ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)

CHENNAI – 600 008

DEPARTMENT OF BIOCHEMISTRY

M.Sc BIOCHEMISTRY SYLLABUS

CHOICE BASED CREDIT SYSTEM

OUTCOME BASED EDUCATION

(OFFERED FROM THE ACADEMIC YEAR 2021-22)

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI-08

DEPARTMENT OF BIOCHEMISTRY

MINUTES OF THE BOARD OF STUDIES MEETING

The Board of Studies of the Department of Biochemistry met on 22/7/2021 at 3.30 pm online with Dr. M.Sujatha in the Chair.

The Board approved the changes made in the examination pattern/papers during the pandemic for the syllabus adopted in 2018-21/2018-20.

The following changes were also approved

- Substitution of Internship with Online review of an Organization.
- Substitution of Research project with Review project.

The Board scrutinized the revision of the syllabus of M.Sc Biochemistry. The Board examined the credit structure and the curriculum template and approved the same.

The Board also Scrutinized the following aspects of the Syllabus:

Outcome Based Education pattern (including Bloom's Taxonomy to be used for Question Paper setting, the correlation of Programme Educational Objectives, Programme Outcomes, Programme Specific Objectives, Course Objectives, Course Outcomes, Mapping of Course Outcomes with PSO's); End Semester Question Paper pattern; Continuous Assessment pattern; Teaching Methodology; Recommended Text books and Recommended Reading; Journals; Online resources, and Panel of Question Paper Setters for each paper.

The Board made the following specific recommendations on the draft syllabi:

Approved Introduction of Self Study paper for extra credits

Changes recommended in Courses

- Biochemical tools and techniques- Inclusion of electrochemical chip technology
- Applied Physiology- Inclusion of physiological changes associated with pregnancy and overview of skeletal system.
- Biomolecules - Inclusion of Non Protein amino acids,elaboration of chemical properties of amino acids and lipids
- Enzymes and Enzyme technology- Inclusion of Action of Ribonuclease and cobamide coenzymes
- Metabolism and Metabolic disorders- Inclusion of redox potential ,free energy calculation and ribonucleotide reductase
- Advanced Clinical biochemistry and Biomedical instrumentation - Inclusion of Glucometer and oxygen concentrator.
- Softskill- Computing skills- Inclusion of Google Docs,Sheets and Slides.
- Self study- Bioethics-Inclusion of Copyrights and licencing
- Advanced Biotechnology - Inclusion of RT-PCR
- Expansion of Abbreviations in all the courses

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)

CHENNAI- 6000 08

PG DEPARTMENT OF BIOCHEMISTRY

BOARD OF STUDIES MEETING – M.Sc BIOCHEMISTRY

The Board of Studies meeting was held in the Department of Biochemistry on 22.07.2021.

The Board consisted of the following members:

S.NO	MEMBER'S NAME & DESIGNATION	SIGNATURE
1.	**Dr.M. SUJATHA (CHAIRMAN BOARD OF STUDIES)** ASSOCIATE PROFESSOR & HEAD DEPARTMENT OF BIOCHEMISTRY ETHIRAJ COLLEGE FOR WOMEN CHENNAI -6000 08.	
2.	**Dr. V. BHUVARAHAMURTHY (UNIVERSITY NOMINEE)** PROFESSOR AND HEAD DR. ALM POST GRADUATE INSTITUTE OF BASIC MEDICAL SCIENCES, TARAMANI CAMPUS, CHENNAI-600 113	
3.	**Dr. N.MEENAKSHI** ASSOCIATE PROFESSOR, DEPT OF BIOCHEMISTRY, BHARATHI WOMENS COLLEGE, BROADWAY, GEORGE TOWN CHENNAI-600108.	
4.	**Dr.A. GNANAMANI** SR. PRINCIPAL SCIENTIST BIOLOGICAL MATERIAL LABORATORY CSIR-CENTRAL LEATHER RESEARCH INSTITUTE	

ADYAR,
CHENNAI – 600 020

5. **Dr.S.SUBRAMANIAM (INDUSTRIAL REPRESENTATIVE)**
DIRECTOR
REGENIX SUPER SPECIALITY LABORATORIES PVT LTD
CHOOLAIMEDU
CHENNAI -600034

6. **Dr. C.N.DEEPA**
ASSOCIATE PROFESSOR
DEPARTMENT OF BIOCHEMISTRY
ETHIRAJ COLLEGE FOR WOMEN
CHENNAI – 6000 08.

7. Dr. V.MALATHI
ASSOCIATE PROFESSOR
DEPARTMENT OF BIOCHEMISTRY
ETHIRAJ COLLEGE FOR WOMEN
CHENNAI – 6000 08.

8. Dr. S.VIJAYALATHA
ASSISTANT PROFESSOR
DEPARTMENT OF BIOCHEMISTRY
ETHIRAJ COLLEGE FOR WOMEN
CHENNAI – 6000 08.

9. Dr. SAFIYA
ASSOCIATE PROFESSOR
DEPARTMENT OF BIOCHEMISTRY
ETHIRAJ COLLEGE FOR WOMEN
CHENNAI – 6000 08.

10. Dr.J.PRIYA
ASSISTANT PROFESSOR
DEPARTMENT OF BIOCHEMISTRY
ETHIRAJ COLLEGE FOR WOMEN

CHENNAI – 6000 08.

11. Ms. A.LAKSHMI DEVI

ASSISTANT PROFESSOR
DEPARTMENT OF BIOCHEMISTRY
ETHIRAJ COLLEGE FOR WOMEN
CHENNAI – 6000 08.

12. Dr. B.THENDRAL HEPSIBHA

ASSISTANT PROFESSOR
DEPARTMENT OF BIOCHEMISTRY
ETHIRAJ COLLEGE FOR WOMEN
CHENNAI – 6000 08.

13. **Dr. FATIMA CYNTHIA ANTONY**

ASSISTANT PROFESSOR
DEPARTMENT OF BIOCHEMISTRY
ETHIRAJ COLLEGE FOR WOMEN
CHENNAI – 6000 08.

14. **Ms.N.SUDHA**

ASSISTANT PROFESSOR
DEPARTMENT OF BIOCHEMISTRY
ETHIRAJ COLLEGE FOR WOMEN
CHENNAI – 6000 08.

15. **ALUMNA**

Ms. NANDHINIE.K
M.Sc Batch (2018-2020)

16. **STUDENT REPRESENTATIVE**

ANUSHA.S – PG Final year

CONTENTS

1. Rules and regulations for the Programme
2. Programme Educational Objectives
3. Programme Outcomes
4. Programme Specific Outcomes
5. Programme Profile
6. Elective Subjects offered to Other Departments
7. Evaluation pattern for CA
8. Rubrics for CA Evaluation
9. Evaluation Pattern for End Semester

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)
CHENNAI- 600008
PG DEPARTMENT OF BIOCHEMISTRY
M.Sc -REVISED SYLLABUS EFFECTIVE FROM 2020-21

PREAMBLE

The PG Department of Biochemistry is revising syllabi with effect from the academic year 2021-22 with existing CBCS as specified by the government of Tamil Nadu.

Every academic year is divided into 2 semester sessions. Each semester will have a minimum of 90 working days and each day will have 5 working hours. Teaching is organized into a modular pattern of credit courses. Credit is normally related to the number of hours a teacher teaches a particular subject. It is also related to the number of hours a student spends learning a subject or carrying out an activity.

