number 20 is Compulsory - Case Study

Mapping of COs with POs and PSOs:

PO/PSO CO	PO							PSO				
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	S	M	S	M	S	M	S	S	S	S	M	S
CO 2	S	M	S	M	S	S	S	S	S	S	S	M
CO 3	S	S	S	S	S	M	S	S	S	S	M	S
CO 4	S	S	M	S	M	S	S	S	S	S	S	M
CO 5	S	M	S	M	S	S	S	S	S	S	M	S

S - Strong, M - Medium, L - Low



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Sem.	Course Code	Core III - Advanced Enzymology	Total Marks: 100		Hours / Week	Credits
			CIA: 50	ESE: 50	4	4
I	21PBFCT103					

Course Objectives:

1. To acquaint students with fundamental of enzymes and kinetics of enzyme catalyzed reactions.
2. To provide a comprehensive overview about the principles of enzymology and techniques employed in the utilization of enzymes.
3. To acquire a better understanding on the modern approaches of enzyme technology and their applications.

Course Outcomes (CO): On completion of the course, students should be able to

CO 1	Recall the fundamentals of concepts of enzymes	K1 - K4
CO 2	Identify the active site of enzyme, catalytic reactions	
CO 3	Evaluate the enzyme kinetic mechanisms. Compare the enzyme inhibitors	
CO 4	Describe the methods for production, purification, characterization and immobilization of enzymes.	
CO 5	Illustrate the industrial applications of enzymes	

K1: Remember ; K2: Understand; K3: Apply; K4: Analyze; K5: Evaluate; K6: Create

Unit - I Enzymes

Enzymes: Introduction, Nomenclature and Classification of enzymes, Factors affecting enzyme activity.

Active site: Definition, Salient features and Theories of active site – Lock and Key theory and Induced Fit Theory, Investigations of active site structure - Trapping ES complex, Enzyme modification by treatment with proteases, Enzyme modification by site directed mutagenesis.

Isoenzymes: Lactate Dehydrogenase and Creatine Kinase.

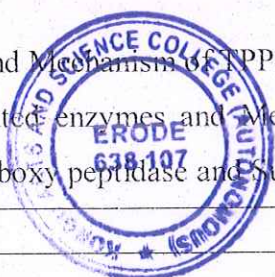
Multi Enzyme Complex: Fatty acid Synthetase complex.

Unit - II Enzyme catalysis, Coenzymes & Cofactors

Enzyme catalysis: Acid-base catalysis and covalent catalysis. Structure and Mechanism of Lysozyme and Chymotrypsin

Coenzymes: Structure and Mechanism of TPP, NAD, FAD, Pyridoxal Phosphate and Coenzyme A.

Cofactors: Metal activated enzymes and Metallo enzymes - Role of metal ions in mechanism of Carbonic anhydrase, Carboxy peptidase and Superoxide dismutase.



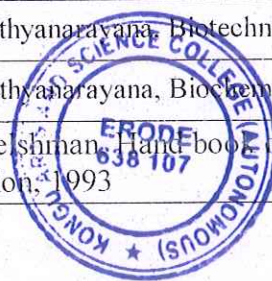
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Unit - III	Enzyme kinetics & Enzyme inhibition
<p>Enzyme kinetics: Michaelis-Menten Equation, Line weaver Burk plot, Eadie - Hofstee plot and Hanes plot.</p> <p>Allosteric enzymes: Definition, Cooperativity, Regulation - Concerted and Sequential Model - Aspartate Transcarbamylase</p> <p>Enzyme inhibition: Types – Difference between the Competitive, Non-competitive and Uncompetitive inhibitions. Ribozyme and Abzyme</p>	
Unit - IV	Applications of enzymes
<p>Industrial applications of enzymes: Extraction and Purification of Amylase and Protease (Bacteria and Fungi).</p> <p>Applications of Enzymes: Enzymes in Brewing, Baking, Meat processing industry. Role of enzymes in Detergent, Leather and Textile Processing.</p> <p>Clinical application of enzymes: Diagnostic and Therapeutic enzymes.</p>	
Unit - V	Immobilization & Biosensors
<p>Enzyme immobilization: Techniques – Adsorption, Cross linking, Covalent bonding, Entrapment and Encapsulation and applications of immobilized enzymes.</p> <p>Biosensors: Principle and applications of Calorimetric, Potentiometric, Optical, biosensors, Immunosensors and Genetic biosensors (For monitoring Plant Stress)</p> <p>Advances in Enzyme Technology: Enzymes in recombinant DNA technology, Protein engineering.</p>	

Skill Development Activities	Max. Marks (10)
Assignment	3
e-Book Review	3
Case Study	3
Punctuality	1

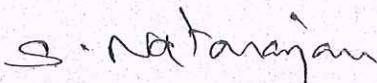
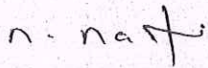
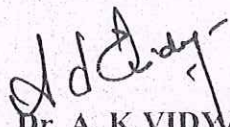
TEXT BOOKS	
1	Palmer, Understanding Enzymes, Printice Hall, 3 rd edition, 1991
2	Trevor Palmer and Philip Bonner, Enzymes, Woodhead publishing, 2 nd Edition, 2007.
3	Dr. U. Sathyanarayana, Biotechnology, Books and allied (P) Ltd, Kolkata, 4 th edition, 2013.
4	Dr. U. Sathyanarayana, Biochemistry, Elsevier Health Sciences, 4 th edition, 2013.
5	Alan Welshman, Hand book of enzyme biotechnology, Cambridge University Press, 2 nd Edition, 1993



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REFERENCE BOOKS	
1	Marangoni, John Wiley. Enzyme Kinetics - A Modern Approach, Wiley Online Library, 1 st Edition, 2002.
2	Chapline. Bucke, Enzyme Technology, Cambridge University Press, 1 st Edition, 1990.
3	Price and Stevens, Fundamentals of enzymology, Oxford University Press, 2 nd edition, 1995
4	Nooralabettu Krishna Prasad, Enzymes technology, PHI Learning Pvt, Kindle Edition, 2011.
5	EE. Conn and PK. Stumpf, G. Bruening and RY. Doi, Outlines of biochemistry, John Wiley and Sons, New York, USA, 5 th edition, 2010

WEB RESOURCES	
1	www.sciencedirect.com
2	www.cheric.org.cybertecture

Course Designed By	Verified By	Approved By HOD
 Mr. S. NATARAJAN	 Mr. R. RASU	 Dr. A. K. VIDYA

QUESTION PAPER PATTERN		
Time: 3 hours	Max. Marks: 50	
SECTION-A (10 X 1 = 10 Marks) Answer ALL the questions Choose the correct answer	SECTION-B (5 X 3 = 15 Marks) Answer ALL the questions Either or type Two questions from each unit	SECTION-C (5 X 5 = 25 Marks) Answer ALL questions Question Number: 16 to 19 (Either or type) Question Number 20 is Compulsory - Case Study

Mapping of COs with POs and PSOs:

PO/PSO CO	PO							PSO				
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	S	M	S	S	S	S	M	S	S	S	M	M
CO 2	S	S	M	S	S	M	S	M	M	S	S	M
CO 3	S	S	S	S	M	S	S	S	S	S	M	S
CO 4	S	S	S	S	M	M	S	S	S	M	S	S
CO 5		M		M	S	M	S	S	S	S	M	S

S - Strong, M - Medium, L - Low



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Sem.	Course Code	Core IV: Cellular Biochemistry	Total Marks: 100		Hours / Week	Credits
I	21PBFCT104		CIA: 50	ESE: 50	4	4

Course Objectives:

1. To develop an understanding of the fundamentals of cell biology.
2. To gain an understanding of the structure and function of living organisms, their life processes and Biochemical basis of motility.
3. To provide a strong basis for membrane and organelle biogenesis, cell-cell interaction, cell-cell signaling, Cancer and cell cycle.

Course Outcomes (CO): On completion of the course, students should be able to

CO 1	Recall the cell types and their organelles	K1 - K4
CO 2	Express the physiological role of cellular components in living system	
CO 3	Illustrate the structure and importance of membrane in a cellular function	
CO 4	Evaluate the various process related to cell cell interaction	
CO 5	Summarize the events of a cell and cell abnormalities.	

K1: Remember ; K2: Understand; K3:Apply; K4:Analyze; K5: Evaluate; K6:Create

Unit - I Membrane bilayer and Proteins

Membrane bilayer: Models – Unit membrane model and Fluid Mosaic model.

Membrane lipids: Fluidity, Asymmetry, Phase transition, Liposomes.

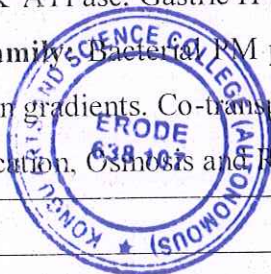
Membrane proteins: Types, Orientation, Mobility - Experiments, Flippases, Proteins of RBC membrane, Bacteriorhodopsin, Porins, Aquaporin. RBC ghosts, Solubilisation of proteins, Lipid anchored proteins.

Unit - II Membrane transport

Membrane transport: Overview, Passive diffusion, Facilitated diffusion in erythrocytes, Carriers and Ion – Channels, Ion concentration gradients, Uniporter catalyzed transport.

Active transport systems: Transport process driven by ATP – Mechanism of Ion Pumps (Calcium ATP ase, Na⁺K⁺ATPase, Gastric H⁺K⁺ATPase). Mechanism that transport peptides and drugs,

ABC super family: Bacterial PM permeases, Mammalian MDR proteins. Transport process driven by light and ion gradients. Co-transport by Symporters and Antiporters, Group translocation, Osmosis and Receptor mediated endocytosis.



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Unit - III	Mitochondria & Cytoskeleton filaments
<p>Mitochondria: Reduction potentials, Electron Transport Chain overview, Complexes:- Q- cycle, Cytochrome C, Cytochrome oxidase complex; Translocation of Protons and the establishment of proton motive force, Machinery for ATP formation- Chemiosmotic mechanism. ATP Synthase Experiments. Inhibitors of Oxidative Phosphorylation, Uncouplers.</p> <p>Cytoskeleton filaments:</p> <p>Microfilaments: Actin and Myosin – Structures, Assembly.</p> <p>Microtubules: Organisation and dynamics, Kinesin and dyenin, Cilia and Flagella - Structure and functions.</p> <p>Intermediary filaments: Types and functions. Striated muscle: Structure, excitation and contraction.</p>	
Unit - IV	Cell-Cell interaction & Signaling
<p>Cell-Cell interaction: ECM, Collagen, Hyaluronan& Proteoglycans and Fibronectins.</p> <p>Cell-Cell adhesion: Specialized junctions -- Desmosomes, Gap junctions, Adhesion molecules - Cadherins and Connexins.</p> <p>Cell-Cell signaling: Signaling molecules and their receptors, Functions of cell surface receptors, Pathways of intracellular signal transduction, Second messengers. G -protein coupled receptors, Receptor tyrosine kinases, Ras, MAP kinases .Signaling Networks.</p>	
Unit - V	Cell cycle and Cancer
<p>Cell Cycle: Overview of cell cycle and its control. General studies with yeasts. Cell cycle control in mammalian cells, Checkpoints in cell - cycle regulation.</p> <p>Apoptosis (Programmed cell death): Pathways, regulators & effectors in apoptosis.</p> <p>Cancer: Properties of tumor cells & Genetic basis and onset of cancer. Tumor viruses - DNA & RNA viruses as transforming agents - Mechanism. Tumor suppressor genes and functions of their products, Carcinogens- Definition, Physical, Chemical and Biological carcinogens, Molecular diagnosis of cancer.</p>	

Skill Development Activities	Max. Marks (10)
Assignment	3
Model Preparation	3
Case Study	3
Practicality	1



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TEXT BOOKS												
1	Ajay Paul, Textbook of Cell and Molecular biology, Books and Allied (P) Ltd, 4 th Edition, 2015											
2	A.C. Deb, Fundamentals of Biochemistry, New Central Agency, Calcutta, 3 rd Edition, 1989.											
3	Veer Bala, Rastogi, Cell biology, MedTech, 1 st Edition, 2021											
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1	Reginald H.Garrette & Charles M.Grisham, Biochemistry, Saunders College Publishing Co, 6 th Edition, 2016.											
2	Lodish, Berk <i>et al.</i> , Molecular cell biology, Freeman and Co, 7 th edition, 2004.											
3	Lodish <i>et al.</i> , Molecular Cell biology, Scientific American Books, Freeman and Co, 5 th edition, 1995.											
4	Alberts <i>et al.</i> , Molecular biology of the cell, Garland Publishers, 4 th edition, 2002											
5	L.Lehninger, D.L.Nelson, M.M.Cox, Principles of Biochemistry, CBS Publishers, 8 th Edition, 2021											
WEB RESOURCES												
1	www.life.uiuc.edu/plantbio/cell											
2	https://epgp.inflibnet.ac.in/											
Course Designed By				Verified By				Approved By HOD				
n. n. r. s. Mr. R. RASU				S. Natarajan Mr. S. NATARAJAN				Dr. A. K. VIDYA				
QUESTION PAPER PATTERN												
Time: 3 hours						Max. Marks: 50						
SECTION-A (10 X 1 = 10 Marks) Answer ALL the questions Choose the correct answer				SECTION-B (5 X 3 = 15 Marks) Answer ALL the questions Either or type Two questions from each unit				SECTION-C (5 X 5 = 25 Marks) Answer ALL questions Question Number: 16 to 19 (Either or type) Question Number 20 is Compulsory - Case Study				
Mapping of COs with POs and PSOs:												
CO \ PO/PSO	PO							PSO				
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	S	M	M	S	M	S	S	S	S	M	S	M
CO 2			S	S	M	M	S	S	S	S	S	M
CO 3	S	M	S	S	S	M	S	S	S	M	M	S
CO 4	M	S	S	S	S	M	S	S	S	M	S	S
CO 5	S	M	S	S	M	M	S	S	S	M	S	M
S - Strong, M - Medium, L - Low												

Sem.	Course Code	Core V: Plant Biochemistry and Biotechnology	Total Marks: 100		Hours / Week	Credits
			CIA: 50	ESE: 50		
I	21PBFCT105				4	3

Course Objectives:

- To provide sufficient knowledge about the various metabolic pathways and its applications in plant productivity.
- To obtain knowledge on production of transgenic plants.
- To become familiar with the exciting topics in plant biology research.

