



KONGU ARTS AND SCIENCE COLLEGE

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

ERODE – 638 107

M.Sc (Biochemistry)



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2018-2019



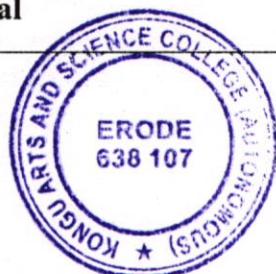
KONGU ARTS AND SCIENCE COLLEGE, ERODE – 638 107
(AUTONOMOUS)
M.Sc BIOCHEMISTRY

(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
17PBFEV404		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
Kongu Arts and Science College
(Autonomous)
Nanjanapuram, Erode – 638 107



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

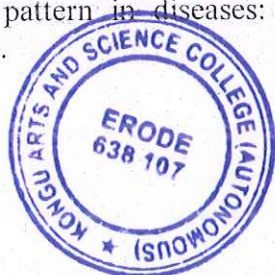
Serology and Hematology: Immunological test for Pregnancy and Rheumatoid arthritis (RA). ESR, Determination of Hemoglobinopathies – Sickle cell anemia, Thalassemia and their identification.

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



Dr. N. RAMAN
PRINCIPAL,
KONGU ARTS AND SCIENCE COLLEGE
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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



Dr. N. RAMAN
 PRINCIPAL
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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.

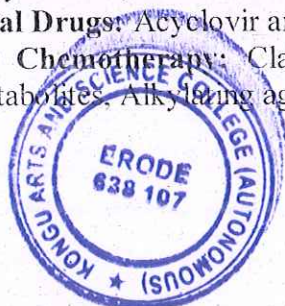
UNIT-III**Chemotherapy**


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



Dr. N. RAMAN
PRINCIPAL

KONGU ARTS AND SCIENCE COLLEGE
(AUTONOMOUS)
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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:

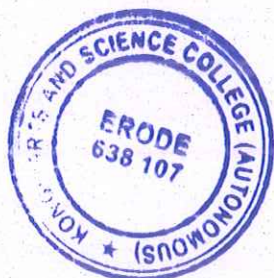
- i) Glucose 6 Phosphatase
- ii) Fructose 1,6 biphosphatase
- iii) Reduced Glutathione
- iv) Acid Phosphatase

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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PRINCIPAL
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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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HEAD OF THE DEPARTMENT
DEPARTMENT OF BIOCHEMISTRY
KONGU ARTS AND SCIENCE COLLEGE
(AUTONOMOUS)
ERODE - 638 107,



[Signature]
Dr. N. RAMAN
PRINCIPAL,
KONGU ARTS AND SCIENCE COLLEGE
(AUTONOMOUS)
NANJANAPURAM, ERODE - 638 107.

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**

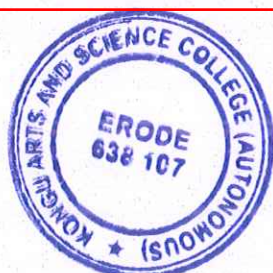
Biotechnology and Social responsibility, Public acceptance issues in Biotechnology, Biotechnology and Biological knowledge in developing countries: The legal and socioeconomic impacts of biotechnology, public awareness in genetic engineering . Biodiversity- National and International laws to maintain 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 and GLP). 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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[Signature]
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