As the Revised Bloom's Taxonomy is being used for teaching learning and evaluation under the Outcome Based Education to improve the skills of students, all syllabi must be framed keeping this objective in mind.

Course objectives may be framed keeping the teaching in mind.

Course outcomes may be framed keeping the student in mind.

All outcomes should be observable and measurable.

REGULATIONS

1.Eligibility for admission:

Candidates for admission to the first year of the P.G Biochemistry degree course shall be required to have passed B.Sc examinations conducted by the University of Madras or an examination accepted as equivalent thereto by the syndicate of the of the University of Madras

with any of the following subjects as major – Biochemistry, Chemistry, Botany, Zoology, Biotechnology, Microbiology & other Life sciences.

2. Eligibility for the award of degree:

The candidate shall be eligible for the award of the degree only if he /she have undergone the prescribed course of the study for the period of not less than 2 academic years, passed the examinations of all the 4 semesters prescribed.

3.Course of the study:

- Core Subjects
- Elective Subjects
- Extra Disciplinary Elective
- Soft Skill
- Internship
- Project

4. Passing minimum:

A candidate shall be declared to have passed in each paper /practical of the main subject of study wherever prescribed, if she secured NOT LESS THAN 50 % of the marks prescribed for the examination.

5. Classification of successful candidates:

- Successful candidates passing the examination and securing the marks 60 % and above , 50% and above but below 60 % in the aggregate shall be declared to have passed the examination in the FIRST and SECOND Class respectively

  .
- Candidates who pass all the examinations prescribed for the course in the FIRST APPEARANCE ITSELF ALONE are eligible for ranking.

6. Question paper pattern :

COMPONENT	NATURE OF THE QUESTION	MAXIMUM MARKS
SECTION A	Remembering / Recalling concepts	20
SECTION B	Recalling / Understanding concepts	40
SECTION C	Understanding / Applying concepts	40

CREDITS

Minimum Credits - 91

Optional Extra credits

Self study papers-2(Students who have no arrears and who have obtained distinction in all the previous semesters alone are eligible for these papers.)

PROGRAMME EDUCATIONAL OBJECTIVES

On obtaining a Postgraduate degree the students will be able to:

- Apply knowledge to pursue research in various fields of Biochemistry.
- Perform well as successful Biochemists in Medical, Pharma and Food Industry
- Handle instruments with expertise and will be able to work both individually & as a part of a team.
- Communicate scientific information in an ethical manner to the society
- Contribute to promoting environmental sustainability and social inclusivity

PROGRAMME OUTCOMES (PO)

On completion of the Programme, the learner will be able to

PO1– To acquire advanced conceptual knowledge and comprehensive understanding of the fundamental principles in respective discipline

PO2– To apply knowledge and critically evaluate the concepts and scientific developments to take up any challenge

PO3- To visualize and work on laboratory multidisciplinary tasks related to current research in the fields of Mathematical, Physical and Life sciences

PO4– To acquire research based knowledge and design methods to conduct investigations of complex problems in research/ Industrial field and achieve employability / self employment.

PO5- To communicate effectively ideas verbally in English, leading to Entrepreneurship ventures such as consultancy and training

PO6- Employ innovative and environment friendly methods, novel ideas to solve complex and challenging societal and environmental issues

PROGRAMME SPECIFIC OUTCOMES (PSO)

On completion of M.Sc Biochemistry, the students will be able to:

1. Explain the advanced concepts of various domains of Biochemistry
2. Design and demonstrate experiments in fields of Molecular Biology, Enzymology, Genetics, food analysis, Clinical Biochemistry, Immunology, Pharmacology and Bioinformatics.
3. Exhibit computational ability by utilizing the conceptual knowledge, and statistical approaches.
4. Demonstrate job oriented skills in relevant industries and diagnostic & Research laboratories.
5. Pursue research in life sciences and contribute their knowledge to the betterment of the society in various research and health care sectors. Utilise effective scientific communication skills both written & oral enabling them to present / publish papers and apply for grants & patents.

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI -08

CURRICULUM (2021-22 ONWARDS)

POSTGRADUATE PROGRAMME PROFILE

DEPARTMENT OF BIOCHEMISTRY

COURSE CODES AND CREDITS

TOTAL MINIMUM CREDITS: 91 **TOTAL TEACHING HOURS: 120**

I SEMESTER											
S.No	**CORE/ALLIED/ELECTIVE**	**TITLE OF THE PAPER**	**CODE**	**L**	**T**	**P**	**H**	**C**	**CA**	**SE**	**MM**
1	**Core 1**	**Biomolecules and Membrane Biochemistry**	**15SP21/1C/BMB**	**3**	**1**	**0**	**4**	**4**	**40**	**60**	**100**
2	**Core 2**	**Biochemical tools & techniques**	**15SP21/1C/BTT**	**3**	**1**	**0**	**4**	**4**	**40**	**60**	**100**
3	**Core 3**	**Applied Physiology**	**15SP21/1C/APH**	**3**	**1**	**0**	**4**	**4**	**40**	**60**	**100**
4	**Elective 1**	**Elective-Molecular Genetics**	**15SP21/1E/MOG**	**3**	**1**	**0**	**4**	**3**	**40**	**60**	**100**
5	**Elective 2**	**Elective-Biostatistics**	**15SP21/1E/BST**	**3**	**1**	**0**	**4**	**3**	**40**	**60**	**100**
6	**Soft Skill**	**Soft Skill- Personality Enrichment for Women**		**2**	**0**	**0**	**2**	**2**	**-**	**50**	**50**
7	**Core Practical**	**Core Practical I –Food Analysis and Chromatographic Separation**	**15SP21/2C/CP1**	**0**	**0**	**4**	**4**	**-**	**-**	**-**	**-**
8	**Core Practical**	**Core Practical II – Separation methods and enzymology**	**15SP21/2C/CP2**	**0**	**0**	**4**	**4**	**-**	**-**	**-**	**-**

SEMESTER II											
S.No	**CORE/ALLIED/ELECTIVE**	**TITLE OF THE PAPER**	**CODE**	**L**	**T**	**P**	**H**	**C**	**CA**	**SE**	**MM**
9	**Core 4**	**Enzymes and Enzyme Technology**	**15SP21/2C/EET**	**3**	**1**	**0**	**4**	**4**	**40**	**60**	**100**
10	**Core 5**	**Metabolism And Metabolic disorders**	**15SP21/2C/MMD**	**3**	**1**	**0**	**4**	**4**	**40**	**60**	**100**
11	**Core 6**	**Hormones And Cell Signalling**	**15SP21/2C/HCS**	**3**	**1**	**0**	**4**	**4**	**40**	**60**	**100**
12	**Elective 3**	**Elective -** **Research Methodology**	**15SP21/2E/REM**	**3**	**1**	**0**	**4**	**3**	**40**	**60**	**100**
13	**Extra disciplinary Elective 1**	**Extra disciplinary elective**		**3**	**1**	**0**	**4**	**3**	**-**	**-**	**-**
14	**Soft Skill**	**SoftSkill - Foreign Language**		**2**	**0**	**0**	**2**	**2**	**-**	**50**	**50**
15	**Core Practical**	**Core practical I –Food Analysis and Chromatographic Separation**	**15SP21/2C/CP1**	**0**	**0**	**4**	**4**	**4**	**40**	**60**	**100**
16	**Core Practical**	**Core practical II- Separation methods and Enzymology**	**15SP21/2C/CP2**	**0**	**0**	**4**	**4**	**4**	**40**	**60**	**100**
17	**Internship**	**During Summer Vacation**					**Min 21 days**	**2**			