Course Outcomes (CO): On completion of the course, students should be able to

CO 1	Correlate the different types of Carbon reactions in plants	K1 - K4
CO 2	Describe the importance of Biogeo chemical cycles in plants	
CO 3	Evaluate the metabolic architecture of plants	
CO 4	Analyze the advances in plant biotechnology	
CO 5	Plan the applications of plant tissue culture	

K1: Remember ; K2: Understand; K3:Apply; K4:Analyze; K5: Evaluate; K6:Create

Unit - I | Photosynthesis and Electron Transport System

Photosynthesis: Photosynthetic apparatus - Chloroplast. Organization of thylakoid, Photosynthetic pigments - Structure, biosynthesis and functions of Chlorophyll and Carotenoids. Light absorption and energy conservation by pigment molecules.

Electron Transport System: Reaction Centre complex, Photo system(s) I and II, Cyclic and Noncyclic Photophosphorylation. Electron transport pathways in Chloroplast membranes; ATP synthesis in Chloroplasts

Unit - II | Carbon reactions and Metabolic Pathways in plants

Carbon reactions in plants: Calvin Cycle (C3), Hatch-Slack Cycle (C4) and CAM plants. Photorespiration (C2) Cycle and its importance

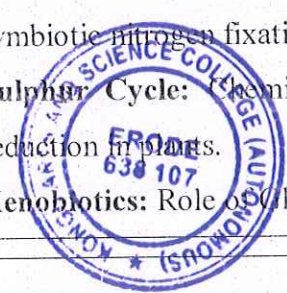
Metabolic Pathways: Pathways of glucose oxidation in plants; Starch biosynthesis and degradation; Overview of lipid and protein metabolism in plants; Phytochrome and its role in flowering of plants; Biochemical changes during Senescence.

Unit - III | Nitrogen Cycle, Sulphur Cycle and Xenobiotics

Nitrogen Cycle: Nitrogen fixation - Enzymology of nitrogen fixation. Symbiotic nitrogen fixation - in legumes by Rhizobia; Nitrate Reduction, Nitrite Reduction and Nitrogen Assimilation. Non-symbiotic nitrogen fixation

Sulphur Cycle: Chemistry and functions, Sulphur uptake and transport, Sulfate activation and reduction in plants.

Xenobiotics: Role of Glutathione during Stress condition.



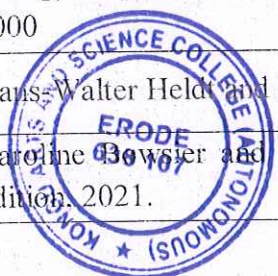
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Unit - IV	Plant Biotechnology
<p>Plant gene: Structure of plant genes. Nuclear and Chloroplast and Mitochondrial genome. Biosynthesis and development of chloroplast.</p> <p>Plant tissue culture: Tissue culture media - MS media - composition and preparation. Callus culture.</p> <p>Micro propagation: Organogenesis and Somatic embryogenesis. Soma clonal variation.</p> <p>Protoplast Technology: Protoplast culture and Protoplast fusion, Identification of Hybrids - Physiological, Biochemical and Molecular markers.</p> <p>Production of Haploid plants: Androgenesis and Gynogenesis.</p>	
Unit - V	Plant Transgenesis
<p>Transgenesis: Gene transfer in plants - Direct gene transfer: Biolistics; Vector mediated transfer - <i>Agrobacterium</i> mediated transformation using Ti and Ri plasmids.</p> <p>Plant viruses as Vectors: CaMV and Gemini viruses.</p> <p>Application of Transgenic plants: Insect resistant (Bt toxin) plants, Virus resistant plants, Herbicide resistant (glyphosate) plants. Germplasm conservation. Genetically engineered plants as Protein factories</p>	

Skill Development Activities	Max. Marks (10)
Assignment	3
e-Content Creation	3
Case Study	3
Punctuality	1

TEXT BOOKS	
1	T.A.Brown, Gene Cloning: An Introduction, Chapman & Hall, 6 th Edition, 2010
2	S. K. Verma, A textbook of Plant Physiology and Biochemistry, S. Chand & Company, 3 rd Revised Edition, 2000.
3	Dr.U.Satyanarayana, Biotechnology, Books and Allied (P) Ltd, 12 th Edition, 2020.
REFERENCE BOOKS	
1	Bob B. Buchanan, Wilhelm Gruissem & Russell L. Jones, Biochemistry and Molecular biology of plants, American Society of Plant Physiologists, Maryland, Rockville, 3 rd Edition, 2000
2	Hans-Walter Heldt and Fiona Heldt, Plant Biochemistry, Elsevier, 3 rd Edition, 2005
3	Caroline Bowler and Alyson Tobin, Plant biochemistry, Taylor & Francis Publications. 2 nd edition, 2021.



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4	Primrose et al. Principles of gene manipulation, Blackwell Scientific Publishers, 6 th edition, 2001
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WEB RESOURCES

1	http://www.brainkart.com/subject/Plant-Biochemistry_257/
2	http://ecoursesonline.iasri.res.in/course/view.php?id=140

Course Designed By	Verified By	Approved By HOD
Mrs. T. RADHA <i>Radha</i>	Mr. R. RASU <i>n. rasu</i>	Dr. A. K. VIDYA <i>Dr. A. K. Vidya</i>

QUESTION PAPER PATTERN

Time: 3 hours	Max. Marks: 50	
SECTION-A (10 X 1 = 10 Marks) Answer ALL the questions Choose the correct answer	SECTION-B (5 X 3 = 15 Marks) Answer ALL the questions Either or type Two questions from each unit	SECTION-C (5 X 5 = 25 Marks) Answer ALL questions Question Number: 16 to 19 (Either or type) Question Number 20 is Compulsory - Case Study

Mapping of COs with POs and PSOs:

PO/PSO CO	PO							PSO				
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	S	M	S	M	S	M	S	S	S	S	M	S
CO 2	S	M	M	S	M	S	S	S	S	S	S	M
CO 3	S	M	S	M	S	M	S	S	S	S	M	S
CO 4	S	S	M	S	M	S	S	S	S	S	S	M
CO 5	S	M	M	M	S	S	S	S	S	S	M	S

S - Strong, M - Medium, L - Low



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Sem.	Course Code	Core Biochemistry Practicals - I	Total Marks: 100		Hours / Week	Credits
			CIA: 50	ESE:50		
I	21PBFCP106				4	3

Course Objectives:

- Develop skills to prepare standard chemical solutions and secondary standards.
- To get practical experience in analyzing the metabolites from different sources
- To gain hands on experience in chromatography and data retrieval from various databases

Course Outcomes (CO): On completion of the course, students should be able to

CO 1	Acquire practical training to handle the instruments like colorimeter, spectrophotometer and to use them for biochemical determinations.	K1 - K4
CO 2	Obtain hands-on training in basic separation techniques in biochemistry	
CO 3	Develop competence in handling various chromatographic techniques and apply them in separation of different biological molecules.	
CO 4	Gain expertise to determine the bioactive contents from various sources	
CO 5	Learn basic bioinformatics tools such as retrieving structures, sequences, aligning the sequences, structure prediction etc.,	

K1: Remember ; K2: Understand; K3: Apply; K4: Analyze; K5: Evaluate; K6: Create**Unit - I | Biochemical Calculations**

Preparation of Molar solutions, Normal solutions and Percentage solutions [v/v,w/v].
Dilution factor calculations.

Unit - II | Colorimetric experiments

1. Isolation and estimation of Starch from Potato
2. Estimation of Fructose in Fruits

Unit - III | Colorimetric experiments

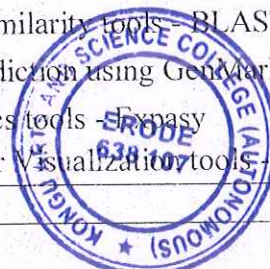
3. Estimation of Lactose from Milk
4. Isolation and estimation of Ascorbic acid from Fruit
5. Estimation of Protein by Lowry Method


Unit - IV | Separation techniques

1. Separation of Amino acids by Paper Chromatography – Circular and Ascending
2. Separation of Lipids by Thin Layer Chromatography
3. Separation of plant pigments by Column Chromatography

Unit - V | Bioinformatics

1. Sequence and Structural Database -NCBI, EMBL, DDBJ, PDB
2. Search Similarity tools - BLAST and Clustal W
3. Gene Prediction using GeneMark and GenScan
4. Proteomics tools - ProMass
5. Molecular Visualization tools - Rasmol, Spdbv



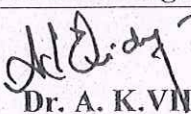
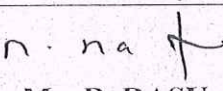
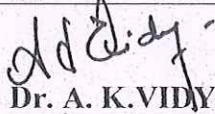

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REFERENCE BOOKS

1	D. T. Plummer. An Introduction to Practical Biochemistry, McGraw-Hill Book Company. 3 rd Edition, 2006.
2	S. Sadasivsam. A. Manickam, Biochemical methods, New Age International publishers, 3 rd edition, 2016
3	T.N.Pattabiraman. Laboratory Manual & Practical Biochemistry, All India Publishers & Distributors; 4 th Edition, 2015
4	K.Mani and N.Vijayaraj, Bioinformatics for Beginners, Kalaikathir Achagam, Coimbatore, 1 st Edition, 2002.

WEB RESOURCES

1	https://biocyclopedia.com/index/plant_protocols/carbohydrates/determination_of_fructose_and_inulin.php
2	http://www.lfp.cuni.cz/biochemie/en/pages/vyuka/materialy/Chromatography.pdf

Course Designed By	Verified By	Approved By HOD
 Dr. A. K. VIDYA	 Mr. R. RASU	 Dr. A. K. VIDYA

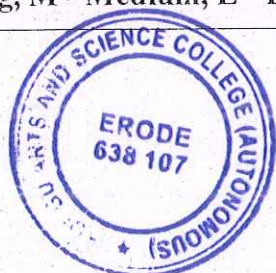
QUESTION PAPER PATTERN


Major Experiment	Minor Experiment	Spotters	Viva Voce	Record
20	10	10	5	5

Mapping of COs with POs and PSOs:

CO \ PO/PSO	PO							PSO				
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	S	M	S	M	S	M	S	S	S	S	M	S
CO 2	S	M	M	S	S	S	S	S	S	S	S	S
CO 3	S	M	S	M	S	M	S	S	S	S	M	S
CO 4	S	S	M	S	S	S	S	S	S	S	S	S
CO 5	S	M	M	M	S	S	S	S	S	S	M	S

S - Strong, M - Medium, L - Low




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Sem.	Course Code	Elective I: Animal Biotechnology and Nanotechnology	Total Marks: 50		Hours / Week	Credits
			CIA: 50	ESE: 50		
I	21PBFET107				4	4

Course Objectives:

1. To understand the components of culture media and various tissue culture techniques
2. To enable the students to have a sound knowledge on advantages of transgenesis
3. To synthesize and characterize nanomaterials using natural sources

Course Outcomes (CO): On completion of the course, students should be able to

CO 1	Outline the basic principles of Animal cell culture.	K1 - K4
CO 2	Discuss the properties of various types of animal cell cultures	
CO 3	Investigate the concepts of transgenic animals production	
CO 4	Discriminate the properties and synthesis of Nanomaterials.	
CO 5	Investigate the characterization and applications of Nanomaterials.	

K1: Remember; K2: Understand; K3: Apply; K4: Analyze; K5: Evaluate; K6: Create

Unit - I Animal Cell Culture Media

Animal Cell Culture: Facilities for animal cell culture - Infrastructure, equipment, Cell sources and cell types required for Animal cell culture.

Culture media: Physico-Chemical properties of culture media. Complete culture media- EMEM and RPMI, Balanced Salt Solution, Composition of Earle's BSS and Hank's BSS.

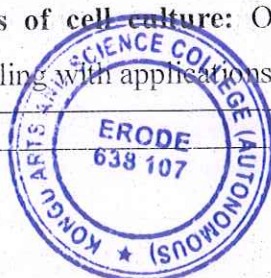
Natural media:- Serum and Tissue extracts. Serum free media- Advantages and Disadvantages. Sterilization of media.

Unit - II Types of Culture

Biology of cultured cells: Cell adhesion, Cell Proliferation, Cell differentiation, Metabolism of cultured cells. Measurement of growth parameters of cultured cells. Cell synchronization. Apoptosis and its measurement.

Primary cell culture: Mechanical and Enzymatic method. Cell line- Finite and Continuous cell line. Subculture

Types of cell culture: Organ culture, Three dimensional culture. Tissue engineering and Tissue modeling with applications.

