



KONGU ARTS AND SCIENCE COLLEGE

(An Autonomous Institution, Affiliated to Bharathiar University, Coimbatore)

ERODE – 638 107

M.Sc (Biochemistry)



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2017-2018



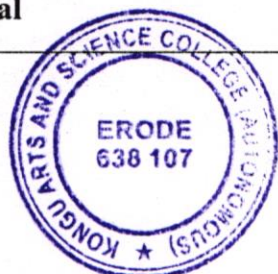
KONGU ARTS AND SCIENCE COLLEGE, ERODE – 638 107
(AUTONOMOUS)
M.Sc BIOCHEMISTRY


(For the Candidates admitted during the Academic Year 2017 – 2018 and onwards)



SCHEME OF EXAMINATION – CBCS PATTERN

Part	Course Code	Course Title	Inst. Hrs /Week	T/P	Examination Details				Credits
					Duration in Hours.	CIA	ESE	Total Marks	
SEMESTER I									
I	17PBFCT101	Core Paper I - Biopolymers	5	T	3	25	75	100	4
	17PBFCT102	Core Paper II - Biochemical Techniques	5	T	3	25	75	100	4
	17PBFCT103	Core Paper III - Enzymes and Enzyme Technology	4	T	3	25	75	100	4
	17PBFCT104	Core Paper IV – Cellular Biochemistry	4	T	3	25	75	100	4
	17PBFCT105	Core Paper V - Plant Biochemistry and Biotechnology	4	T	3	25	75	100	4
	17PBFCT106	Core Biochemistry Practicals - I	4	P	6	40	60	100	3
	17PBFET10.	Elective - I	4	T	3	25	75	100	4
Total			30					700	27
SEMESTER II									
I	17PBFCT201	Core Paper VI - Microbial Biochemistry	5	T	3	25	75	100	4
	17PBFCT202	Core Paper VII - Immunology	5	T	3	25	75	100	4
	17PBFCT203	Core Paper VIII - Endocrinology	5	T	3	25	75	100	3
	17PBFCT204	Core Paper IX - Molecular Biology and Molecular Genetics	5	T	3	25	75	100	4
	17PBFCT205	Core Biochemistry Practicals - II	5	P	6	40	60	100	3
	17PBFET20.	Elective - II	5	T	3	25	75	100	4
Total			30					600	22




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Part	Course code	Course Title	Inst. Hrs /Week	T/P	Examination Details				Credits
					Duration in Hours.	CIA	End Semester Exam	Total Marks	
SEMESTER III									
I	17PBFCT301	Core Paper X - Research Methodology and Biostatistics	5	T	3	25	75	100	4
	17PBFCT302	Core Paper XI - Metabolism and Metabolic Regulation	4	T	3	25	75	100	4
	17PBFCT303	Core Paper XII - Advanced Clinical Biochemistry	4	T	3	25	75	100	4
	17PBFCT304	Core Paper XIII - Genetic Engineering	5	T	3	25	75	100	4
	17PBFCT305	Core Paper XIV - Pharmaceutical Biochemistry	4	T	3	25	75	100	4
	17PBFCT306	Core Biochemistry Practical-III	4	P	6	40	60	100	3
	17PBFET30.	Elective - III	4	T	3	25	75	100	4
	17PBEIT01	Institutional Training*	Completed / Not Completed						
Total			30					700	27
SEMESTER IV									
I	17PBFVCV401	Project Viva-voce	-	P	-	40	160	200	10
	17PBFEP40.	Elective - IV	5	P	6	40	60	100	4
Total								300	14
TOTAL								2300	90

* **Institutional Training:** Students have to undergo Institutional Training during May-June for a period of 15 days at the end of II Semester and the report of the same to be submitted.



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Course Code	List of Elective Courses (Students can choose any one of the papers as Elective)		
17PBFET107	Elective – I	A	Bioinformatics and Nanotechnology
17PBFET108		B	Computational Molecular Biology
17PBFET109		C	Biophysics and Crystallography
17PBFET206	Elective – II	A	Animal Cell Culture Techniques
17PBFET207		B	Genomics
17PBFET208		C	Stem Cell Technology
17PBFET307	Elective – III	A	Biochemical and Environmental Toxicology
17PBFET308		B	Proteomics
17PBFET309		C	Characterization and Application of Nanomaterials
17PBFEP402	Elective – IV	A	Elective Practicals- Cell Culture and Molecular Techniques
17PBFEP403		B	Elective Practicals : Bioinformatics
17PBFEP404		C	Elective Project Work