III SEMESTER											
S.No	**CORE/ALLIED/ELECTIVE**	**TITLE OF THE PAPER**	**CODE**	**L**	**T**	**P**	**H**	**C**	**CA**	**SE**	**MM**
18	**Core 7**	**Macro Molecular Biology**	**15SP21/3C/MMB**	**4**	**0**	**0**	**4**	**4**	**40**	**60**	**100**
19	**Core 8**	**Advanced Clinical Biochemistry & Biomedical Instrumentation**	**15SP21/3C/ACB**	**4**	**0**	**0**	**4**	**4**	**40**	**60**	**100**
20	**Elective 4**	**Elective – Pharmacology**	**15SP21/3E/PRY**	**4**	**0**	**0**	**4**	**3**	**40**	**60**	**100**
21	**Extra disciplinary Elective 2**	**Extra disciplinary elective**		**4**	**0**	**0**	**4**	**3**	**40**	**60**	**100**
22	**Soft Skill 3**	**Soft skill -Computing Skills**	**15SP21/3S/COS**	**1**	**1**	**0**	**2**	**2**	**-**	**50**	**50**
23	**CorePractical**	**Core Practical- III** **Immunology & Clinical Biochemistry**	**15SP21/4C/CP3**	**0**	**0**	**4**	**4**	**-**	**-**	**-**	**-**
24	**Core Practical**	**Core practical IV- Molecular biology and antioxidant studies**	**15SP21/4C/CP4**	**0**	**0**	**4**	**4**	**-**	**-**	**-**	**-**
25	**Project**	**Project**		**0**	**0**	**4**	**4**	**-**	**-**	**-**	**-**

IV SEMESTER											
S.No	**CORE/ALLIED/ELECTIVE**	**TITLE OF THE PAPER**	**CODE**	**L**	**T**	**P**	**H**	**C**	**CA**	**SE**	**MM**
26	**Core 9**	**Advanced Immunology**	**15SP21/4C/AIM**	**5**	**0**	**0**	**5**	**4**	**40**	**60**	**100**
27	**Core 10**	**Advanced Biotechnology**	**15SP21/4C/ABI**	**5**	**0**	**0**	**5**	**4**	**40**	**60**	**100**
28	**Elective 5**	**Elective – Bioinformatics**	**15SP21/4E/BIN**	**3**	**1**	**0**	**4**	**3**	**40**	**60**	**100**
29	**Soft Skill**	**Soft skill- Presentation Skills**	**15SP21/4S/PRS**	**1**	**1**	**0**	**2**	**2**	**-**	**50**	**50**
30	**Core Practical**	**Core Practical- III Immunology & Clinical Biochemistry**	**15SP21/4C/CP3**	**0**	**0**	**5**	**5**	**4**	**40**	**60**	**100**
31	**Core Practical**	**Core practical IV- Molecular biology and antioxidant studies**	**15SP21/4C/CP4**	**0**	**0**	**5**	**5**	**4**	**40**	**60**	**100**
32	**Project**	**Project**	**15SP21/4C/PRJ**	**0**	**0**	**4**	**4**	**4**	**40**	**60**	**100**
I	**Extra Credits (OPTIONAL)**	**Self-Study (Semester III)**		**-**	**-**	**-**	**-**	**2**	**-**	**100**	**100**

SELF STUDY PAPERS FOR EXTRA CREDITS

S.No	CORE/ALLIED/ ELECTIVE	TITLE OF THE PAPER	CODE	L	T	P	H	C	CA	SE	MM
1	SELF STUDY	Ecology & Environmental toxicology	15SP21/3SS/ECE					2		100	100
2	SELF STUDY	Bioethics	15SP21/3SS/BIE					2		100	100

Elective Subjects offered to other departments											
S.No	CORE/ALLIED/ELECTIVE	TITLE OF THE PAPER	CODE	L	T	P	H	C	CA	SE	MM
1	ELECTIVE	Women and Health	15SP21/2E/WOH	3	1	0	4	3	40	60	100
2	ELECTIVE	Lifestyle Associated Diseases	15SP21/3E/LIF	3	1	0	4	3	40	60	100

L = Lecture Hours T = Tutorial Hours P=Practical Hours H = Hours per week

C= Credits CA=Continuous Assessment

SE=Semester Examinations MM=Maximum Marks

EVALUATION PATTERN FOR CONTINUOUS ASSESSMENT

CA marks for Core & Elective papers

COMPONENT	TIME	MAX.MARKS	CAMARK
1. TEST I	2 HRS	50 MARKS (TO BE CONVERTED)	10
2.TEST II	2 HRS	50 MARKS (TO BE CONVERTED)	10
3.ASSIGNMENT/SEMINAR/ FIELD VISIT			10
4.PARTICIPATORY LEARNING			10
		Total	**40**

PRACTICAL PAPERS

COMPONENT	MAX.MARKS	CAMARK
1. MODEL PRACTICAL EXAM	40 MARKS (TO BE CONVERTED)	20
2. PARTICIPATORY LEARNING		10
3. INTERNAL VIVA		0
	Total	**40**

PROJECT

COMPONENT	CAMARK
Periodical Submission	**10**
Internal viva	10

Participatory learning	20
Total	**40**

CA TEST

QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total
K 1	**A-7X2 marks**	**50**	**14**	**50**
K1. K 2	**B-2/3x 8 marks**	**500**	**16**	
K2, K 3	**C-1/2x20 marks**	**1500**	**20**	

RUBRICS FOR CONTINUOUS ASSESSMENT

Assignment	**Content/originality/Presentation/Schematic Representation and Diagram/Bibliography**

Seminar	**Organisation/Subject Knowledge/Visual Aids/Confidence level/presentation-Communication and Language**
Field Visit	**Participation/Preparation/Attitude/Leadership**
Participation	**Answering Questions/Clearing Doubts/Participating in Group Discussions/Regular Attendance**
Case Study	**Finding the Problem/Analysis/Solution/Justification**
Problem Solving	**Understanding Concepts/Formula and Variable Identification/Logical Sequence/Answer**
Group Discussion	**Preparation/Situation Analysis/Relationship Management/Information Exchange/Delivery Skills**
Flipped/Blended Learning	**Preparation/Information Exchange/ Group interaction/Clearing doubts**

- FIRST FOUR RUBRICS SHOULD BE INCLUDED.
- OTHERS ARE OPTIONAL BASED ON TEACHING-LEARNING METHODOLOGY ADOPTED FOR THE PROGRAMME OF STUDY

END SEMESTER EVALUATION PATTERN-PG

THEORY PAPERS

SEMESTER I/II/III/IV

DOUBLE VALUATION BY COURSE TEACHER AND EXTERNAL EXAMINER

MAXIMUM MARKS: 100 TO BE CONVERTED TO 60

PASSING MARKS: 50

PRACTICAL PAPERS

SEMESTER II/IV

DOUBLE VALUATION BY COURSE TEACHER AND EXTERNAL EXAMINER

MAXIMUM MARKS: 100 TO BE CONVERTED TO 60

PASSING MARK:30

PROJECT PAPER

SEMESTER: IV semester

DOUBLE VALUATION BY RESEARCH SUPERVISOR AND EXTERNAL EXAMINER

DISSERTATION:40

VIVA: 20

MAXIMUM MARKS:60

PASSING MARKS:30

SOFT SKILLS PAPERS

SEMESTER I/II/III/IV

SINGLE VALUATION BY COURSE TEACHER

MAXIMUM MARKS: 50

PASSING MARKS:25

QUESTION PAPER PATTERN FOR SOFT SKILL

Knowledge Level	**Section**	**Word Limit**	**Marks**	**Total**
K 1, K2	**A-5X10**	**350**	**50**	**50**