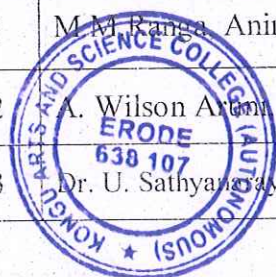


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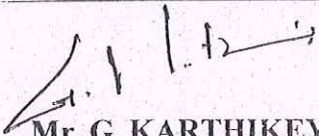
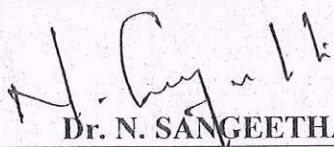
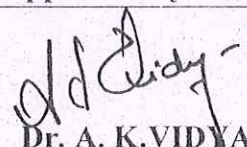
Unit - III	Transgenesis
<p>Embryo Culture: An overview of collection and preservation of embryos - IVF and Embryo transfer.</p> <p>Transgenic animals: Methods - Microinjection method and Embryonic Stem cell method.</p> <p>Transgenesis in Large animals: Transgenic Cattle, Transgenic Sheep, Goat and Chicken</p>	
Unit - IV	Nanotechnology
<p>Nanotechnology: Basics of Nano science and Nano scale.</p> <p>Classification of Nanomaterials: Quantum Dots, Synthesis, Properties and applications of Carbon nanotubes</p> <p>Metal based nanomaterials: Preparation and applications of Nano gold, Nano silver and Silica metal oxide.</p> <p>Properties of Nanostructured materials: Size and Shape dependent properties, Thermal Property, Magnetism, Conductivity and Band Gap.</p> <p>Synthesis of Nanomaterials: CVD, Sol-Gel processing, Biological method - use of Plant extracts, Bacteria and Fungi.</p>	
Unit - V	Characterization and Applications of Nanomaterials
<p>Characterization of Nano phase materials: Principle and Working of Scanning Electron Microscopy, Transmission Electron Microscopy, Scanning Tunneling Microscopy and Atomic Force Microscopy</p> <p>Applications of Nanotechnology: In Medicine, Textile, Cosmetics, Food & Agriculture.</p> <p>Nano remediation: Environmental Cleanup technologies.</p>	

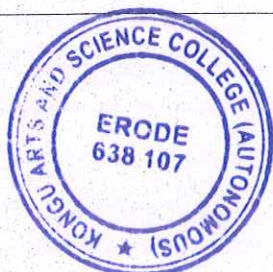
Skill Development Activities	Max. Marks (10)
Journals Review	3
e-Content Creation	3
Case Study	3
Punctuality	1


TEXT BOOKS	
1	M.M.Ranga, Animal Biotechnology, AgroBios, 2 nd edition, 1993.
2	A. Wilson Arora, P.Ramadass, Animal Tissue Culture, MJP Publishers, 1 st Edition, 2011.
3	Dr. U. Sathyavayana, Biotechnology, Books and allied (P) Ltd, Kolkata, 4 th Edition, 2013.



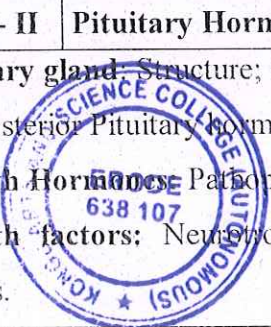
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4	B.S.Murty, P. Shankar, B.Raj, B.B.Rath, Murday, Textbook of Nanoscience and Nanotechnology. Universities Press Pvt Ltd, 1 st Edition, 2013											
REFERENCE BOOKS												
1	T.Pradeep, Nano: The Essentials: Understanding Nanoscience and Nanotechnology, McGraw Hill Education, 1 st Edition, 2017											
2	R. Ian Freshney, Culture of Animal cells-A Manual of Basic technique, A John Wiley & Sons.Inc Publications, 4 th Edition, 2000.											
WEB RESOURCES												
1	https://www.notesonzooology.com/animal-cell-culture/animal-cell-and-cell-culture-notes-introduction-substrates-isolation-types-and-techniques/13503											
2	https://microbeonline.com/animal-cell-culture-introduction-types-methods-applications/											
3	https://www.vedantu.com/biology/transgenic-animals											
Course Designed By				Verified By				Approved By HOD				
 Mr. G. KARTHIKEYAN				 Dr. N. SANGEETHA				 Dr. A. K. VIDYA				
QUESTION PAPER PATTERN												
Time: 3 hours						Max. Marks: 50						
SECTION-A (10 X 1 = 10 Marks) Answer ALL the questions Choose the correct answer				SECTION-B (5 X 3 = 15 Marks) Answer ALL the questions Either or type Two questions from each unit				SECTION-C (5 X 5 = 25 Marks) Answer ALL questions Question Number: 16 to 19 (Either or type) Question Number 20 is Compulsory - Case Study				
Mapping of COs with POs and PSOs:												
PO/PSO CO	PO							PSO				
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	S	M	S	M	S	M	S	S	S	S	M	S
CO 2	S	M	M	S	M	S	S	S	S	S	S	M
CO 3	S	M	S	M	S	M	S	S	S	S	M	S
CO 4	S	S	M	S	M	S	S	S	S	S	S	M
CO 5	S	M	M	M	S	S	S	S	S	S	M	S
S - Strong, M - Medium, L - Low												




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Sem.	Course Code	Core VI - Endocrinology	Total Marks: 100		Hours / Week	Credits
II	21PBFCT201		CIA: 50	ESE: 50	5	4
Course Objectives:						
<ol style="list-style-type: none"> To provide the students with a basic knowledge of the complex endocrine system To provide wide range of information related to Pituitary, Thyroid, Pineal, Pancreatic, Adrenal and gonadal hormones and various disorders related to each hormones. To learn about the mechanism of action of various hormones with its effect on human due to their hypo and hyper secretion. 						
Course Outcomes (CO): On completion of the course, students should be able to						
CO 1	Enumerate the classification of hormones, understand the mechanism of action					K1 - K4
CO 2	Explain how the secretion of hormones are regulated, including the principles of negative and positive feedback mechanisms					
CO 3	Categorize the physiological role of hormones such as Pituitary, Thyroid, Pancreas, Adrenal hormones.					
CO 4	Illustrate the structure and chemical nature of hormones					
CO 5	Assess the consequences of under and over production of hormones.					
K1: Remember; K2: Understand; K3: Apply; K4: Analyze; K5: Evaluate; K6: Create						
Unit - I Hormones - Classification and Regulation						
<p>Hormones: Introduction, Hormones and Homeostasis, Neuroendocrine integration in homeostasis.</p> <p>Classification of Hormones: Based on Chemical nature and Mechanism of action - Group I hormones (Action of steroid hormones) and Group II hormones.</p> <p>Secondary messengers: cAMP</p> <p>Feedback Regulation of hormone action: Positive and Negative Regulation.</p> <p>Eicosanoids and Hormone action</p>						
Unit - II Pituitary Hormones & Growth factors						
<p>Pituitary gland: Structure; mechanism, functions and pathophysiology of Anterior Pituitary hormones and Posterior Pituitary hormones. Control of hypothalamic secretion</p> <p>Growth Hormones: Pathophysiology - Gigantism and Dwarfism.</p> <p>Growth factors: Neurotropic growth factors, Hematopoietic growth factors, Endothelial growth factors.</p>						

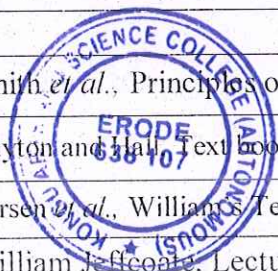



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Unit - III	Hormones of Thyroid, Parathyroid and Pineal gland
<p>Thyroid gland: Structure, Synthesis, Physiological role, Mechanism of Action and regulation of Thyroid hormones. Pathophysiology - Goiter, Thyrotoxicosis, Cretinism and Myxedema.</p> <p>Parathyroid gland: Structure and Synthesis of Parathyroid hormones.</p> <p>Physiological role of Vitamin D, Calcitonin and Calmodulin; Mechanism of action of Calcium homeostasis; Pathophysiology - Hyper and Hyperparathyroidism</p> <p>Pineal gland: Secretion and circulation of Melatonin, proposed role of pineal gland.</p>	
Unit - IV	Hormones of Pancreas, Adrenal medullary and Adrenocortical
<p>Endocrine Pancreas: Insulin, Glucagon and Somatostatin – Chemistry, Physiological role, Mechanism of action and Pathophysiology - Diabetes Mellitus.</p> <p>Adrenal medullary hormones: Chemistry, Synthesis and Metabolism of Epinephrine and Norepinephrine.</p> <p>Adrenocortical hormones: Glucocorticoids (Aldosterone) and Mineralocorticoids (Cortisol) - Chemistry, Synthesis, Metabolism and Pathophysiology.</p>	
Unit - V	Reproductive Endocrinology
<p>Male Reproductive system: Source, chemistry, synthesis, metabolism, physiological role and mechanism of action of Androgen (Testosterone).</p> <p>Female reproductive system: Synthesis, physiological role and mechanism of action of ovarian steroid hormone (Estrogen and Progesterone).</p> <p>Biochemical changes during Pregnancy, Parturition and lactation.</p> <p>Human Infertility: Causes and Treatment</p>	

Skill Development Activities	Max. Marks (10)
e-Content Development	3
Group Discussion	3
Case Study	3
Punctuality	1

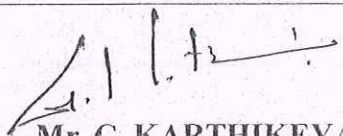
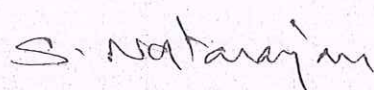
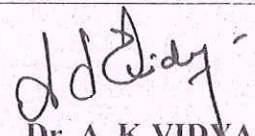
TEXT BOOKS	
1	Smith <i>et al.</i> , Principles of Biochemistry, McGraw Hill, 3 rd Edition 2000
2	Guyton and Hall, Text book of Medical Physiology, Saunders Publishing Co, 12 th Edition, 2006
3	Larsen <i>et al.</i> , Williams Textbook of Endocrinology, Saunders Publishing Co, 10 th Edition, 2003.
4	William Jefferson, Lecture Notes on Endocrinology, Blackwell Scientific Publications, 5 th Edition, 1993.



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REFERENCE BOOKS	
1	M.E.Hadley, Endocrinology, Prentice Hall International, 5 th Edition, 2000.
2	P.S.Lohar, Endocrinology - Hormones and Human health, MJP Publishers, 1 st Edition, 2005.
3	S.Nagini, Textbook of Biochemistry: Molecular and Clinical Aspects, Scitech Publication, 2002

WEB RESOURCES	
1	www.endocrinology.org
2	www.endocrineweb.com

Course Designed By	Verified By	Approved By HOD
 Mr. G. KARTHIKEYAN	 Mr. S. NATARAJAN	 Dr. A. K. VIDYA


QUESTION PAPER PATTERN		
Time: 3 hours	Max. Marks: 50	
SECTION-A (10 X 1 = 10 Marks) Answer ALL the questions Choose the correct answer	SECTION-B (5 X 3 = 15 Marks) Answer ALL the questions Either or type Two questions from each unit	SECTION-C (5 X 5 = 25 Marks) Answer ALL questions Question Number: 16 to 19 (Either or type) Question Number 20 is Compulsory - Case Study

Mapping of COs with POs and PSOs:

PO/PSO CO	PO							PSO				
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	S	M	M	M	S	M	S	S	S	S	M	M
CO 2	S	M	S	M	S	M	S	S	M	M	M	S
CO 3	S	M	S	M	S	M	S	M	S	S	M	S
CO 4	S	S	M	M	M	M	S	M	S	S	S	M
CO 5	S	S	S	M	S	S	S	S	S	S	S	M

S - Strong, M - Medium, L - Low




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Sem.	Course Code	Core VII - Immunology and Immunotechniques	Total Marks: 100		Hours / Week	Credits
			CIA: 50	ESE: 50	5	4

Course Objectives:

1. To provide a clear understanding of the molecular and cellular components that comprise the immune system, including their function and interaction.
2. To enable students to learn diseases caused by disorders of the immune system (failure, aberrant action, and malignant growth of the cellular elements of the system).
3. To gain an insight on the latest methods of detecting disease causing pathogens, its treatment using novel vaccines.

Course Outcomes (CO): On completion of the course, students should be able to

CO 1	Locate the components of the immune system and how cells and organs play an important role in the immune responses.	K1 - K4
CO 2	Illustrate the structure and mechanism of action of different immune components and their resultant reaction responses.	
CO 3	Compare the principle and applications of various immuno techniques ranging from precipitation and agglutination reactions to ELISA, Radio immunoassay and flow cytometry.	
CO 4	Complete knowledge of the molecular mechanisms and kinetics of the immune responses, both humoral and cell mediated immunity.	
CO 5	The course will aid in understanding abnormal manifestations of the immune response in the form of Hypersensitive reactions, the mechanisms of transplantation of the various organs the principles of Graft rejection, Autoimmunity, Knowledge of pathogenesis of diseases and designing of immunology based interventions for effective treatment like Antibody based therapy.	

K1: Remember; K2: Understand; K3: Apply; K4: Analyze; K5: Evaluate; K6: Create

Unit - I | Cells and Organs of Immune system

Immunity: Innate and Adaptive immunity. Hematopoiesis

Immune cells: Structure, properties and functions of the T and B - lymphocytes, NK cells, Monocytes and Macrophages, Dendritic cells, Neutrophils, Eosinophil, and Basophils.

Lymphoid organs: Primary and Secondary lymphoid organs (Bursa, Thymus, Bone marrow, Lymph nodes, Spleen, MALT, GALT and CALT).