List of Advanced Learners Courses

S. No	Course Code	Course
1.	17PBFAL310	Industrial Biochemistry
2.	17PBFAL311	Bioethics and Intellectual Property Rights

A.K. Vidya
Dr.A.K.Vidya

Chairman, Board of Studies
Department of Biochemistry
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Sem.	Course Code	CORE PAPER I - BIOPOLYMERS	Total Marks: 100		Hours Per Week	Credits
			CIA: 25	ESE: 75		
I	17 PBFCT101				5	4

Objectives:

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

UNIT-I**Polysaccharides - Homo and Heteroglycans**

Occurrence, Structure, Isolation, properties and functions of Homoglycans - Starch, Glycogen, Cellulose, Dextrin, Inulin, Chitins, Xylans, Arabinans, Galactans.

Occurrence, Structure, Properties and functions of Heteroglycans – Bacterial cell wall polysaccharides, Glycosaminoglycans, Agar, Alginic acid, Pectins and Deoxy sugars, Blood group substances and Sialic acid.

Glycoproteins and their 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 - Alpha helix, Beta sheet and Beta turns structure. Pauling and Corey model for fibrous proteins. Collagen triple helix. Super secondary structures (Helix-Loop-Helix), **Ramachandran plot.**

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

Quaternary structure – Structure and Biological functions of Hemoglobin.

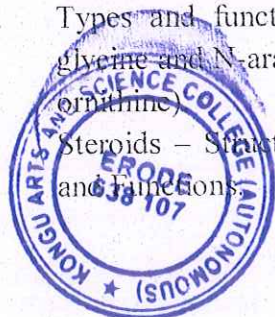
UNIT-III**Lipids**

Lipids – Classification of lipids. Phospholipids - Classification, Structure and functions. Glycolipids - Ceramides and Sphingomyelins.

Eicosanoids - Structure and functions of Prostaglandin, Thromboxane, Leukotriene.

Types and functions of Plasma lipoproteins. Lipaminoacids – Animal cells (N- acyl glycine and N-arachidonyl serine) and Bacteria (N-acyl-L-homoserine lactones and N-acyl ornithine)

Steroids – Structure and biological significance of Cholesterol. Statin drugs- Properties and functions.



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UNIT-IV**Nucleic acids**

Watson & Crick Model of DNA structure. A, B and Z forms of DNA. Properties of DNA – Buoyant density, Viscosity, Denaturation and Renaturation; Cot curve analysis. Hypochromic effect.

Major classes of RNA – mRNA, rRNA, tRNA – Structure and biological functions.

DNA-Protein interactions. DNA binding motifs in proteins – Helix Loop Helix (HLH) motif. Zinc finger motif and Leucine zipper motif. Techniques characterizing Nucleic acid-Protein complex – Gel retardation assay, DNase I footprinting.

UNIT-V**Natural products**

Carbohydrates and derived products - Drugs containing Glycosides, Tannins, Lipids (fixed oils, fats and waxes), Properties and health benefits of Volatile oils, Synthesis and Biological importance of Terpenoids, Alkaloids (Cocaine, Nicotine and Quinine), Flavonoids (Quercetin, Flavonols and Chalcones). Chemistry and potential uses of Quinone derivatives

Heterocyclic compounds – Definition, synthesis and applications of Porphyrin.

Potential uses of Plant and Animal pigments - Betalins, Xanthophyll, Anthocyanin, Cytochrome and Melanin.

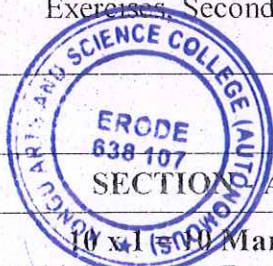
TEXT BOOKS:

1. Rastogi S.C, V.N. Sharma, Anuradha Tanden, Concepts in Molecular Biology, 1993.
2. Zubay, GL, 'Biochemistry' WCB Publishers.
3. Deb, A.C., Fundamentals of Biochemistry, New Central Agency, Calcutta, 3rd Edition, 1989.

REFERENCE BOOKS:

1. Lehninger, A.L., Nelson, D.L., Cox, M.M., Principles of Biochemistry, CBS Publishers, 2nd Edition, 1993.
2. Lubert stryer, Biochemistry, Freeman and company, 4th Edition, 1995.
3. Voet and Voet, John Wiley and sons NY, 'Fundamentals of Biochemistry' 2002.
4. Thomas .M. Devlin, 'Text Book of Biochemistry with clinical correlation', John WileyLiss, Hobokhen NJ publishers 2006.
5. Robert N Trigiano, Dennis J Gray, Plant Tissue Culture Concepts and Laboratory Exercises, Second Edition, CRC Press November 1999.