SELF STUDY PAPER

SINGLE VALUATION

MAXIMUM MARKS:100

PASSING MARK: 50

QUESTION PAPER PATTERN FOR SELF STUDY PAPER

Knowledge Level	**Section**	**Word Limit**	**Marks**	**Total**	**Special Instruction if any**
K 1	**A-10X2 marks**	**50**	**20**	**100**	**Question number compulsory for all questions** **Section A - Two questions from each unit** **Section B - Minimum of 1 question from each unit**
K1, K 2	**B-5/8x8 marks**	**500**	**40**		
K2, K 3	**C- 2/4 x 20 marks**	**1200**	**40**		

					Section C - 4 Questions from 4 different Units

SEMESTER I

BIOMOLECULES AND MEMBRANE BIOCHEMISTRY

TOTAL HOURS: 60 **COURSE CODE:15SP21/1C/BMB**

CREDITS: 4 **L-T-P: 3-1-0**

COURSE OBJECTIVES:

1. To explain the structure and role of glycans.
2. To discuss the organization and folding of proteins. To study about the molecular structure of interactions proteins involved in cytoskeletal structures and interactions among cells.
3. To instill the structural features of lipids and nucleic acids.
4. To explain the arrangement, functions and properties of biomolecules in membranes.
5. To study the role of membrane channels in transportation and different movement processes across the membrane.

COURSE OUTLINE:

UNIT I (12 Hours)

Carbohydrates – Overview of Classification, Overview of Structure and biological importance of Monosaccharides, Disaccharides, Homopolysaccharides - storage polysaccharides (starch, dextrin, glycogen), structural polysaccharides (cellulose, chitin). Glycans – Types of glycosylation (N and O - linked glycosylation, extrinsic glycosylation), blood group sugars, glycosphingolipids, preoteoglycans and glycosaminoglycans. Biological roles of glycans. Glycosylation in cancer- mechanism.

UNIT II (12 Hours)

Protein – Overview of Classification based on structure and function, Overview of forces involved in the stabilization of protein structure, Ramachandran plot, primary, secondary, tertiary and quarternary structure. Super secondary structures – helix (helix-turn-helix, helix-loop-helix, helix-hairpin-helix, α-α corner), sheets (β hairpin, β-β corner, greek key meander), mix (β-α-β, Rossman fold).

Folding of proteins - molecular chaperons (GroEL-ES system), chaperonins and protein disulphide isomerase (PDI). Defects in protein folding – mad-cow disease. Simple problems based on length of the protein in extended and folded conformations, number of amino acids in a given molecular weight. Proteins in cytoskeleton - microtubules, micro filaments, intermediate

filaments. Cell – cell and cell- matrix adhesion proteins, Cell junctions - Anchoring junctions, Tight junctions and Gap junctions.

UNIT III (12 Hours)

Lipids – Overview of classification, Overview of structure and functions of fatty acids triglycerides, phospholipids and glycolipids. Structure and functions of prostaglandins, thromboxanes, leukotrienes. Structure and functions of sterols and steroids.

Nucleic acids - A, B and Z types of DNA (an overview), Triple helix and quadruplex DNA, topology of DNA- writhe, twist and linking number , Overview of types of RNA- rRNA, tRNA, mRNA and other types – Structure and functions. Simple problems based on number of nucleotides, codons in a given DNA.

UNIT IV (12 Hours)

Composition of biomembranes – Prokaryotes, eukaryotes, neuronal and subcellular membrane. Membrane composition - Membrane lipids, Membrane carbohydrates, Membrane proteins. Micelle and bilayer sheets. Membrane model - Fluid Mosaic model. Biological Membranes - Function of biomembranes, features - fluidity, cold acclimatization, self sealing nature, selective permeability. Membrane asymmetry, Flip flop movement- flippases, floppases, RBC membrane as a model.

UNIT V (12 Hours)

Transport process- Overview of Simple diffusion, Osmosis, Facilitated diffusion - gated channels, Active transport - Uniport, Symport, Passive transport – glucose transporter, anion transporter. Active transport – primary (P type ATPase - Na+/K+ ATPAse; V type ATPase - H+-ATPase; F type - ATP synthetase), secondary (lactose permease, Na^+ - glucose symport). Ion channel – Na^+ / K^+ (voltage gated channel), acetyl choline (ligand gated channel). Specialised membrane pores - porins, aquaporins. Ionopores - Valinomycin-mobile carrier ionophore, Gramicidin-channel forming ionophores.

RECOMMENDED TEXTBOOKS:

1. Principles of Biochemistry - Lehninger, Nelson and Cox, WH Freeman and Company, New York, USA, 4th Edition, 2005.
2. Biochemistry- Donald Voet& Judith G. Voet, John Wiley and Sons Publication, 3rd Edition, 2004.

REFERENCE BOOKS:

1. Harper's Illustrated Biochemistry -Robert K. Murray, Darryl K. Granner, Peter A. Mayes, Victor W. Rodwell, Mcgraw-Hill, 26th Edition, 2003.

2. Biochemistry- Geoffrey L Zubay, Dubuque, IA : Wm. C. Brown Publishers, 4th Edition, 1998.
3. Biochemistry- Jeremy M Berg, John L Tymoczko, and LubertStryer, Freeman Publications, 6th Edition, 2006.
4. Biochemistry – The Chemical reactions of living cells – David E. Metzler, Academic Press, 2nd Edition, 2003.
5. Introduction to Biochemistry – Mary K. Campbell & Shawn O. Farrell, Cengage Learning, 1st Edition, 2009.

JOURNALS:

1. Indian Journal of Biochemistry & Biophysics
2. Indian Journal of Experimental Biology
3. International Journal of Biological Macromolecules
4. Biomolecules
5. Journal of Biomolecular Structure and Dynamics

E-LEARNING RESOURCES:

1. https://www.thermofisher.com/in/en/home/life-science/protein-biology/protein-biology-learning-center/protein-biology-resource-library/pierce-protein-methods/protein-glycosylation.html
2. https://ocw.mit.edu/courses/biology/7-88j-protein-folding-and-human-disease-spring-2015/study-materials/
3. https://www.open.edu/openlearn/science-maths-technology/science/biology/nucleic-acids-and-chromatin/content-section-3.4.2
4. https://www.genome.gov/genetics-glossary/Cell-Membrane
5. https://nptel.ac.in/content/storage2/courses/102103012/pdf/mod3.pdf

COURSE OUTCOMES:

CO. Number	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Harness the fundamentals and role of glycans in biological systems	K1, K2, K3
CO 2	Apply the concept gained in modelling the structure of protein and interpret the role of proteins in biological structures and in cell to cell interactions	K2, K3, K4
CO3	Use the knowledge gained on lipids and nucleic acids structures in molecular research.	K1, K2, K3

CO4	Creatively comprehend the role of membrane components with their biological functions	K1, K2, K3
CO5	Apply the molecular mechanism behind the transport of solutes and signals across the membrane in drug delivery process	K2, K3, K4

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	3
CO2	3	3	3	3	3
CO3	3	2	3	3	3
CO4	2	3	3	2	2
CO5	3	3	3	3	3
AVERAGE	**2.8**	**2.8**	**2.8**	**2.8**	**2.8**

KEY: STRONGLY CORRELATED – 3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED – 1, NO CORRELATION – 0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-LCD)
2. Blended Classroom-E Content, Videos
3. Quiz, Seminar
4. Peer Learning

QUESTION PAPER PATTERN:

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,K2	**A-10X2 marks**	**50**	**20**	**100**	Question number compulsory for all questions.