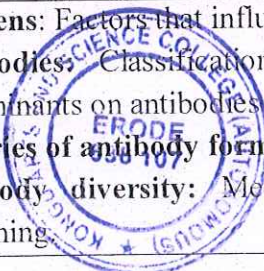
Unit - II | Antigens and Antibodies

Antigens: Factors that influence Immunogenicity, Haptens, B and T cells epitopes.

Antibodies: Classification, Structure, Function and Properties of the antibodies: Antigenic determinants on antibodies (isotype, allotype and idio type); Immunoglobulin Superfamily

Theories of antibody formation: Side chain and Clonal selection theory, Sars-Covid2 Spike Protein.

Antibody diversity: Mechanisms contributing to diversity - Somatic Recombination, Class Switching.

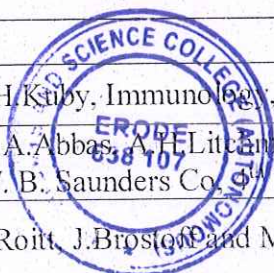


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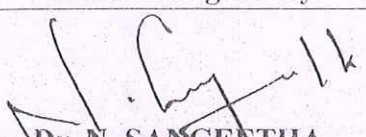
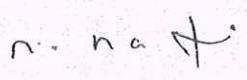
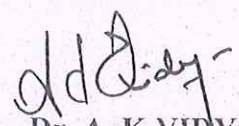
Unit - III	Vaccines and Techniques of Antigen-Antibody Interactions
<p>Vaccines: Subunit vaccines, Attenuated organisms, Recombinant vaccines, DNA vaccines, Synthetic peptide vaccines, Antidiotypic vaccines.</p> <p>Immunological techniques: Affinity and Avidity, Cross reactivity, Precipitation, Agglutination, Principle and Applications of Immunodiffusion, Rocket immuno electrophoresis, ELISA, RIA.</p> <p>Hybridoma technology: Techniques and applications of Monoclonal Antibodies.</p> <p>Experimental Animal models: SCID mice, Knockout mice and Nude mice.</p>	
Unit - IV	MHC, Cell and Antibody mediated immunity and Complement
<p>Major histocompatibility gene complex: Types - Structure and Functions, Structure and cellular distribution of HLA antigens.</p> <p>Cell mediated immunity: Cell types (CTLs, NK cells, macrophages and TDTH cells), Effector mechanisms and Effector molecules of cell mediated reactions.</p> <p>Cytokines: Interleukins and Interferons (outline only).</p> <p>Complement system: Components of the complement activation, Pathways - Classical, Alternative and Lectin pathways. Biological consequences of complement activation and complement deficiencies</p>	
Unit - V	Hypersensitivity, Autoimmunity and Transplantation immunology
<p>Hypersensitivity: mechanism of types I, II, III and IV Hypersensitivity reactions.</p> <p>Autoimmune diseases: Definition, Mechanisms of induction of organ specific (Myasthenia Grave's disease and IDDM) and systemic diseases (Rheumatoid arthritis and SLE).</p> <p>Transplantation immunology: Graft – Definition, Types, Immunologic basis of graft rejection, Properties and types of rejection, Tissue typing, Immunosuppressive therapy.</p> <p>Tumor Immunology: Types of tumors, Tumor antigens, Immune response to tumors, Cancer Immunotherapy (Cytokine Therapy and Monoclonal Antibody Therapy)</p> <p>Diseases weakening immune system: AIDS – Structure of HIV, HIV Transmission and Infection of target cells, Diagnosis and Treatment. An overview on signs and symptoms of Dengue, Swine flu, Sars Covid.</p>	

Skill Development Activities	Max. Marks (10)
Assignment	3
Journal Review	3
Case Study	3
Punctuality	1


TEXT BOOKS	
1	J.H.Kuby, Immunology, W. H. Freeman Publication, 6 th Edition, 2007
2	K.A.Abbas, A.L.Littman and J.S.Pober, Cellular and Molecular Immunology, W. B. Saunders Co., 6 th Edition, 2007.
3	I.Roitt, J.Brostoff and M.David, Immunology, Mos by publisher



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REFERENCE BOOKS													
1	R.I.Tizard. Immunology. Saunders college publishing, 4 th Edition, 2007.												
2	Ivon Roitt. Essential Immunology. Blackwell Publishing, 11 th edition. 2006.												
WEB RESOURCES													
1	https://csmb.co.uk												
2	https://www.roitt.com												
Course Designed By				Verified By				Approved By HOD					
 Dr. N. SANGENTHA				 Mr. R. RASU				 Dr. A. K. VIDYA					
QUESTION PAPER PATTERN													
Time: 3 hours						Max. Marks: 50							
SECTION-A (10 X 1 = 10 Marks) Answer ALL the questions Choose the correct answer				SECTION-B (5 X 3 = 15 Marks) Answer ALL the questions Either or type Two questions from each unit				SECTION-C (5 X 5 = 25 Marks) Answer ALL questions Question Number: 16 to 19 (Either or type) Question Number 20 is Compulsory - Case Study					
Mapping of COs with POs and PSOs:													
CO	PO								PSO				
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	
CO 1	S	M	M	S	S	M	S	S	S	S	M	M	
CO 2	S	M	M	S	S	M	S	S	S	S	M	M	
CO 3	S	S	M	S	M	M	M	S	S	S	S	M	
CO 4	S	M	M	M	S	M	S	S	S	S	S	S	
CO 5	S	S	S	S	S	S	M	S	S	S	M	M	
S - Strong, M - Medium, L - Low													




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Sem.	Course Code	Core VIII - Molecular Biology and Molecular Genetics	Total Marks: 100		Hours / Week	Credits
			CIA: 50	ESE: 50		
II	21PBFCT203				5	4

Course Objectives:

1. To enlighten the basic principles of genetics and the roles of genes and inheritance.
2. To understand the gene structure, replication, transcription, translation, recombination, mutation and DNA repair.
3. To become familiar with the diagnostic molecular biology.

Course Outcomes (CO): On completion of the course, students should be able to

CO 1	Analyze the molecular organization of genes	K1 - K4
CO 2	Evaluate the mechanism of DNA repair and DNA replication.	
CO 3	Distinguish the importance of enzymes in transcription process.	
CO 4	Compute the strategies of synthesis and translocation of proteins.	
CO 5	Explain the basic principles of transmission genetics.	

K1: Remember ; K2: Understand; K3: Apply; K4: Analyze; K5: Evaluate; K6: Create

Unit - I Organization of Chromosomes

Molecular structure of Genes and Chromosomes: Molecular definition of gene, chromosomal organization of genes and non-coding DNA - Protein coding genes and tandemly repeated genes.

DNA sequence Polymorphism: Single Nucleotide Polymorphism.

Transposons: Bacterial transposons and retroviral transposons.

Structural organization of Eukaryotic chromosomes; Functional elements of Eukaryotic chromosomes;

Epigenetics - Fundamentals only

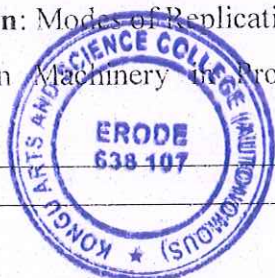
Unit - II DNA - Mutation, Repair & Replication

Mutation – Definition, Types.

DNA Damage and DNA Repair: Types - Excision repair, Mismatch Repair, Photo reactivation Repair and SOS Repair.

DNA Replication: Modes of Replication - Semiconservative mechanism;

DNA replication Machinery in Prokaryotes and Eukaryotes. Role of Topoisomerase in DNA Replication



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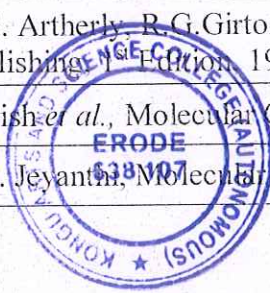
Unit - III	Transcription
<p>Prokaryotic Transcription: Initiation, Elongation and Termination.</p> <p>Operon Model: Lac operon and Trp operon.</p> <p>Eukaryotic Gene Control: Regulatory sequences in protein coding genes – TATA box, Promoter proximal elements, distant enhancer sites.</p> <p>Eukaryotic RNA Polymerases: I, II & III.</p> <p>Post-transcriptional modification: Processing of Eukaryotic pre-mRNA, rRNA and tRNA.</p>	
Unit - IV	Translation & Recombination
<p>Translation: Activation of amino acids, Initiation, Elongation and Termination.</p> <p>Genetic Code: Salient features and Wobble Hypothesis.</p> <p>Protein Sorting and Targeting of Mitochondria and Chloroplast proteins; Translocation of Secretory products across ER membrane; Post-translational Modification of Proteins; Protein glycosylation in ER and Golgi complex.</p> <p>DNA Recombination: Holliday Model of Recombination.</p>	
Unit - V	Transmission Genetics
<p>Transmission Genetics: Mendelian Analysis of Inheritance.</p> <p>Terms in Genetics: Genes, Chromosomes, Alleles, Homozygous, Heterozygous, Dominance and Recessive. Law of Dominance, Back cross and Test cross.</p> <p>Mendel's law: Law of Segregation and Law of Independent Assortment.</p> <p>Linkage: Definition and Types. Salient features of Autosomal Dominance, Autosomal Co-dominance and Autosomal Recessive, X-linked Recessive and Y-linked characters.</p>	

Skill Development Activities	Max. Marks (10)
Model Presentation	3
e-content creation	3
Case Study	3
Punctuality	1

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TEXT BOOKS	
1	A.G. Artherly, R.G.Girton, J.F.McDonald, The Science of Genetics, Saunders Publishing Co. Edition, 1999.
2	Lodish <i>et al.</i> , Molecular Cell Biology, W.H. Freeman and Company, 4 th Edition, 2000.
3	G.P. Jeyanthi, Molecular Biology, MJP Publishers, 1 st Edition, 2009.

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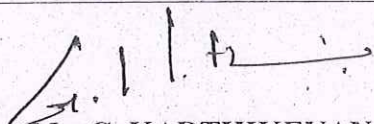
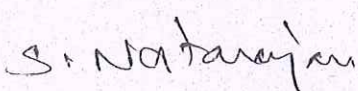
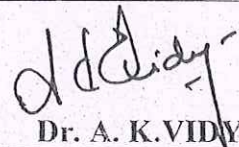


REFERENCE BOOKS

1	Twyman. Advanced Molecular Biology. Viva publication. 2 nd Edition, 1998.
2	Lewin. Genes VIII, Prentice Hall International, 8 th Edition, 2004.
3	Alberts <i>et al.</i> , Molecular Biology of the cell, Garland Science Publications, 4 th Edition, 2002.
4	Watson, Molecular Biology of the gene. Pearson Education, 5 th Edition, 2004.

WEB RESOURCES

1	https://byjus.com/biology/dna-replication-machinery-enzymes/
2	https://byjus.com/biology/genetics/
3	http://www1.biologie.uni-hamburg.de/b-online/library/biology107/bi107vc/fa99/terry/RNAprot.html

Course Designed By	Verified By	Approved By HOD
 Mr. G. KARTHIKEYAN	 Mr. S. NATARAJAN	 Dr. A. K. VIDYA

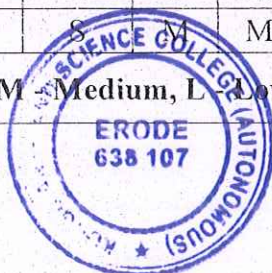
QUESTION PAPER PATTERN

Time: 3 hours		Max. Marks: 50
SECTION-A (10 X 1 = 10 Marks) Answer ALL the questions Choose the correct answer	SECTION-B (5 X 3 = 15 Marks) Answer ALL the questions Either or type Two questions from each unit	SECTION-C (5 X 5 = 25 Marks) Answer ALL questions Question Number: 16 to 19 (Either or type) Question Number 20 is Compulsory - Case Study

Mapping of COs with POs and PSOs:

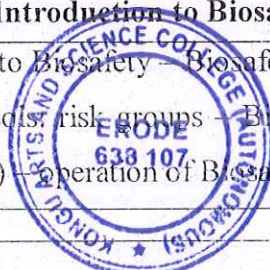
PO/PSO CO	PO							PSO				
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	S	M	S	M	S	M	S	S	S	S	M	S
CO 2	S	M	M	S	S	S	S	S	S	S	S	S
CO 3	S	M	S	M	S	M	S	S	S	S	M	S
CO 4	S	S	M	S	S	S	S	S	S	S	S	S
CO 5	S	M	M	M	S	S	S	S	S	S	M	S

S - Strong, M - Medium, L - Low



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Sem.	Course Code	Core IX - Bioethics, Biosafety, TQM & IPR	Total Marks: 100		Hours / Week	Credits
			CIA: 50	ESE: 50		
II	21PBFCT204				5	3
Course Objectives:						
To provide basic concepts and importance of biodiversity, bioethics and biosafety, TQM and IPR						
Course Outcomes (CO): On completion of the course, students should be able to						
CO 1	Describe the concepts of Biodiversity in India and global level					K1 - K4
CO 2	Describe the Biosafety levels of microbes, plants and animals					
CO 3	Demonstrate Ethics and Ethical issues in GMO's					
CO 4	Understand the Trade Quality Management					
CO 5	Illustrate the concepts of IPR					
K1: Remember ; K2: Understand; K3: Apply; K4: Analyze; K5: Evaluate; K6: Create						
Unit - I	Biodiversity					
Biodiversity: Introduction, levels, values, loss of biodiversity. Species concept - Classification and systematics: biological nomenclature – biological classification;						
Biodiversity conservation: in situ and ex situ - Magnitude and distribution of biodiversity - wild life biology – conservation strategies – measures of biodiversity – biodiversity in India and global level – biodiversity hot spots.						
Unit - II	Introduction to ethics/bioethics					
Introduction to ethics/bioethics: Framework for ethical decision making; biotechnology and ethics – benefits and risks – genetic engineering and bio warfare.						
Ethical implications of cloning: Reproductive cloning, therapeutic cloning; Ethical, legal and socio-economic aspects of gene therapy						
GM crops and GMO's: biotechnology and bio piracy – ELSI of human genome project.						
Unit - III	Introduction to Biosafety					
Introduction to Biosafety – Biosafety issues in biotechnology – risk assessment and risk management – safety protocols, risk groups – Biosafety levels – Biosafety guidelines and regulations (National and International) – operation of Biosafety guidelines and regulations – types of Bioterrorism containment.						