QUESTION PAPER PATTERN		
SECTION - A	SECTION - B	SECTION - C
10 x 1 (50) Marks	5 x 7 = 35 Marks	3 x 10 = 30 Marks
(Multiple Choice. Four options) Two questions from each unit	(Either or choice) Two questions from each unit	(Answer any three Questions) One Question from each unit



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Sem.	Course Code	CORE PAPER II - BIOCHEMICAL TECHNIQUES	Total Marks: 100		Hours Per Week	Credits
			CIA: 25	ESE: 75		
I	17 PBFCT102				5	4

Objectives:

- To have a basic understanding of the theoretical principles involved in Bioinstrumentation
- To have the practical skills and techniques required in biochemical analysis
- To become competent in the basic experimental techniques of biochemistry

UNIT – I

Chromatographic Techniques – Principle, technique and applications of Paper, Thin Layer Chromatography, Ion-exchange, Molecular sieve, Affinity, Adsorption, Gas Liquid Chromatography, High Performance Liquid Chromatography (HPLC).

Identification and Expression Assay – Flow Cytometry, DNA Microarray and Protein Microarray.

Cytotoxicity Assay – Comet and MTT Assay.

UNIT - II

Electrophoresis – Principle, technique and applications of Agarose gel Electrophoresis for DNA separation, SDS-PAGE for protein separation, Isoelectric focusing, Capillary electrophoresis, 2D gel electrophoresis, Pulsed-field gel electrophoresis for DNA separation, KASPar assay.

Applications of Electrophoresis in Blotting techniques and DNA Fingerprinting.

UNIT - III

Centrifugation – Basic Principles, Relative Centrifugal Force (RCF), Factors affecting Sedimentation. Ultracentrifuge – Preparative and Analytical ultracentrifuge.

Preparative Ultracentrifuge: Subcellular organelle separation by Density gradient and Differential centrifugation. Analytical ultracentrifuge – Determination of molecular weight by Sedimentation Velocity method.

UNIT - IV

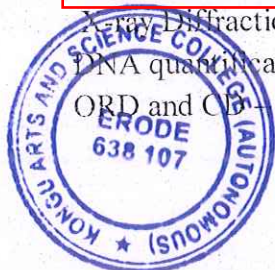
Spectrophotometry – Basic principles, Laws of Absorption, UV Visible and IR Spectroscopy. ESR, NMR, Mass Spectrometry, Flame Photometry, Fluorimetry,

Applications of GC-MS.

X-ray Diffraction technique – Principle, Instrumentation and Applications.

DNA quantification using NanoDrop.

ORD and CD – Principle and Applications.



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UNIT - V

Radiochemical techniques – Nature of Radioactive Emissions – Alpha, Beta, Gamma Emissions. Units of Radioactivity. Detection and Measurement of Radioactivity – GM Counter, Scintillation Counting and Autoradiography. Radioactive (^{32}P) and Nonradioactive (Digitonin) Labeling. Applications of Radioisotopes in Biology. Radiochemical purity in Radiopharmaceuticals. Radiation safety in Radioisotope Laboratories.

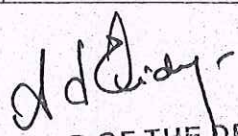
TEXT BOOKS:

1. Asokan, Analytical Biochemistry, China Publications, 2003.
2. Upadhyay *et al.*, Biophysical Chemistry – Principles and Techniques, Himalaya Publishing House, 2009.
3. Sharma.V.K, Instrumental Methods for Chemical Analysis, XI Edition, 1981.
4. Plummer.D.T, An Introduction to Practical Biochemistry, III Edition, 1998.


REFERENCE BOOKS:

1. Wilson and Walker, A biologist's guide to principles and techniques of Practical Biochemistry, V Edition, Cambridge University Press, 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 III - ENZYMES AND ENZYME TECHNOLOGY	Total Marks: 100		Hours Per Week	Credits
			CIA: 25	ESE: 75		
I	17 PBFCT103				4	4

Objectives:

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

UNIT I

Enzymes: Introduction, Classification of enzymes, Factors affecting enzyme activity. Active site- Definition: investigations of active site structure, Trapping ES complex, use of substrate analogues. Enzyme modification by treatment with proteases, Enzyme modification by site directed mutagenesis. Isoenzymes (LDH and CK), Multienzyme complex (Fatty acid Synthetase complex).