K3,K4	**B-5/8x8 marks**	**500**	**40**		Section A - Two questions from each unit Section B- Minimum of 1 question from each unit. Section C - 4 Questions from 4 different units**.**
K3,K4,K5	**C-2/4x20 marks**	**1200**	**40**		

SEMESTER I

BIOCHEMICAL TOOLS AND TECHNIQUES

TEACHING HOURS: 60 **COURSE CODE:15SP21/1C/BTT**

CREDITS: 4 **L-T-P: 3- 1- 0**

COURSE OBJECTIVES:

1. To Impart Knowledge about possible hazards in a laboratory and follow safety rules.
2. To inculcate the difference between separation, identification and quantification processes.
3. To ingrain the principles of various biochemical tools & techniques.
4. To explain the instrumentation & working of different tools.
5. To expose the students to the applications of each of the analytical methods.

COURSE OUTLINE:

UNIT I **(**12 Hours)

Safe Laboratory practices - General lab safety rules and symbols, Protection from Physical, Chemical and Biological hazards, Hazardous waste management, Containment facility - Primary and secondary barriers, Four Levels of Biosafety, GLP, GCP - Objectives & Guidelines

Radioactivity - Basic concepts in radioactivity, types of decay, units of radioactivity, Detection and quantification of Radioactivity - GM counter, Scintillation counter, Autoradiography, Isotope dilution; calculations based on radioactivity- Half life & isotope dilution. Applications of radioisotopes in Diagnosis, Prognosis and Research.

UNIT II **(**12 Hours)

Centrifugation Techniques - Basic principles of Sedimentation, Preparative centrifugation - Differential centrifugation, Density gradient centrifugation - Rate zonal and Isopycnic, Analytical

ultracentrifugation - Molecular weight determination by sedimentation velocity and sedimentation equilibrium method.

Electrochemical Techniques: General principle of Electrochemistry; Potentiometry - Ion selective Electrodes, Amperometry- Clarkes oxygen electrode, Polarography, Electrochemical Chip Technology.

UNIT III (12 Hours)

Chromatography - General principles of adsorption and partition chromatography, Basic principles of column chromatography, Gel permeation Chromatography, Ion exchange Chromatography, Affinity Chromatography, Gas liquid Chromatography, High performance liquid chromatography, Capillary electrochromatography, SEP Box

UNIT IV (12 Hours)

Electrophoresis - General principle, Factors affecting Electrophoretic separation, Isoelectric focussing , SDS PAGE, 2D PAGE , 3 D gel electrophoresis, Estimation and recovery of proteins in gels; Electrophoresis of nucleic acids - agarose gel electrophoresis, DNA sequencing gels, Pulse field gel electrophoresis; Blotting techniques - Southern, Northern and Western; Single cell gel electrophoresis - Comet Assay;Immunoelectrophoresis.

UNIT V (12 Hours)

Spectroscopy - General principles, Principle, Instrumentation and applications - UV-Visible Spectrophotometry, Simple calculations based on Beer Lambert's Law; Fluorimetry, Atomic absorption spectroscopy, Flame emission spectroscopy, IR Spectroscopy, Nephlometry, Luminometry.

RECOMMENDED TEXTBOOKS:

1. Principles and techniques of practical Biochemistry – Keith Wilson and John Walker , 7th Edition, Cambridge University Press.2004
2. Biophysical Chemistry Principles and Techniques – Upadhyay&UpadhyayNath, Himalaya Publishing House, Reprint 2006.

REFERENCE BOOKS:

1. Instrumental methods of Chemical Analysis- Chatwal & Anand, Himalaya Publishing House. Reprint 2005
2. Analytical Biochemistry- Mohammed Raees
3. Analytical Biochemistry- David J Holme, Prentice Hall ,1998
4. Text Book of Analytical Biochemistry-Jessica Carol ,SyrawoodPublising House ,2016
5. Analytical Biochemistry- Artie Weissberg, Syrawood Publising House, 2016

JOURNALS:

1. Analytical Biochemistry
2. Biochemistry &Analytical Biochemistry

3. International Journal of Analytical Biochemistry Research
4. Analytical and Bioanalytical Chemistry
5. Trends in analytical Chemistry

E-LEARNING RESOURCES:

1. https://www.ncbi.nlm.nih.gov › books ›
2. http://www cancer.umn.edu/for-researchers/shared resources/Analytical biochemistry.
3. www.merlot.org
4. https://chem.libretexts.org
5. https://www.thermofisher.com/blog/ask-a-scientist/

COURSE OUTCOMES:

CO . NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Identify safety signs and follow safe lab practices. Use radioactivity in biochemical analysis.	K1,K2
CO 2	use the principles of centrifugation and electrochemistry to separate and identify compounds	K2, K3
CO3	Explain various chromatographic techniques and apply them practically	K2,K3
CO4	Use appropriate electrophoretic method in identification & separation of biomolecules	K3, K4
CO5	Compare various spectroscopic methods; choose and apply suitable techniques to quantify different biomolecules	K3, K4

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	1	1	1
CO2	2	3	3	3	3

CO3	2	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
AVERAGE	**2.2**	**2.8**	**2.8**	**2.8**	**2.8**

KEY: STRONGLY CORRELATED – 3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED – 1, NO CORRELATION – 0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-LCD)
2. Blended Classroom-E Content, Videos
3. Quiz, Seminar
4. Peer Learning

QUESTION PAPER PATTERN:

Knowledge Level	**Section**	**Word Limit**	**Marks**	**Total**	**Special Instructions if any**
K1,K2	**A-10X2 marks**	**50**	**20**	**100**	Question number compulsory for all questions. Section A - Two questions from each unit Section B- Minimum of 1 question from each unit. Section C - 4 Questions from 4 different units**.**
K3,K4	**B-5/8x8 marks**	**500**	**40**		
K3,K4,K5	**C-2/4x20 marks**	**1200**	**40**		

SEMESTER I

APPLIED PHYSIOLOGY

TEACHING HOURS: 60 **COURSECODE:15SP21/1C/APH**

CREDITS: 4 **L-T-P : 3-1-0**

COURSE OBJECTIVES:

1. To impart knowledge on the Anatomy of digestive organs and function tests.
2. To gain knowledge on Nervous systems, spinal cord & Brain.
3. To appreciate the functional Anatomy of kidney, nephrons and KFT
4. To understand cardiac, muscular and Respiratory System.
5. To study the Female and male reproductive system.

COURSE OUTLINE:

UNIT I (12 Hours)

Digestive system :– Anatomy of digestive system. Structure & functions of Liver-Liver function test -Vanden Berg reaction,Hippuric acid test, & Prothrombin time. Salivary, Gastric & Biliary Secretion- Composition and functions. Gastric function test-Examination of resting content, fractional gastric analysis & stimulation test.

UNIT II (12 Hours)

Nervous system: Organisation, Neurons and its types, conduction of nerve impulse and neurotransmission. Synapses & Mechanism of synaptic transmission, CNS - Structure of the Spinal Cord &Brain-chemical composition, metabolism, metabolic adaptation, cAMP. Biochemical aspects of learning and memory. Enkephalins and endorphins.