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Unit - IV	Total Quality Management
<p>TQM: Principles, Tools, steps, techniques and methods for TQM (Six sigma, charts, Ishikawa diagram, tree diagram, RCA and PDCA cycle),</p> <p>Requirements for supplementing TQM - steps for supplementing TQM – questionnaire preparation and assessment through questionnaire, mission statement, benefits of TQM, check list for implementing TQM - Introduction to GMP and GLP.</p>	
Unit - V	Intellectual property rights
<p>IPR: protection of biotechnological inventions, patents- types, patenting of genes, biological organisms, plants, animals, microbes and transgenic organisms, trade secrets, copyright, World Intellectual Property Rights organization (WIPO), GATT (General agreement of tariff and trade), biodiversity bill of India.</p>	

Skill Development Activities	Max. Marks (10)
Journal Review	3
e-content creation	3
Case Study	3
Punctuality	1

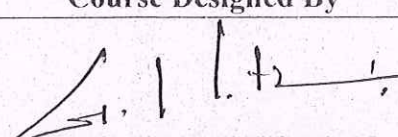
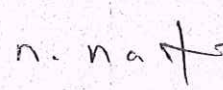
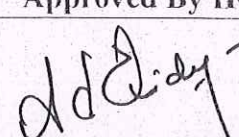
TEXT BOOKS	
1	Radhakrishnan R. and Balasubramanian, S, Intellectual Property Rights: Text and Cases, 1 st edition. Excel Books, 2008
2	Subbaram, N. R., Viswanathan, S, Handbook of Indian Patent Law and Practice. 1st Edition. Printers and Publishers Pvt. Ltd, 1998.
REFERENCE BOOKS	
1	Krishna, V. S, Bioethics and Biosafety in Biotechnology, 1 st Edition. New Age International Publishers, 2007.
2	Cohen.G, Technology Transfer. 1 st Edition. Sage Publications, 2004
3	Ram Narain. Twelve management skills for success. Viva books private limited, Chennai.
4	A. Rao, L.P.Carr, I.Dambolena, R.Kopp, J.Martin, F.Rafii and P.FSchlesinger, Across functional perspectives of TQM. First Edition. John Wiley and sons, New York, 1996
5	Martinez, W. and Schinzinger. R, Ethics in engineering, Tata McGraw-Hill, New Delhi, 4 th Edition, 2004.
6	DEBHELINGS, Biosafety issues related to transgenic crops, Biotech Consortium India Limited, New Delhi, 2005.




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WEB RESOURCES

1	World Trade Organisation - http://www.wto.org
2	World Intellectual Property Organization - http://www.wipo.int
3	International Union for the Protection of New Varieties of Plants - http://www.upov.int
4	National Portal of India - http://www.archive.india.gov.in
5	National Biodiversity Authority - http://www.nbaindia.org
6	Recombinant DNA Safety Guidelines, 1990 Department of Biotechnology, Ministry of Science and Technology, Govt. of India - Retrieved from http://www.envfor.nic.in/divisions/csurv/geac/annex-5.pdf
7	Guidelines and Standard Operating Procedures for Genetically Engineered Plants, 2008 - http://www.igmoris.nic.in/guidelines1.asp

Course Designed By	Verified By	Approved By HOD
 Mr. G. KARTHIKEYAN	 Mr. R. RASU	 Dr. A. K. VIDYA

QUESTION PAPER PATTERN


Time: 3 hours	Max. Marks: 50	
SECTION-A (10 X 1 = 10 Marks) Answer ALL the questions Choose the correct answer	SECTION-B (5 X 3 = 15 Marks) Answer ALL the questions Either or type Two questions from each unit	SECTION-C (5 X 5 = 25 Marks) Answer ALL questions Question Number: 16 to 19 (Either or type) Question Number 20 is Compulsory - Case Study

Mapping of COs with POs and PSOs:

PO/PSO CO	PO							PSO				
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	S	M	S	M	S	M	S	S	S	S	M	S
CO 2	S	M	M	S	S	S	S	S	S	S	S	S
CO 3	S	M	S	M	S	M	S	S	S	S	M	S
CO 4	S	S	M	S	S	S	S	S	S	S	S	S
CO 5		M	M	M	S	S	S	S	S	S	M	S

S - Strong, M - Medium, L - Low




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Sem.	Course Code	Core Biochemistry Practicals - II	Total Marks: 100		Hours / Week	Credits
			CIA: 50	ESE: 50		
II	21PBFCP205				5	3
Course Objectives:						
<ul style="list-style-type: none"> To specialize in screening and estimation of active constituents in Medicinal plants To acquire knowledge in concepts & application of Enzyme Assay techniques To gain practical experience in immunological techniques 						
Course Outcomes (CO): On completion of the course, students should be able to						
CO 1	Perform different laboratory procedures in the analysis of active constituents of natural sources					K1 - K4
CO 2	Acquire expertise in phytochemical screening of plant extract					
CO 3	Learn the to isolate biomolecules from various sources					
CO 4	Gain hand on experience in qualitative and quantitative analysis of different biomolecules					
CO 5	Develop skills to perform various immunoassays such as Ouchterlony double immuno diffusion (DID), RIA					
K1: Remember ; K2: Understand; K3: Apply; K4: Analyze; K5: Evaluate; K6: Create						
Unit - I Plant Biochemistry						
Qualitative analysis of Phytochemicals:						
(i) Carbohydrates (ii) Alkaloids (iii) Anthraquinones (iv) Flavonoids (v) Phenols (vi) Lipids (vii) Proteins and Amino acids						
Unit - II Colorimeter and Spectroscopic experiments						
Estimation of RNA - UV and visible methods						
Isolation and estimation of DNA from spleen/liver - UV and visible method						
Criteria of Purity of DNA						
Unit - III Colorimeter and Spectroscopic experiments						
Estimation of Total Phenol						
Estimation of Total Flavonoids						
Unit - IV Enzyme studies: (Group Experiments)						
Isolation, purification, properties, kinetic studies of the following enzymes - a) Amylase b) Protease						
Unit - V Immunology						
Immuno diffusion						
Immunoelectrophoresis						
Rocket immuno electrophoresis						



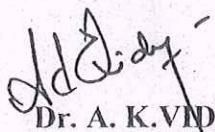
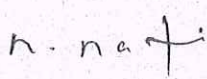
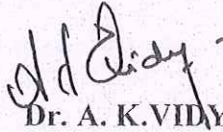
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REFERENCE BOOKS

1	D. T. Plummer. An Introduction to Practical Biochemistry, McGraw-Hill Book Company, 3 rd Edition, 2006.
2	S. Sadasivsam. A. Manickam, Biochemical methods, New Age International publishers, 3 rd edition, 2016.
3	T.N.Pattabiraman, Laboratory Manual & Practical Biochemistry, All India Publishers & Distributors, 4 th Edition, 2015

WEB RESOURCES

1	https://ijpsr.com/bft-article/phytochemical-screening-quantitative-analysis-of-flavonoids-and-minerals-in-ethanolic-extract-of-citrus-paradisi/?view=fulltext
2	https://www.hindawi.com/journals/jchem/2013/673173/

Course Designed By	Verified By	Approved By HOD
 Dr. A. K. VIDYA	 Mr. R. RASU	 Dr. A. K. VIDYA

QUESTION PAPER PATTERN


Major Experiment	Minor Experiment	Spotters	Viva Voce	Record
20	10	10	5	5

Mapping of COs with POs and PSOs:

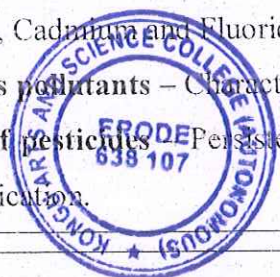
PO/PSO CO	PO							PSO				
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	S	M	S	M	S	M	S	S	S	S	M	S
CO 2	S	M	M	S	S	S	S	S	S	S	S	S
CO 3	S	M	S	M	S	M	S	S	S	S	M	S
CO 4	S	S	M	S	S	S	S	S	S	S	S	S
CO 5	S	M	M	M	S	S	S	S	S	S	M	S

S - Strong, M - Medium, L - Low




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Sem.	Course Code	Elective II: Biochemical and Environmental Toxicology	Total Marks: 100		Hours / Week	Credits
			CIA: 50	ESE: 50		
II	21PBFET206				5	4
Course Objectives:						
<ol style="list-style-type: none"> To understand the basic concepts of toxicology. To understand the relationship between exposure, hazards and development of disease. To assess risk factors associated with exposure to toxic chemicals 						
Course Outcomes (CO): On completion of the course, students should be able to						
CO 1	Design strategies for study the of dose-response relations.					K1 - K4
CO 2	Critically evaluate different advanced exposure assessment methods.					
CO 3	Analyze the effects of different types of Hazardous pollutants.					
CO 4	Clearly understand the mechanisms and mode of action of different toxic agents.					
CO 5	Gain knowledge about utilizing microbes and natural agents for Bioremediation and Detoxification purposes.					
K1: Remember; K2: Understand; K3: Apply; K4: Analyze; K5: Evaluate; K6: Create						
Unit - I						
General principles of Toxicology: Definition, Sources of environmental toxicants, Classification of toxicants. Evaluation of Toxicity – Acute Toxicity, Chronic Toxicity, Lethal Concentration (LC), Lethal Dose (LD), Lethal Time (LT), Effective Concentration (EC), Effective Dose (ED), Knockdown Dose (KD), Knockdown Time (KT), Medium Tolerance Limit (TLm) – Definitions only. Dose response relationship. Factors affecting action of Toxicants. Biomarkers of Toxicity.						
Unit - II						
Biotransformation: Routes of exposure of Toxicants. Absorption, Distribution, Accumulation, Biotransformation (Phase I and Phase II reactions) and Elimination. Bioavailability – Area under curve. Toxicity Testing – Invivo (Acute, Subchronic and Chronic toxicity test) and Invitro Test (Prokaryotic and Eukaryotic mutagenicity test, DNA Damage and Repair).						
Unit - III						
Metal poisoning – Definition, Types. Toxic mechanism and sites of action of Mercury, Lead, Chromium, Cadmium and Fluoride. Hazardous pollutants – Characteristics and Categories (Plastics and Medical wastes) Toxicity of pesticides – Persistent and Degradable pesticides with examples - Bioconcentration and Biomagnification.						

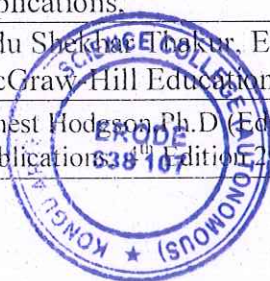


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Unit - IV	
Action of Toxicants:	
Teratogenesis - Causes, Mode of action and Evaluation (Examination of Pregnant animals and Fetus).	
Carcinogenesis - Causes, Mode of action and Evaluation (Biochemical markers).	
Mutagenesis - Causes, Mode of action and Evaluation (Ame's test).	
Organ Toxicity	
Hepatotoxicity – Hepatotoxicants (Carbon tetrachloride) and its mechanism	
Neurotoxicity – Structural effects of toxicants on neurons, Toxicant mediated alteration in synaptic junction.	
Unit - V	
Bioremediation: Insitu and Exsitu Bioremediation. Phytoremediation. Bioabsorption of metals by bacteria, fungi and actinomycetes (with one example).	
Natural therapies to promote detoxification – Antioxidants: Vitamin A, Vitamin C, Vitamin E and Phenolics, Glutathione. Detoxifying agents: Alfalfa, Chlorella. Protective agents: SAM, Silibinin.	

Skill Development Activities	Max. Marks (10)
Assignment	3
e-Content Presentation	3
Case Study	3
Punctuality	1

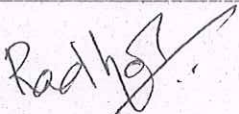
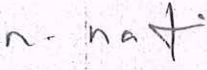
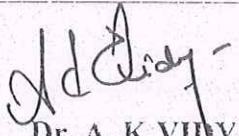
TEXT BOOKS	
1	M.A.Subramanian, Toxicology Principles and Methods, MJP Publishers, 2 nd edition, 2019
2	Vijayan Kannampilly, Toxicology, Rajat Publications, 2009
REFERENCE BOOKS	
1	Curtis D Klaassen Ph.D (Editor) Casarett and Doull's, Toxicology - The Basic Science of Poison, Mc Graw-Hill Medical Publishing division, 7 th Edition, 2008
2	Bruce E. Rittmann and Perry L.McCarty, Environmental Biotechnology - Principles and applications.
3	Indu Shekhar Editor, Environmental Biotechnology: Basic concepts and applications, McGraw Hill Education, 2001
4	Ernest Hodgson Ph.D (Editor) A Text Book of Modern Toxicology, A John Wiley and Sons Inc Publications, 4 th Edition, 2010.