UNIT II

Mechanism of Enzyme Action: Enzyme catalysis- Acid base catalysis, covalent catalysis, Mechanisms of catalysis -Lysozyme, Chymotrypsin. Metal activated enzymes & Metallo enzymes. Role of metal ions in mechanism - Carbonic anhydrase, Superoxide dismutase, Carboxy peptidase. Coenzymes - Pyridoxal Phosphate, Co-enzyme A, TPP, NAD and FAD and its catalytic reaction. Cofactors.

UNIT III

Enzyme kinetics: Michaelis Menten equation and its significance, Lineweaver Burk plot, Eadie - Hofstee plot and Hanes plot. Allosteric enzymes- Concerted, Sequential Model, Allosteric inhibition- Aspartate transcarbomylase and regulation. Enzyme inhibition - Types & kinetic differentiation of Competitive, Non-competitive and Uncompetitive inhibitions. Ribozyme and Abzymes.




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UNIT IV

Industrial applications of enzymes: Extraction, Purification and Stabilization of Amylases (Bacterial and Fungal) and Proteases (Bacterial and Fungal).

Applications of Enzymes in Food industry: Role of enzymes in Brewing, Baking, and meat processing industry.

Applications of Enzymes in Detergent, Leather, Textile Processing.

Clinical application of enzymes – Diagnostic and Therapeutic enzymes.

UNIT V

Immobilised enzymes:- Techniques of immobilization and applications of immobilized enzyme. Biosensors: Calorimetric biosensors: Potentiometric biosensors: Amperometric biosensors, Immunosensors.

Recent advances and future prospects in Enzyme Technology: Enzymes and recombinant DNA technology, Modification enzymes.

Enzyme engineering- Synthesis of artificial enzymes, Use of 'unnatural' substrates.

TEXT BOOKS:

1. Palmer, 'Understanding Enzymes' 3rd edition, Printice Hall, 1991
2. Trevor Palmer and Philip Bonner, 'Enzymes', 2nd Edition, Woodhead publishing, 2007.
3. Enzymes – Dixon and Webb.
4. Alan Welshman, 2nd Edition, Hand book of enzyme biotechnology.

REFERENCE BOOKS:

1. Marangoni, John Wiley, 'Enzyme Kinetics. 'A Modern Approach', 2002.
2. Chapline, Bucke, 'Enzyme Technology', 1st Edition, Cambridge University Press, 1990.
3. Price and Stevens, 'Fundamentals of enzymology', 2nd edition, Oxford University Press, 1995
4. Nooralabettu Krishna Prasad, 'Enzymes technology', PHI Learning Pvt, 2011.
5. Galy Walch, Protein Biotechnology.

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 V - PLANT BIOCHEMISTRY AND BIOTECHNOLOGY	Total Marks: 100		Hours Per Week	Credits
			CIA: 25	ESE: 75		
I	17 PBFCT105				4	4

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

UNIT-I

Photosynthesis: Photosynthetic apparatus- Chloroplast. Organisation of thylakoid. Photosynthetic pigments - Structure, biosynthesis and functions of Chlorophyll, 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 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: Nitrogen fixation- Enzymology of nitrogen fixation. Symbiotic nitrogen fixation- Root nodules and Symbiosomes. Symbiotic nitrogen fixation in legumes by Rhizobia. Nitrate Reduction, Nitrite Reduction and Nitrogen Assimilation. Non-symbiotic nitrogen fixation, Nitrogen assimilation.

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

Xenobiotics: Role of Glutathione during Stress condition.

UNIT-IV

Plant gene: Structure of plant genes. Nuclear and Chloroplast and Mitochondrial genome. Biosynthesis and development of chloroplast.

Plant tissue culture: Tissue culture media- MS media- composition and preparation. Callus culture and initiation.

Micro propagation- Organogenesis and Somatic embryogenesis. Somaclonal variation, Protoplast culture and Protoplast fusion, Identification of Hybrids - Physiological, Biochemical and Molecular markers.

Production of Haploid plants-Androgenesis and Gynogenesis.



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UNIT-V

Transgenesis: Gene transfer in plants - Direct gene transfer: Biolistics; Vector mediated transfer - *Agrobacterium* mediated transformation using Ti and Ri plasmids. Plant viruses as Vectors - CaMV and Gemini viruses.