UNIT III (12 Hours)

Excretory system: Functional anatomy of kidney, Structure of Nephrons, formation of urine. Micturition & Normal and abnormal constituents of urine.Non excretory functions of kidney. Kidney function test- Clearance test- urea, creatinine and inulin. PAH test & filtration fraction.

UNIT IV (12 Hours)

Circulatory System: Structure and function of heart, cardiac cycle, heart sounds, vasomotor and coronary circulation.

Muscular system: Structure of Skeletal muscle and muscle contraction. Electromyography and Nerve conduction studies, Skeletal system(Overview).

Respiratory system-Structure and Functions of the lungs - Gaseous exchange. Pulmonary function test- Spirometry,plethysmography& diffusion capacity test.

UNIT V (12 Hours)

Reproductive System :Anatomy of female reproductive system and Causes of female infertility (acquired and genetic), treatments, Gametogenesis, fertilization (natural and assisted (*in vitro*), Pregnancy (first,second& third trimester),Physiological changes Associated with Pregancy, Placenta as source of stem cells, cord banking, reproductive aging (menopause and andropause). Anatomy of Male reproductive system and causes of male infertility (environmental and genetic) & treatments.

RECOMMENDED BOOKS:

1. Human Anatomy and Physiology- Elaine Marieb ,11th Edition ,Pearson Publications.
2. Textbook of Human Physiology-AK. Jain , 4th Edition 2008.

REFERENCE BOOKS:

1. TextBook of Medical Physiology by Guyton and Hall, 11th Edition 2006, Press Pub Saunders.
2. Principles of Biochemistry- Voet ,Voet& Pratt 4th Edition, John Wiley & Sons,2013
3. Essentials of Physiology –Sembulingam,JP publications ,6th Editions
4. Physiology – Linda .S Costanzo.
5. Principles of Medical Physiology – Sabyasachisircar 12th Edition.

JOURNALS:

1. International Journal of Advanced Physiology and Allied Sciences

2. American Journal of Physiology
3. Indian Journal of Physiology and Pharmacology
4. National Journal of Physiology, Pharmacy and Pharmacology
5. Journal of Applied Physiology

E-LEARNING RESOURCES:

1. https://openstax.org/books/anatomy-and-physiology/pages/23-2-digestive-system-processes-and-regulation
2. https://openstax.org/books/anatomy-and-physiology/pages/12-1-basic-structure-and-function-of-the-nervous-system
3. https://courses.lumenlearning.com/boundless-ap/chapter/overview-of-the-urinary-system/
4. https://www.kenhub.com/en/library/anatomy/circulatory-system
5. https://courses.lumenlearning.com/boundless-ap/chapter/overview-of-the-muscular-system/
6. https://courses.lumenlearning.com/boundless-ap/chapter/overview-of-the-respiratory-system/
7. https://courses.lumenlearning.com/suny-ap2/chapter/anatomy-and-physiology-of-the-female-reproductive-system/
8. https://courses.lumenlearning.com/boundless-ap/chapter/overview-of-the-reproductive-system/
9. https://openstax.org/books/anatomy-and-physiology/pages/27-1-anatomy-and-physiology-of-the-male-reproductive-system
10. https://www.healthline.com/health/pulmonary-function-tests

COURSE OUTCOMES:

CO. NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Explain the human digestive system and learn to identify various liver and gastric disorders.	K2,K3
CO 2	Discuss the functions of spinal cord & d Brain-chemical composition, metabolism, metabolic adaptation its Biochemical aspects of learning and memory	K3
CO3	Explain the structure and function of kidney and nephrons to learn the concept of dialysis and kidney transplantation.	K1,K2

CO4	Discuss the importance of cardiac and respiratory system. To create awareness on cardiovascular and respiratory diseases.	K3, K4
CO5	Practice about personal hygiene & reduce infertility problems. Significance of cord banking and therapeutic uses of stem cells.	K3 , K4

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	1	1	1
CO2	2	3	3	3	3
CO3	2	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
AVERAGE	**2.2**	**2.8**	**2.8**	**2.8**	**2.8**

KEY: STRONGLY CORRELATED – 3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED – 1, NO CORRELATION – 0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-LCD)
2. Blended Classroom-E Content, Videos
3. Quiz, Seminar
4. Peer Learning

QUESTION PAPER PATTERN:

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,K2	**A-10X2 marks**	**50**	**20**	**100**	Question number compulsory for all questions. Section A - Two questions from each unit Section B- Minimum of 1 question from each unit. Section C - 4 Questions from 4 different units**.**
K3,K4	**B-5/8x8 marks**	**500**	**40**		
K3,K4,K5	**C-2/4x20 marks**	**1200**	**40**		

SEMESTER I

ELECTIVE-MOLECULAR GENETICS

TEACHING HOUR: 60 **COURSE CODE:15SP21/1E/MOG**

CREDITS: 3 **L-T-P: 3-1-0**

COURSE OBJECTIVES:

1. To impart Knowledge about the organization, structure & function of chromosomes and the consequences of chromosomal anomalies and about Mendelian Genetics .
2. To impart knowledge about Various Genetic Inheritance..
3. To educate students about Epigenetics and its functional consequences .
4. To enable the students to understand the genetic basis of Prevalent diseases like Diabetes,Cardiovascular Disease and Cancer
5. To help students understand the genetic basis of common neurological diseases and to help them understand the genetic differences in drug metabolism and to impart knowledge about Population and Evolutionary genetics .

COURSE OUTLINE:

UNIT I (12 Hours)

Genes & Chromosomes -Definition of gene, Organization of genes, Chromosome– Composition, structure and function,Types , Human Karyotype ,Types of chromosomal anomalies-Ploidy,Chromosomal Aberrations – Duplication, Inversion, Deletion and Translocation, Gene Mutations,

Mendelian Genetics -Mendel's experiments-monohybrid, dihybrid, trihybrid and multi hybrid crosses. Concept of Allele, multiple alleles, pseudo allele, Extensions of mendelian principles: Codominance, Incomplete dominance, Gene interactions, Pleiotropy, Penetrance and expressivity, Phenocopy, Linkage and crossing over.

UNIT II (12 Hours)

Genetic Inheritance - Autosomes, Autosomal Inheritance, Autosomal linked diseases, Autosomal Dominant Inheritance– Huntington Disease, Autosomal recessive Inheritance- Cystic Fibrosis, Allosomes, Structure of sex chromosomes , Sex determination, Sex linked inheritance, X linked Dominant- Fragile X Syndrome ,X Linked Recessive - Haemophilia, Mitochondrial Inheritance, Prenatal and Neonatal Genetic disorders diagnosis and Genetic Counselling.

UNIT III (12 Hours)

Epigenetics -Hetero chromatin and Histone interactions , Telomeric Silencing , Polycomb, Trithorax, CpG islands, DNA Methylation ,Prions, Genomic Imprinting, Adaptive Epigenetic Inheritance, Epigenetics &Evolution,Techniques to study epigenetics-Chromatin Immuno precipitation, Chip-Seq,Bisulfite Sequencing, Epigenetic Diseases- Cancer, Mental Retardation,Epigenetic Therapy.

UNIT IV (12 Hours)

Genetic basis of Diseases - Genetics of Non Insulin dependent Diabetes, Molecular Genetics of Cardiovascular Diseases- Disease causing genes of Coronary Artery disease & Myocardial infarction , Genetic basis of cancer- Gene Mutations, Hereditary Cancer ,Genetic Testing of Cancer, Human genetic diseases-Down's Syndrome, Klinefelter's Syndrome, Turner's Syndrome.