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WEB RESOURCES

1	https://www.mlsu.ac.in/econtents/49_CLASSIFICATION%20OF%20TOXICANTS.pdf
2	https://www.biologydiscussion.com/biochemistry/food-toxicants/classification-of-toxicants-present-in-food-biochemistry/44020
3	http://www.mlkwe.ac.in/pdf/study-material/zoology/UG%20VI%20teratogenesis.pdf

Course Designed By	Verified By	Approved By HOD
 Mrs. T. RADHA	 Mr. R. RASU	 Dr. A. K. VIDYA

QUESTION PAPER PATTERN


Time: 3 hours		Max. Marks: 50
SECTION-A (10 X 1 = 10 Marks) Answer ALL the questions Choose the correct answer	SECTION-B (5 X 3 = 15 Marks) Answer ALL the questions Either or type Two questions from each unit	SECTION-C (5 X 5 = 25 Marks) Answer ALL questions Question Number: 16 to 19 (Either or type) Question Number 20 is Compulsory - Case Study

Mapping of COs with POs and PSOs:

PO/PSO CO	PO							PSO				
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	S	M	S	M	S	M	S	S	S	S	M	S
CO 2	S	M	M	S	S	S	S	S	S	S	S	S
CO 3	S	M	S	M	S	M	S	S	S	S	M	S
CO 4	S	S	M	S	S	S	S	S	S	S	S	S
CO 5	S	M	M	M	S	S	S	S	S	S	M	S

S - Strong, M - Medium, L - Low




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Sem	Course Code	CORE PAPER – X RESEARCH METHODOLOGY AND BIOSTATISTICS	Total Marks: 100		Hours Per Week	Credits
			CIA:25	ESE:75	5	
III	17PBFCT301					4

Objective(s):

- To enable the student to understand the concept of the methods used in scientific research
- To emphasize on the importance of statistical concepts
- To provides guidelines on accessing scientific literature and preparing scientific papers and presentation

Course Outcome:

On successful completion of the course, Students will able to

- CO1 - Propose and distinguish appropriate research designs and methodologies to apply to a specific research project
- CO2 - Understand Data presentation techniques and research report writing
- CO3 - Know about averages in detail and interpret Correlation and Regression
- CO4 - Understand the concept of large samples with applications.
- CO5 - Know and apply test for small samples

UNIT I**Research and Research Design**

Research: Objectives of Research , Types & Significance of Research. Criteria for good Research, Selecting & defining a Research problem–Limitations in Research – Qualities of a Good Research Worker

Research Design

Need for Research design, Features of good Research design, Classifications of Research Design Hypothesis testing, Errors in Research Design.

UNIT II**Report Writing and Presentation of Data**

Report Writing; Significance of Report writing, different steps in Report writing, Bibliography, Types of Report, layout of Research paper. Writing research reports for Scientific Journals ; Impact factor of Journals, Ethical issues related to publishing, Plagiarism and Self-Plagiarism, Shodhganga- Digital repository of Thesis, Intellectual Property Rights (IPR).

Presentation of Data: Graphical presentation - Tabular, Chart, Diagrammatic presentation.



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UNIT III

Measures of Averages: Arithmetic Mean – Median – Quartiles and Deciles - Mode –Related problems.

Measures of Dispersion: Range – Quartile Deviation - Standard Deviation -Coefficient of Variation

Sample Correlation –Rank Correlation –Properties – Limitations.

Regression – Regression lines –Properties.

UNIT IV

Large Samples: Characteristic of a Sampling Distribution – Standard Error of the mean -

Test of hypothesis – Significance Level - Test for a specified mean – Test for equality of two means – Test for specified proportion.

UNIT V

Small Samples t Test: Introduction – Uses of t Test – Properties of the sample distribution of t - Test for a specified mean – Test for equality of two means –t Test for paired observations. Analysis of Variance: One way and Two way classification – Chi Square test – Test of independent of attributes: SPSS packages.

Text Books

1. C.R.Kothari, "Research Methodology: Methods and Techniques", New Age International Publication, 4th Edition, 2014.
2. P.R.Vittal, "Mathematical Statistics", Margam Publications Chennai 2002.

Reference Books

1. R.S.N.Pillai & Bagavathi, "Statistics", S.Chand and Company LTD, 7th Revised Edition 2008.
2. Danien, "Biostatistics –A foundation for analysis in health science" 6th edition, 1995.
3. Jerrold H.Zar, "Biostatistical analysis"- Pearson Education, 4th Edition, 1999.
4. S.Prasad, "Elements of Biostatistics", Rastogi publications 2005, Meerut.
5. P.Raja, "Mathematics and Biostatistics", Subash Publications 1999.
6. S.P.Gupta, "Statistical Methods" 28th edition, Sultan Chand & Sons (P) Ltd

SECTION – A	SECTION – B	SECTION – C
10x1=10 Marks (Multiple choice, Four options) Two questions from each unit	5 x 7 = 35 Marks (Either or choice) Two questions from each unit	3x10 = 30 Marks (Answer any three questions) One question from each unit



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Sem.	Course Code	CORE PAPER XI- METABOLISM AND METABOLIC REGULATION	Total Marks: 100		Hours Per Week	Credits
			CIA: 25	ESE: 75	4	4
III	17PBFCT302					

Objective(s):

- To provide students with a understanding of Intermediary metabolism
- To understand the catabolic and anabolic pathways of carbohydrate, lipids, amino acids and porphyrin metabolism
- To learn the role of plant hormones and biosynthesis of secondary metabolites and its application.

Course Outcome :

At the end of this course, the student is able to:

- CO1 - Understand how carbohydrate metabolism normally responds in the fed state, the fasting state, and during exercise
- CO2 - Recognize and understand the regulatory mechanisms of lipid metabolism
- CO3 - Understand the metabolic consequences and significance of Protein metabolism
- CO4 - Analyse the core metabolic pathways of Porphyrins and Nucleic acids
- CO5 - Learn the role of plant hormones & biosynthesis of secondary metabolites and acquire knowledge on stress adaptations in biological systems.

UNIT I**Carbohydrate Metabolism**

An overview & energetics of Glycolysis and Gluconeogenesis - Regulation of Glycolysis and Gluconeogenesis - Phosphofruktokinase, Hexokinase and Pyruvate kinase as regulatory enzymes in glycolysis; Hormone regulation. Anaplerotic reactions ('filling up' reactions)

Gluconeogenesis: Regulation by allosteric and substrate level control mechanisms.

TCA cycle : Steps - Regulation at branch points:-Pyruvate dehydrogenase. Alpha - keto glutarate dehydrogenase and Citrate Synthase.

Glycogen metabolism - Regulation of Glycogen Phosphorylase; Glycogen Synthase by effectors, Covalent modification and hormones.

UNIT II**Lipid Metabolism**

An overview of Fatty acid anabolism and catabolism. Regulation of Fatty acid synthesis - Control of Acetyl CoA Carboxylase on Fatty acid Synthetase Complex: Role of hormones; effect of diet on fatty acid synthesis.

Biosynthesis and regulation of Triacylglycerols, Cholesterol, Phosphatidyl choline, Phosphatidyl ethanolamine and Sphingomyelin.

Biosynthesis and regulation of Prostaglandins, Eicosanoids, Thromboxanes, Leukotrienes.

UNIT III**Amino acid Metabolism**

Gamma -glutamyl cycle. Methionine as Methyl Donor (SAM pathway)

Biosynthesis and regulation of Urea Cycle.

Regulation of Alpha-keto glutarate family, Pyruvate family, 3-Phosphoglycerate family,

Aspartate family and Aromatic family of amino acids.

Allosteric regulation of Glutamine Synthetase.



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UNIT IV**An overview on Porphyrin metabolism**

Biosynthesis & degradation : Hemoglobin & Chlorophyll.

Nucleic acid metabolism

Purines and Pyrimidines biosynthesis (both de novo and salvage pathways) & degradation.

Regulation of Purine biosynthesis: PRPP aminotransferases.

Regulation of Pyrimidine biosynthesis: Aspartate carbamoyl Transferase.

Regulation of deoxyribonucleotides by activators and inhibitors.

UNIT V**Plant Metabolism**

Plant Hormones: Biosynthesis of Indole acetic acid, Gibberellins, Cytokinins, Ethylene, Salicylic acid.

Pathways: BioSynthesis of Secondary Metabolites and its application - Alkaloids, Flavanoids and Terpenoids.

Metabolic response to Biotic and Abiotic Stress in Plants and Humans.

Metabolic Engineering with Bioinformatics : Metabolic pathway Databases – Metacyc, KEGG, Biocarta.**Text Books**

1. J.L.Jain, Sun Jain and Nitin Jain ,Fundamentals of Biochemistry 6th Edition S.Chand & Company Ltd, 2005.
2. Robert K Murray, Daryl K Granner, Peter A Mayes and Victor W Rodwell ,Harper's Illustrated Biochemistry 27th Edition 2003.
3. Voet, Donald, Voet, Judith G, Biochemistry 4th Edition,

Reference Books

1. Biochemistry 3rd edition - Zubey, John Wiley, 2002.
2. Regulation in metabolism - Newshome, Start John Wiley
3. Principles or Biochemistry with human focus – Garrette, Grisham. Brookes Cole 1997
4. Biochemistry and molecular biology of plants – Buchanan.
5. Biochemistry 5th edition – Stryer, Freeman 2002
6. Lehninger's Principles of biochemistry, 4th edition – Nelson, Cox, McMillan Worth, 2005

QUESTION PAPER PATTERN		
SECTION - A	SECTION - B	SECTION - C
10 x 1 = 10 Marks (Multiple Choice Four options) Two questions from each unit	5 x 7 = 35 Marks (Either or choice) Two questions from each unit	3 x 10 = 30 Marks (Answer any three Questions) One Question from each unit



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Sem.	Course Code	CORE PAPER XII- ADVANCED CLINICAL BIOCHEMISTRY	Total Marks: 100		Hours Per Week	Credits
III	17PBFCT303		CIA: 25	ESE: 75	4	4

Objective(s):

- To understand the common metabolic pathology and enzyme assays
- To provide an insight into Specimen collection and processing
- To understand Liver and Renal function tests
- To gain knowledge about Cancer biology and Free radicals.

Course Outcome :

Upon successful completion of this course, students will be able to:

- CO1 - Understand the methods of collection of Sample in basic analysis of clinical Biochemistry
- CO2 - Correlate testing to Blood system to assess the abnormal conditions of the Blood disorders
- CO3 - Understand the Enzymes role in Diagnostic disorders of Organs
- CO4 - Learn about the Functional tests and Clinical conditions of the diseases to understand the significance of Diagnostic
- CO5- Assess the Various free radicals and cancer markers in various disease

UNIT – I**Specimen collection and processing**

Collection of blood - Vein puncture, Skin puncture and Arterial puncture. Collection with syringe.. Anticoagulants.

Collection and analysis of Normal and Abnormal Urine and its Clinical significance of sugars, proteins, ketone bodies, bilirubin.

CSF: Collection, Composition, Chemical examination and analysis.

UNIT II**Serology, Hematology and Erythrocyte metabolic disorder**

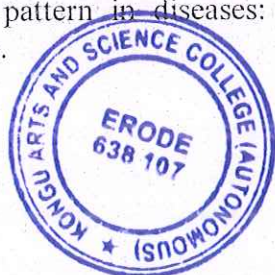
Serology and Hematology: Immunological test for Pregnancy and Rheumatoid arthritis (RA). ESR, Determination of Hemoglobinopathies – Sickle cell anemia, Thalassemia and their identification.

Disorders of Erythrocyte metabolic pathways, Porphyrins and Porphyrins.

UNIT III**Clinical Enzymology**

Principle, assay, and clinical significance of Transaminases, Gamma – glutamyl transferase, Creatine kinase, Lactate Dehydrogenase, Isocitrate Dehydrogenase, Glutamate Dehydrogenase, Glucose -6-phosphate Dehydrogenase, Acid and Alkaline Phosphatases and Ceruloplasmin.

Enzyme pattern in diseases: Hepatobiliary diseases, Myocardial infarction – Role of Troponin.



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UNIT IV**Thyroid, Liver and Renal Function tests**

Thyroid function test: test based on primary function- measuring circulating T3, T4, TSH level and in vitro resin-uptake of T3 test.

Liver function test: Jaundice, Cirrhosis, Hepatitis and Gall stones.

Renal function test: Acute and Chronic renal failure. Clearance tests - Urea, Creatinine, Inulin, Renal calculi.

UNIT V**Cancer biology and Free Radicals**

Oncology:- Cancer markers for Oral cancer, Prostate cancer and Breast cancer.

Tumour markers:- AFP, CEA and Carcinogenic agents.

Free radicals in health and diseases: - Introduction, Types of free radicals. Free radical induced lipid peroxidation, Oxidative damage to lipids, proteins and DNA. Antioxidants (Enzymic – SOD, Glutathione Peroxidase, Glutathione Reductase, Catalase; Non Enzymic - Ascorbic acid, Tocopherol, Reduced Glutathione).