Application of Transgenic plants: Insect resistant (Bt toxin) plants, Virus resistant plants, Herbicide resistant (glyphosate) plants. Germplasm conservation. Genetically engineered plants as Protein factories.

TEXT BOOKS:

1. T.A.Brown, 'Gene Cloning: An Introduction' 3rd edition, Chapman & Hall, 1995.
2. Verma.S.K., A textbook of Plant Physiology and Biochemistry, 3rd Revised Edition. S.Chand & Company, 2000.
3. Dr.U.Satyanarayana, Biotechnology, Books and Allied (P) Ltd., 2005.

REFERENCE BOOKS:

1. Bob, Buchannan "Biochemistry and Molecular biology of plants" I.K International Pvt. Ltd, 2000.
2. Anderson, Beandall, "Metabolic activities of plant cells" Blackwell Scientific Publishers
3. Anderson, Beandall, "Biochemistry and molecular biology of plants" Blackwell Scientific Publishers, 1960.
4. Bonner, Varner, "Plant biochemistry" 3rd edition, Academic Press Inc, 1997.
5. Chrispeels *et al.*, Jones and Bartlett, "Plants, genes and crop biotechnology" 2nd edition, 2002.
6. Doyle, Griffiths, John Wiley, "Cell and tissue culture: laboratory procedures" 1998.
7. Hans, Walter-Heldt, "Plant biochemistry and molecular biology" Oxford University Press, 1997
8. Nicholls, "Genetic engineering" 2nd edition, Cambridge University Press, 2002
9. Primrose *et al.*, "Principles of gene manipulation" 6th edition, Blackwell Scientific Publishers, 2001
10. William .G.Hopkins, Norman .P.A .Huners, Plant Physiology 4th Edition 2008.

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 BIOCHEMISTRY PRACTICAL - I	Total Marks: 100		Hours Per Week	Credits
			CIA: 40	ESE: 60		
I	17 PBFCP106				4	3

I. Biochemical Calculations

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

II. Colorimetric experiments

2. Isolation and estimation of Starch from Potato
3. Estimation of Fructose in Fruits
4. Estimation of Lactose from Milk
5. Isolation and estimation of Ascorbic acid from Fruit
6. Estimation of Protein by Lowry Method

III. Separation techniques

7. Separation of Amino acids by Paper Chromatography – Circular and Ascending
8. Separation of Lipids by Thin Layer Chromatography
9. Separation of plant pigments by Column Chromatography

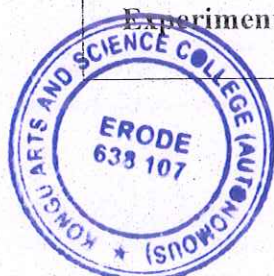
IV. Bioinformatics

10. Sequence and Structural Database –NCBI, EMBL,DDBJ, PDB
11. Search Similarity tools - BLAST and Clustal W
12. Gene Prediction using GenMark and GenScan
13. Proteomics tools – Expsy
14. Molecular Visualisation tools – Rasmol, Spdbv.

BOOKS FOR REFERENCES

1. David T. Plummer, An introduction to practical biochemistry.
2. Pattabiraman, Laboratory manual in biochemistry.
3. J.Jayaraman, Practical Biochemistry.
4. K. Mani and N. Vijayaraj, Bioinformatics for Beginners, I Edition, Kalaikathir Achagam, Coimbatore, 2002.

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



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Sem.	Course Code	CORE BIOCHEMISTRY PRACTICALS - II	Total Marks: 100		Hours Per Week	Credits
II	17 PBFPC205		CIA: 40	ESE: 60	5	3

I. Plant Biochemistry

- Qualitative analysis of Phytochemicals:
 - Carbohydrates
 - Alkaloids
 - Anthraquinones
 - Flavonoids
 - Phenols
 - Lipids
 - Proteins and Aminoacids

II. Colorimetry 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
- Estimation of Total Phenol
- Estimation of Total Flavanoids

Enzyme studies: (Group Experiments)

- Isolation, purification, properties, kinetic studies of the following enzymes:
 - Amylase
 - Protease

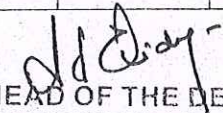
III. Immunology

- Immunodiffusion
- Immuno-electrophoresis
- Rocket immunoelectrophoresis


BOOKS FOR REFERENCES

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

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


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