UNIT V (12 Hours)

Neurogenetics-Genetic basis of Schizophrenia , Autism, Spinal Muscular atrophy
Pharmacogenetics-Genes & Drugs, Multi drug resistance gene polymorphism.
Population genetics- Hardy Weinberg theory, Factors affecting Hardy Weinberg theory, Gene and genotypic frequencies, Evolutionary Genetics

RECOMMENDED BOOKS:

1. Cell Biology , Genetics, Molecular Biology, Evolution & Ecology- Verma&Agarwal,S . Chand & Company, 2013 Reprint

2. Principles of Genetics – Gardner , Simmons and Snustad. John Wiley & Sons, 8th Edition 1993.

REFERENCE BOOKS:

1. Lewin's Genes X– Krebs Jocelyn, Lewin Benjamin , Goldstein,Eliottt, Kilpatrick, Stephen : 2009 . Jones and Bartlett ,
2. Molecular Cell Biology-Baltimore, 5th Edition, W.H.Freeman Company, 2003.
3. Human Genetics (Third Edition),S.D. Gangane,ISBN 10: 8131211282 / ISBN 13: 9788131211281,Published by Elsevier/Paras Medical Books, 2008
4. Essential Medical Genetics (Essentials Book 23) 6th Edition, Kindle Edition,by Edward S.Tobias , MichaelConnor , Malcolm Ferguson-Smith,ISBN-13: 978-1405169745,ISBN-10: 1405169745
5. Essentials of Human Genetics Paperback – 2009,by Kothari,Universities Press; Fifth edition (2009),ISBN-10: 8173716471,ISBN-13: 978-8173716478

JOURNALS:

1. Journal of Genetics
2. Journal of Human Genetics
3. International Journal of Genetics and Genomics
4. Genetics Research International
5. Genes and Diseases

E-LEARNING RESOURCES:

1. https://www.ndsu.edu/pubweb/~mcclean/plsc431/eukarychrom/eukaryo3.html
2. https://www.ndsu.edu/pubweb/~mcclean/plsc431/mendel/mendel1.html
3. https://nptel.ac.in/courses/102/104/102104056/
4. https://www.msdmanuals.com/en-in/home/fundamentals/genetics/genes-and-chromosomes
5. https://www.who.int/genomics/public/geneticdiseases/en/index1.html
6. https://ghr.nlm.nih.gov/primer/genomicresearch/pharmacogenomics

COURSE OUTCOMES:

CO . NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Discuss about the chromosomal organization,structure, function and identify chromosomal anomalies both structural and numerical. Explain and analyse Mendelian Genetics & Deviation from Mendelian Genetics.	K1,K2
CO 2	Identify the reason for inheritance of gene tic diseases and predict the nature of inheritance	K1,K2,K3
CO3	Discuss about Epigenetics and its functional implications	K2,K3,K4

CO4	Explain the genetic basis of diabetes, identify the genes of coronary heart disease and discuss about human genetic diseases.	K3, K4,K5
CO5	Predict the genetic basis of Neurogenetic diseases and apply the knowledge of genetics in drug dosage determination. Discuss about Population and Evolutionary genetics	K4,K5

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	3
CO2	2	3	3	2	3
CO3	2	3	2	3	3
CO4	3	3	2	3	3
CO5	2	3	3	3	3
AVERAGE	**2.4**	**3**	**2.4**	**2.8**	**3**

KEY: STRONGLY CORRELATED – 3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED – 1, NO CORRELATION – 0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-LCD)
2. Blended Classroom-E Content, Videos
3. Quiz, Seminar
4. Peer Learning

QUESTION PAPER PATTERN:

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any

K1,K2	**A-10X2 marks**	**50**	**20**	**100**	Question number compulsory for all questions. Section A - Two questions from each unit Section B- Minimum of 1 question from each unit. Section C - 4 Questions from 4 different units**.**
K3,K4	**B-5/8x8 marks**	**500**	**40**		
K3,K4,K5	**C-2/4x20 marks**	**1200**	**40**		

SEMESTER I

ELECTIVE- BIOSTATISTICS

TEACHING HOUR: 60 **COURSE CODE:15SP21/1E/BST**

CREDITS: 3 **L-T-P: 3-1-0**

COURSE OBJECTIVES:

1. To enable the student to understand the methods of data collection and different sampling techniques.
2. To introduce different types of studies and methods of presentation of data
3. To enable the student to identify the suitable statistical test to be applied in different studies.
4. To develop competency and expertise in the students for application of statistical methods.
5. To help the student understand the role of statistical analysis in Interpretation of experimental results.

COURSE OUTLINE:

UNIT I (12 Hours)

Biostatistics- An outline of Statistical investigations, Types of data- Based on source and nature of data, Individual observations, Frequency distribution of ungrouped (discrete series) and grouped data (Continuous series), Population and sample - Types of sampling- Advantages & disadvantages. Sampling and non-sampling errors. Concept of Inclusion & Exclusion criteria in studies.Methods of data collection – Experimental, Survey and Observation methods,Fisher's design to reduce experimental error – Replication, Randomization, Local control. Experimental designs- Completely randomized design, Randomized block design, Latin square design.

UNIT II (12 Hours)

Types of studies – Cohort studies, Case control studies, Cross sectional studies- Advantages & disadvantages

Presentation of data in the form of tables – types of tables. Presentation of data in the form of diagrams and graphs.

Descriptive Statistics- Measures of Central tendency- Mean- simple average & weighted average, Median, Mode (Individual observations, Discrete series & Continuous series- Equal & unequal class intervals, Inclusive & exclusive class intervals, Open ended classes) Graphical location of median and mode, Merits and demerits of measures of different measures of Central tendencies.

UNIT III (12 Hours)

Measures of variability- Range, coefficient of range, Quartile deviation, Coefficient of quartile deviation. Standard deviation (Individual observations, Discrete series & Continuous series), Coefficient of variation, Standard error, Variance, Merits and demerits of different methods of dispersion.

Normal distribution curve, Skewness- Karl Pearson's coefficient of skewness, Bowley's measure of skewness, Measure of skewness based on moments, Kurtosis-measure of kurtosis based on moments

Inferential Statistics- Correlation – Types of correlation, Calculation of Pearson's and Rank correlation coefficient, Graphical methods to study correlation,

UNIT IV (12 Hours)

Regression analysis- Regression lines, Calculations using normal equations.

Testing of hypothesis – Steps involved, Level of significance, Type I & Type II errors.