Text Books

1. Fundamentals of clinical chemistry – Teitz, W.B.Saunders company, 1994
2. Clinical chemistry in diagnosis and treatment 6th edition – Mayne, ELBS Publications, 1994
3. Practical clinical biochemistry, volume I and II, 5th edition – Varley *et al.*, CBS Publishers, 1980

Reference Books

1. Teitz text book of clinical biochemistry 3rd edition – Burtis *et al.*, William Heinmann medical books, Ltd., 1999
2. Clinical biochemistry – Metabolic and clinical aspects, Pearson Professional Ltd. 1995
3. Clinical chemistry 5th edition – Mosby, Marshall, 2004
4. Harrison's Principles of internal medicine Vol. I and II. 14th edition, McGraw Hill
5. Clinical chemistry – principles, procedures and correlations, Bishop, Lippincott, 2000

QUESTION PAPER PATTERN		
SECTION - A	SECTION - B	SECTION - C
10 x 1 = 10 Marks (Multiple Choice, Four options) Two questions from each unit	5 x 7 = 35 Marks (Either or choice) Two questions from each unit	3 x 10 = 30 Marks (Answer any three Questions) One Question from each unit



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Sem.	Course Code	CORE PAPER XIII- GENETIC ENGINEERING	Total Marks: 100		Hours Per Week	Credits
			CIA: 25	ESE: 75		
III	17PBFCT304				5	4

Objective(s):

- To introduce the basics and advent of DNA research in gene cloning
- To provide an insight into the techniques and applications of gene technology
- To understand the ability to change gene expressions
- To gain knowledge about the potentially momentous applications of transgenic in treating diseases

Course Outcome:

Upon successful completion of this course, students will be able to:

- CO1 - Able to understand the capacity of different cloning vectors and its role in gene cloning
- CO2 - Assess the ability of using various nucleic acid probes; selection and identification of recombinants
- CO3 - Had insight into various hybridization techniques
- CO4 - Acquire sound knowledge about expression of cloned genes in different host systems
- CO5 - Learn about transgenic plant and animal production and applications.

UNIT – I**Basics of gene cloning**

Basic steps in Gene Cloning. Restriction Endonuclease – Types and Features; Ligations; Linkers and Adaptors.

Vectors of gene cloning: Plasmid vectors – Basic Features. pBR322, pUC, Natural vectors – pSC101, pEMBL, pBluescript.

Bacteriophage vectors – Lambda phage, M13 phage, Cosmid.

Viral vectors – Baculoviruses as vectors, Recombinant vaccinia virus vectors, Retrovirus vectors.

High capacity cloning vectors – BAC, YAC, PAC, HAC.

UNIT – II**Introduction of DNA into Bacterial cells**

Preparation of Competent Cells, Transformation of E.coli, Selection of transformed cells, Identification of Recombinants.

Introduction of Phage DNA into bacterial cell, Identification of Recombinant phages.

Genomic library and cDNA library. Short gun Cloning method.

Nucleic acid probes: Types – DNA, RNA and Oligonucleotide probes.

Probe Labeling methods: Strand synthesis labeling (DNA Probes), Run-off transcription (RNA Probes), End labeling (Oligonucleotide Probes).



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UNIT – III**Hybridization and PCR technique**

Southern, Northern and Western hybridization, Dot Blot, Insitu hybridization – FISH.

PCR – Design of primers, Types (Standard PCR, Quantitative Real Time PCR, Reverse Transcriptase PCR). PCR in genomic analysis and diagnostic application.

Hybridization based applications: DNA fingerprinting, RFLP.

PCR based applications: RAPD, RACE.

UNIT – IV**Expression of Cloned genes and Recombination selection**

Expression vectors – Production of proteins from cloned genes. Fusion proteins as biopharmaceutical – Insulin, Erythropoietin.

Expression of cloned genes in *E.coli*.

Cloning and expression of cloned genes in *Bacillus subtilis*.

Cloning in Yeast: Yeast Expression Vectors. Expression of cloned genes in *S.cerevisiae*.

Recombination, Selection and Screening Methods – Insertional Inactivation, Colony (plaque) hybridization, HRT & HART.

UNIT – V**Gene Transfer Methods in Animal and Plant Cells**

Selectable Markers (Antibiotic and Antimetabolite genes) and Reporter Genes.

Gene knock out Technology. DNA Sequencing, Protein Engineering: Site Directed Mutagenesis.

Transgenic science in plant improvement, Biopharming - plants as bioreactors.

Transgenic science for animal improvement, Biopharming- Animals as bioreactors.

Production of Transgenic Plants – Golden Rice

Gene Therapy – Ex vivo and In vivo gene therapy, Somatic and Germ line gene therapy.

Stem cells and gene therapy. Human Genome Project.

Text Books

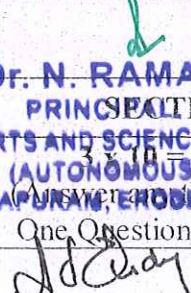
1. Gene cloning – An Introduction, T.A.Brown, Chapman and Hall publishers, I Edition, 1995.
2. Old R.W & Primrose S.B, Principles of Gene Manipulation, Blackwell scientific publications, 2001.
3. Bernard R.Glick & Jack J.Pasternak, Molecular Biotechnology: Principles and Applications of Recombinant DNA, Panima Publishing corporation, Indian Reprint, 2002.

Reference Books:

1. Biotechnology, U.Satyanarayana, Books and Allied (P) Limited, 2013.
2. A textbook of Biotechnology, R.C.Dubey, S.Chand & Company Ltd, IV Edition, 2007.
3. Genetic Engineering and its Application, P.Joshi, Agrobios Publications, I Edition, 2001.
4. Human Molecular Genetics, Tom Strachan & Andrew P Read, Garland Science Publishers, III Edition, 2004.

QUESTION PAPER PATTERN		
SECTION - A	SECTION - B	SECTION - C
10 x 1 = 10 Marks (Multiple Choice Four options) Two questions from each unit	5 x 7 = 35 Marks (Either or choice) Two questions from each unit	3 x 10 = 30 Marks (Answer any three Questions) One Question from each unit




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Sem.	Course Code	CORE PAPER XIV- PHARMACEUTICAL BIOCHEMISTRY	Total Marks: 100		Hours Per Week	Credits
			CIA: 25	ESE: 75		
III	17PBFCT305				4	4

Objective(s):

- To learn various routes of Drug administration, its distribution, metabolism and excretion
- To understand the Drug –Receptor interaction
- To gain knowledge about effect of drugs on Kidney, Central Nervous system and associated diseases

Course Outcome:

On successful completion of the course students will be able to:

- CO1 - Obtain Pharmacokinetic concepts of chemotherapeutic agents
- CO2 - Develop an understanding of Adverse Drug Responses
- CO3 - Obtain the knowledge of various Chemotherapeutic agents
- CO4 - Gain an idea of Diuretic drugs and its action
- CO5 - Understand the Neurodegenerative disorders and its drugs

UNIT-I**Basic concepts of Drug and Pharmacokinetics**

Drugs: Pharmacokinetics, Pharmacodynamics, Sources and Classification of drugs, Dosage forms, Routes of administration. Structural features and Pharmacological activity of drugs – Optical isomerism, Geometrical isomerism and Conformational isomerism.

Drug Absorption: Mechanisms, Physicochemical properties affecting drug absorption.

Drug Distribution: Definition, Factors determining drug distribution.

Drug Metabolism: Biotransformation, Factors, Mechanism of Cytochrome P₄₅₀. Microsomal and Non – Microsomal reactions ; Phase I and Phase II reactions.

Excretion of drugs: Renal excretion mechanism.

UNIT-II**Drug receptor interaction and Pharmacological responses**

Drug receptors: Theories, Types, Forces involved in Drug-Receptor interaction.

Drug response: Adverse response to drugs, Drug tolerance and intolerance, Tachyphylaxis, Factors modifying the effects of drug action.

Assay of Drug Potency: Chemical, Biological and Immunological assay.

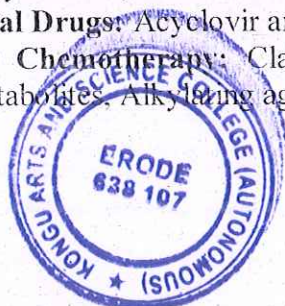
UNIT-III**Chemotherapy**


Drugs used in Respiratory disorders: Bronchial Asthma and Pulmonary tuberculosis.

Antimicrobial Drugs: Sulfonamide, Penicillin and Amino glycosides – Properties of aminoglycosides , Mechanism and Pharmacokinetics of Streptomycin.

Antiviral Drugs: Acyclovir and Famciclovir.

Cancer Chemotherapy: Classification of Anticancer Drugs - Mechanism of action of Antimetabolites, Alkylating agents and Natural products.




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UNIT -IV

Drugs acting on Kidney

Diuretics: Mode of action and Classification of Diuretics.

Pharmacology of Diuretics : Loop Diuretics, Thiazide Diuretics, Potassium Sparing Diuretics, Osmotic Diuretics, Carbonic anhydrase Inhibitors, Xanthine Diuretics, Mercurial Diuretics and Acidifying salts.

Drug induced Nephrotoxicity: Drugs inducing different types of Nephrotoxicity.

UNIT -V

Drugs acting on Central Nervous System

Drug Abuse: Psychological Dependence and Physical Dependence.

CNS Stimulants: Psychomotor Stimulants – Amphetamine ; Psychotomimetics (Hallucinogens) - Lysergic Acid Diethyl amide (LSD).

Non Steroidal Anti Inflammatory Drugs (NSAIDs): Classification of NSAIDs, Pharmacokinetics and Mechanism of action of Paracetamol.

Neurodegenerative Disorder Drugs: Drugs used in Parkinson's disease, Huntington's disease and Alzheimer's disease.

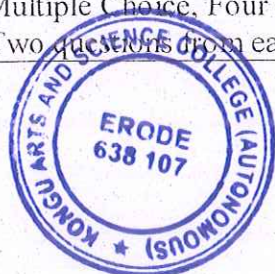
Text Books

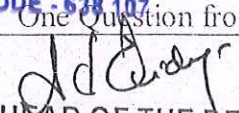
1. Salil K Bhattacharya, Parantapa Sen and Arunabha Ray. Pharmacology 2nd Edition , Elsevier Publication, New Delhi. 2004.
2. K.D. Tripathi. Essentials of Medical Pharmacology 5th Edition , Jaypee Brothers Medical Publishers (P) Ltd, New Delhi. 2003.

Reference Books

1. Goodman, Gilman ,The Pharmacology, Volumes I and II
2. Katzung, Basic and Clinical Pharmacology 7th edition ,Printice Hall, New Delhi
3. Rang, Dale ,Pharmacology 3rd edition.
4. Satoskar et al., Pharmacology and Pharmacotherapeutics ,Popular Prakashar, Mumbai
5. Foye, Principles of Medicinal Chemistry, Waverks Pvt. Ltd. New Delhi
6. Wolf, Burger's Medicinal Chemistry and Drug Discovery: principles and practice, John Wiley
7. Davies, Read ,Molecular basis of inherited diseases , IRL Press
8. Glick, Pasternak, Molecular Biotechnology 2nd edition, Panima Publishers.

QUESTION PAPER PATTERN		
SECTION - A	SECTION - B	SECTION - C
10 x 1 = 10 Marks (Multiple Choice, Four options) Two questions from each unit	5 x 7 = 35 Marks (Either or choice) Two questions from each unit	10 x 3 = 30 Marks (Answer any three Questions) One Question from each unit




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Sem.	Course Code	CORE BIOCHEMISTRY PRACTICAL III	Total Marks: 100		Hours Per Week	Credits
III	17PBFCP306		CIA: 40	ESE: 60	4	3

Objective(s):

- To learn the techniques of clinical analysis

Course Outcome:

On successful completion of the course students will be able to:

- CO1 - Gain an idea of Lipid components in the given sample
- CO2 - Know the knowledge of Quantitative analysis of Carbohydrates
- CO3 - Understand the clinical importance of Vitamins
- CO4 - Obtain the knowledge of activity of enzymes in the sample
- CO5 - Understand the abnormal range and diseases

I. Blood/ Serum/ Tissue Analysis**A. Estimation of Blood /Serum/Tissue components :**

1. Estimation of Triglycerides
2. Estimation of Cholesterol- Zak's method
3. Estimation of Glycosylated Hemoglobin
4. Estimation of Glycogen by Anthrone Method
5. Estimation of Ascorbic Acid
6. Estimation of α -Tocopherol

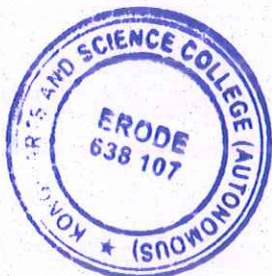
B. Determination of the activity of the following Tissue /Plasma /Serum Enzymes:

- i) Glucose 6 Phosphatase
- ii) Fructose 1,6 biphosphatase
- iii) Reduced Glutathione
- iv) Acid Phosphatase

Reference Books

1. David T. Plummer, An introduction to practical Biochemistry.
2. Pattabiraman, Laboratory manual in Biochemistry.
3. J.Jayaraman, Practical Biochemistry.

Question Paper Pattern (60 Marks)							
Major & Minor Experiments	40 Marks	Spotter	10 Marks	Viva Voce	05 Marks	Record	05 Marks



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Sem.	Course Code	ELECTIVE PAPER III	Total Marks: 100		Hours Per Week	Credits
III	17PBFET307	BIOCHEMICAL AND ENVIRONMENTAL TOXICOLOGY	CIA: 25	ESE: 75	4	4

Objective(s):

- To understand the basic concepts of toxicology.
- To understand the relationship between exposure, hazards and development of disease.
- To assess risk factors associated with exposure to toxic chemicals

Course Outcome:

On successful completion of the course students will be able to:

CO1 - Design strategies for study the of dose-response relations.

CO2 - Critically evaluate different advanced exposure assessment methods.

CO3 - Analyze the effects of different types of Hazardous pollutants.

CO4 - Clearly understand the mechanisms and mode of action of different toxic agents.

CO5 - Gain knowledge about utilizing microbes and natural agents for Bioremediation and Detoxification purposes.

UNIT – I

General principles of Toxicology: Definition, Sources of environmental toxicants, Classification of toxicants. Evaluation of Toxicity – Acute Toxicity, Chronic Toxicity, Lethal Concentration (LC), Lethal Dose (LD), Lethal Time (LT), Effective Concentration (EC), Effective Dose (ED), Knockdown Dose (KD), Knockdown Time (KT), Medium Tolerance Limit (TLm) – Definitions only. Dose response relationship. Factors affecting action of Toxicants. Biomarkers of Toxicity.

UNIT – II

Biotransformation: Routes of exposure of Toxicants. Absorption, Distribution, Accumulation, Biotransformation (Phase I and Phase II reactions) and Elimination. Bioavailability – Area under curve.

Toxicity Testing – Invivo (Acute, Subchronic and Chronic toxicity test) and Invitro Test (Prokaryotic and Eukaryotic mutagenicity test, DNA Damage and Repair).

UNIT – III

Metal poisoning – Definition, Types. Toxic mechanism and sites of action of Mercury, Lead, Chromium, Cadmium and Fluoride.

Hazardous pollutants – Characteristics and Categories (Plastics and Medical wastes)

Toxicity of pesticides – Persistent and Degradable pesticides with examples - Bioconcentration and Biomagnification.



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UNIT – IV**Action of Toxicants:**

Teratogenesis - Causes, Mode of action and Evaluation (Examination of Pregnant animals and Fetus).

Carcinogenesis - Causes, Mode of action and Evaluation (Biochemical markers).

Mutagenesis - Causes, Mode of action and Evaluation (Ame's test).

Organ Toxicity

Hepatotoxicity – Hepatotoxicants (Carbon tetrachloride) and its mechanism

Neurotoxicity – Structural effects of toxicants on neurons, Toxicant mediated alteration in synaptic junction.

UNIT – V

Bioremediation: Insitu and Exsitu Bioremediation. Phytoremediation. Bioabsorption of metals by bacteria, fungi and actinomycetes (with one example).

Natural therapies to promote detoxification – Antioxidants: Vitamin A, Vitamin C, Vitamin E and Phenolics. Glutathione. Detoxifying agents: Alfalfa, Chlorella. Protective agents: SAM, Silibinin.

Text Books

1. M.A.Subramanian, Toxicology Principles and Methods, MJP Publishers, 2004.
2. Vijayan Kannampilly, Toxicology, Rajat Publications, 2009.

Reference Books:

1. Curtis D Klaassen Ph.D (Editor) Casarete and Doull's Toxicology The Basic Science of Poison . Mc Graw-Hill Medical Publishing division, Seventh Edition 2008.
2. Environmental Biotechnology Principles and applications, Bruce E. Rittmann and Perry L.McCarty.
3. Environmental Biotechnology: Basic concepts and applications, Indu Shekhar Thakur.
4. Ernest Hodgson,Ph.D (Editor) AText Book of Modern Toxicology, A John Willey and Sons.Inc Publications,Fourth Edition 2010.

QUESTION PAPER PATTERN		
SECTION - A	SECTION - B	SECTION - C
10 x 1 = 10 Marks (Multiple Choice, Four options) Two questions from each unit	5 x 7 = 35 Marks (Either or choice) Two questions from each unit	3 x 10 = 30 Marks (Answer any three Questions) One Question from each unit

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Sem.	Course Code	ADVANCED LEARNERS COURSE-I INDUSTRIAL BIOCHEMISTRY	Total Marks: 100	Hours Per Week	Credits
III	17PBFAL310		ESE: 100	Self Study Paper	2

Objective(s):

- To equip students with a basic understanding of industrial biochemical systems and processes necessary for production of products with commercial value
- To equip students with techniques of extracting biochemical substances from biological material in order to add value to these substances
- To equip students with basic skills necessary for the production of bioactive compounds

Course Outcome:

On successful completion of the course students will be able to:

- CO1 - Understand the students in the basic principles of processing of bioreactor
- CO2 - Develop skills on recent Methodologies in Clinical Trials
- CO3 - Gain the Knowledge in Food Processing
- CO4- Learn the applications of Enzymes in Food Industry and Recombinant Technology
- CO5- Expose students to relevant and recent advances in microbes in Environmental

UNIT I**Fundamentals of Bioprocess Technology**

Introduction to fermentation technology. Isolation and screening of industrially important microbes, Inoculum preparation, strain improvement for better yield. Primary and secondary detection and assay of fermentation products. Advantages of bioprocess over chemical process.


UNIT II**Pharmaceutical Biochemistry and Vaccine Development**

Development of new drug/molecules and elucidation of their mechanisms of actions; formulations. Large scale production of humanized monoclonal antibodies; vaccine development. Clinical Trials – Phase I, II, III and IV.

UNIT III**Food Biochemistry**

Introduction to different categories of food; constituents of food products and their functional properties; Introduction to food processing and types (Physical, Chemical and Biological); Intermediate moisture food; Food spoilage; Intrinsic and Extrinsic factors affecting the quality and life of food material; Food storage and Preservation techniques; Food Poisoning and Intoxication.




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UNIT IV**Industrial uses of Enzymes and other Biomolecules**

Industrial production of enzymes from traditional sources and genetically engineered organisms; Proteases; Carbohydrases; Lipases and their applications; Enzymes for Analytical applications; Industrial uses of seed oils; Vaccine/Protein production by rDNA technology;

UNIT V**Microbes and Environment, IPR & GATT**

Microbes in mineral recovery, Bioleaching and Biosorption. Microbial recovery of Petroleum.

Biosafety: Biological Containment; Biosafety levels;

Patenting; Intellectual Property Rights (IPR) and General agreement on trade and tariff (GATT).

Text Books

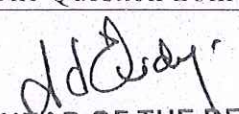
1. U. Sathyanarayana, Biotechnology. Books and Allied (P) Ltd 2009.
2. B.D. Singh, Biotechnology. Kalyani Publishers, 2009.
3. Ananthanarayanan. R. and Jayaram Panicker. *Textbook of Microbiology 5th Edition. Orient BlackSwan Publication, 2005.*

Reference Books

1. Singh K, Intellectual Property rights on Biotechnology, BCIL, New Delhi, 2010.
2. Shaleesha A. Stanley, Bioethics, Wisdom educational service, 2008 .
3. Beier, F.K., Crespi, R.S. and Straus, T. Biotechnology and Patent protection- Oxford and IBH Publishing Co. New Delhi, 1985.
4. Prescott.L.M, JP. Harley and D.A. Klein, Microbiology, 2nd edition, W.C. Brown Publishing Co. 1993.
5. A.H. Patel. Industrial microbiology, 2nd Edition, Laxmi Publications, Pvt. Ltd, 2015.
6. Stanbury. P. Whitaker and S.J. Hall Principles of Fermentation technology, 2nd Edition, Elsevier Publications, 1995.
7. David Green Wood, Richard C.B. Slack. John Foreest Pevtherer, Medical microbiology, 14th edition, ELBS with Churchill Living Stone, 1992.

QUESTION PAPER PATTERN		
SECTION - A	SECTION - B	SECTION - C
10 x 2 = 20 Marks Ten questions out of 12 Two questions from each unit	5 x 7 = 35 Marks 5 Questions (Either or choice) Two questions from each unit	3 x 15 = 45 Marks (Answer any three Questions out of 5) One Question from each unit




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Sem.	Course Code	ADVANCED LEARNERS COURSE-II	Total Marks: 100	Hours Per Week	Credits
III	17PBFAL311	BIOETHICS AND INTELLECTUAL PROPERTY RIGHTS	ESE: 100	Self Study Paper	2

Objective(s):

- This subject aims at studying ethical concerns about patenting of living organisms and genetic material.
- The objectives also include the effects of international trade, future economic systems and the ethical and social impact of Biosciences.

Course Outcome:

On successful completion of the course students will be able to:

- CO1 - Understand the concept of Genetic Engineering
- CO2 - Learn the knowledge of Ethical Issues
- CO3 - Understand the Biosafety concepts
- CO4 - Gain the knowledge of Intellectual Property Rights And Regulations
- CO5 - Understand the Patent and its Types

UNIT I**Biosciences, Society and Legal Issues**

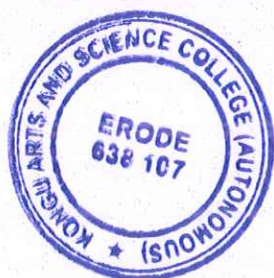
Biotechnology and Social responsibility, Public acceptance issues in Biotechnology, Biotechnology and Biological knowledge in developing countries: The legal and socioeconomic impacts of biotechnology, public awareness in genetic engineering . Biodiversity- National and International laws to maintain Biodiversity, Environmental sustainability, Public Vs Private funding.

UNIT II**Ethical Issues:**

Ethical issues regarding genetically modified organisms (foods and crops); bioethics in biodiversity and resource management. Ethical issues in Human Cloning and Stem Cell Research. Testing of drugs on human volunteers, organ transplantation and ethical issues; Xenotransplantation and its ethical and social issues. Human Genome project and Genome editing.

UNIT III**Biosafety Concepts And Issues**

Introduction to Biosafety: definition and needs of biosafety, levels of biosafety, applications of biosafety at work place, Biosafety during development of biotech products. Good manufacturing practice and Good laboratory practices (GMP andGLP). The Cartagena protocol on biosafety.Safety assessment of foods and food ingredients produced by genetically modified microorganisms. Social and ethical implications of biological weapons.



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UNIT IV**Intellectual Property Rights And Regulations**

Introduction to IPR: IP definition and needs, GATT, TRIPS, & WTO Agreement. Different forms of IPR - Copyrights, Trademarks, Industrial designs, Geographical Indications, Traditional Knowledge, Plant varieties, Trade Secrets. Role of IPR in Research and Development. Increasing the value of a technology through the use of Trademark.

UNIT V**Patent**

Introduction to Patents -Types of Patent applications: Classification of patents in India, Classification of patents by WIPO, Categories of Patent, Special Patents, Patenting Biological products. Patentable subject matter, Inventions that are not Patentable, Term of patent, Maintenance of a Patent.

Text Books

1. Sateesh, M. K. Bioethics and Biosafety. I. K. International Publishers.
2. Thomas, J.A., Fuch, R.L. (2002). Biotechnology and Safety Assessment (3rd Ed). Academic Press.
3. Fleming, D.A., Hunt, D.L., (2000). Biological safety Principles and practices (3rd Ed). ASM Press, Washington.

Reference Books

1. Sassoon A. Biotechnologies and development. UNESCO Publications, 1988.
2. Intellectual Property Rights on Biotechnology by Singh K. BCIL, New Delhi.
3. WTO and International Trade by M B Rao. Vikas Publishing House Pvt. Ltd.
4. Intellectual Property Rights in Agricultural Biotechnology by Erbisch F H and Maredia K M. Orient Longman Ltd.
5. Cartagena Protocol on Biosafety, January 2000.
6. Food Biotechnology in the Ethical prospective, 2nd edition, by Paul B. Thompson, published Springer.

QUESTION PAPER PATTERN		
SECTION - A	SECTION - B	SECTION - C
<p>10 x 2 = 20 Marks Ten questions out of 12 Two questions from each unit</p>	<p>5 x 7 = 35 Marks 5 Questions (Either or choice) Two questions from each unit</p>	<p>3 x 15 = 45 Marks (Answer any three Questions out of 5) One Question from each unit</p>



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Sem.	Course Code	ELECTIVE –IV: ELECTIVE PRACTICALS - CELL CULTURE AND MOLECULAR TECHNIQUES	Total Marks: 100		Hours Per Week	Credits
IV	17PBFEP402		CIA: 40	ESE: 60	5	4

Objective(s):

- To learn the Plant and Animal tissue culture techniques
- To understand the molecular techniques

Course Outcome:

On successful completion of the course students will be able to:

- CO1 - Know the sterilization techniques in plant and animal tissue culture
- CO2 - Gain an idea of preparation of PTC medium
- CO3 - Know the idea about the Micropropagation techniques
- CO4 - Understand the method of production of artificial seeds
- CO5 - Develop an understanding of DNA isolation from the animal cell

I.PLANT TISSUE CULTURE

1. PTC Laboratory Organization
2. Sterilization Procedures
3. Preparation of PTC Medium
4. Sterilization and Explant Preparation
5. Callus induction and Micropropagation
6. Artificial Seed Production
7. Cytogenetic Studies - Mitotic Preparation - Onion root tip

II. ANIMAL TISSUE CULTURE

1. Preparation of ATC Medium and Membrane Filtration (Demonstration)
2. Isolation of DNA from Animal Cell
3. Quantification of DNA- Diphenylamine method


III.METHODS IN MOLECULAR BIOLOGY (Demonstration)

1. Isolation of Genomic DNA
2. Isolation of Plasmid DNA

Reference Books:

1. Molecular Cloning: A Laboratory Manual, J. Sambrook, Fritsch and Maniatis, Cold Spring, Harbor Laboratory Press, New York, 2000.
2. Applied Molecular Genetics, Roger, L.Miesfield, John Wiley and Sons Inc Publications, 1999.
3. Recombinant DNA Principles and Methodologies, James .J. Greene, Vengalla B.Rao, Marcel Dekker Publications, 1998.




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4. DNA Cloning. a practical approach. D.M. Glover and B.D. Hames, IPL press, Oxford, 1995
5. Molecular and Cellular methods in Biology and Medicine, P.B. Kaufman, W.Wu, D.Kim and L.J.Cseke. CEC press, Florida. 1995.

Question Paper Pattern (60 Marks)							
Major & Minor Experiments	40 Marks	Spotter	10 Marks	Viva Voce	05 Marks	Record	05 Marks

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