Student's t test – One tailed and two tailed tests, Comparison of mean of population and sample, Comparison of means of two samples (paired and unpaired), Assess significance of correlation coefficient,

UNIT V (12 Hours)

Variance ratio or F test, Analysis of variance (ANOVA)- One way, Duncan multiple range test, Chi-square test- with apriori and without a priori hypothesis

Probability- Definition, Concepts, Theorems, Applications of principles of probability to biological problems. (Proof of theorems not necessary)

RECOMMENDED TEXTBOOKS:

1. Introduction to Biostatistics – N. Gurumani, MJP publishers , 2nd Edition, 2005
2. Principles and Practice of Biostatistics -by B Antonisamy, Prasanna S. Premkumar, Solomon Christopher , Elsevier India 2017

REFERENCE BOOKS:

1. Biostatistical analysis – Jerrold H Zar, Pearson Publishers Fourth Edition , First Indian Reprint 2003
2. Biostatistics - Basic and Advanced - Manju Pandey, Viva books , 2015
3. Mahajan's methods in Biostatistics for Medical students and Research workers- Bratati Banerjee (Editor), Jaypee Brothers Medical Publishers,2018
4. Medical Biostatistics-AbhayaIndrayan , Rajeev Kumar Malhotra, Chapman & Hall/CRC, 2017
5. Introduction to Biostatistics and Research Methods- P.S.S. Sundar Rao, J. Richard,Fifth edition, Phi Learning Pvt Ltd , 2012

JOURNALS:

1. Biostatistics (Oxford academic)
2. International Journal of Clinical Biostatistics & Biometrics
3. Current research in Biostatistics

4. JP Journal of Biostatistics
5. Current Research in Biostatistics

E-LEARNING RESOURCES:

1. www.degruyter.com
2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5453888/
3. http://biostatcourse.fiu.edu/
4. https://www.ncbi.nlm.nih.gov/books/Biostatistics
5. http://www.ru.ac.bd/stat/wp-content/uploads/sites/25/2019/03/501_06_Rohatgi_An-Introduction-to-Probability-and-Statistics-Wiley-2015.pdf

COURSE OUTCOMES:

CO. NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Acquire the knowledge of methods of data collection and different experimental designs	K1,K2
CO 2	Understand the methods of presentation of data and calculation of central tendencies	K1,K2
CO3	To comprehend calculation of measures of dispersion and correlation coefficients	K3,K4
CO4	Acquire the knowledge of testing of hypothesis and drawing of inferences	K4,K5
CO5	Understand the principles and applications of ANOVA & Chi Square	K4,K5

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	3	2	3	3
CO2	3	3	3	3	2
CO3	3	2	3	2	3
CO4	3	3	3	3	3
CO5	3	3	3	2	3
AVERAGE	**2.8**	**2.8**	**2.8**	**2.6**	**2.8**

KEY: STRONGLY CORRELATED – 3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED – 1, NO CORRELATION – 0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-LCD)
2. Blended Classroom-E Content, Videos
3. Quiz, Seminar
4. Peer Learning
5. Problem solving

QUESTION PAPER PATTERN:

Knowledge Level	**Section**	**Word Limit**	**Marks**	**Total**	**Special Instructions if any**
K1,K2	**Sec A – 10 x 2**	**50**	**20**	**100**	Question number compulsory for all questions. Section A - Two questions from each unit Section B- Minimum of 1 question from each unit. Minimum of 2 problems to be included. Section C - 4 Questions from 4 different units. Minimum of 1 problem to be included.
K3,K4	**B – 5/8 x 8**	**500**	**40**		
K3,K4,K5	**C – 2/4 x 20**	**1200**	**40**		

SEMESTER II

ENZYMES AND ENZYME TECHNOLOGY

TOTAL HOURS: 60 **COURSE CODE:15SP21/2C/EET**

CREDITS: 4 **L-T-P: 3-1-0**

COURSE OBJECTIVES:

1. To instill the knowledge about enzyme classification, factors influencing its activity and application of enzymes in various fields.
2. To impart the role of catalytic aminoacids in enzyme action and various mechanism of enzyme catalysis.
3. To explain about cofactors and mechanism of Pyruvate dehydrogenase action
4. To explain the enzymes kinetics and mechanism of allosteric enzyme regulation.
5. To explain the methods adopted for extraction and purification of enzymes and applications of enzyme technologies

COURSE OUTLINE:

UNIT I (12 Hours)

Nomenclature and IUB Classification of enzymes, Enzyme units, Activation energy, Progressive curve of uncatalysed and enzyme catalysed reaction, Specificity and Active site. Factors affecting enzyme activity- substrate concentration, enzyme concentration, pH, temperature and modulators, Applications of enzymes in industries (food, paper, textile, leather), enzymes in clinical diagnosis and as therapeutic agents.

UNIT II (12 Hours)

Trapping of ES Complex, Mapping of active site by chemical modification. Site directed mutagenesis of enzymes. Mechanism of enzyme activity-covalent catalysis, proximity and orientation effects, acid-base catalysis, strain and distortion. Structure and mechanism of action of Chymotrypsin, Lysozyme and Ribonuclease.

UNIT III (12 Hours)

Coenzymes - structure and function (reactions involving CoA, TPP, PLP, NAD/NADP, FMN/FAD, Biotin and Cobamide coenzymes. Role of metal cofactors in enzyme catalysis (Carbonic anhydrase). Multienzyme systems - Mechanism of action of Pyruvate dehydrogenase complex.

UNIT IV (12 Hours)

Michaelis Menten equation, Line -Weaver Burk plot, EadieHofstee plot, Hanes plot, Eisenthal and Cornish Bowden plot, Briggs Haldane modifications. Determination of Km and Vmax, Enzyme turn over. Simple problems based on Km and Vmax. Bisubstrate reactions-single and double displacement reactions. Methods to investigate the kinetics – Rapid reaction technique (stopped and continuous flow technique).

Enzyme inhibition- Competitive, Uncompetitive and Noncompetitive inhibition with derivation. Allosteric enzymes-K series and V series enzymes, MWC and KNF models and Feed back inhibition with ATCase as an example.

UNIT V (12 Hours)

Homogenization technique for enzyme isolation, separation methods of cellular organelles, purification of enzymes - chromatography, electrophoresis, dialysis, criteria of purity of enzymes. Simple problems based on specific activity and enzyme purification.

Immobilized enzymes- methods of immobilization and applications. Isoenzymes (LDH, CK), Biosensors – Features and principle, Types (Amperometric and Optical - clinical applications). Abzymes, Ribozymes, Artificial enzymes.

RECOMMENDED TEXTBOOKS:

1. Enzymes: Biochemistry, Biotechnology and Clinical Chemistry - Trevor Palmer, Horwood Publishing Limited, East- West Press Edition, 2004.
2. Principles of Biochemistry - Lehninger, Nelson and Cox, WH Freeman and Company, New York, USA, 4th Edition, 2005.

REFERENCE BOOKS:

1. Biochemistry- Donald Voet& Judith G. Voet, John Wiley and Sons Publication, 3rdEdition, 2004.
2. Biochemistry- Geoffrey L Zubay, Dubuque, IA : Wm. C. Brown Publishers, 4th Edition, 1998.
3. Enzyme Technology- AnushaBaskar and V.GVidhya, MJP Publishers, 2014.
4. Fundamentals of Enzymology: the Cell and Molecular Biology of Catalytic proteins - Nicholas C.Price and Lewis Stevens, Oxford University Press, 3rd Edition, 2000.
5. Biochemistry- Jeremy M Berg, John L Tymoczko, and LubertStryer, Freeman Publications, 6th Edition, 2006.

JOURNALS:

1. Enzyme Research
2. Journal of Enzyme and Microbial Technology

3. Journal of Enzyme Inhibition and Medicinal Chemistry
4. ACS Catalysis
5. Biocatalysis and Biotransformation

E-LEARNING RESOURCES:

1. https://nptel.ac.in › /courses/102/102/102102033/
2. https://nptel.ac.in/content/storage2/courses/104103018/pdf/mod3.pdf
3. https://www.tuscany-diet.net/2019/04/10/pyruvate-dehydrogenase-complex/
4. https://www.khanacademy.org/science/ap-biology/cellular-energetics/environmental-impacts-on-enzyme-function/a/basics-of-enzyme-kinetics-graphs
5. https://www.smohanty.org/Publications_Journals/2006/MohantyIEEEPotentials2006Mar-Apr.pdf

COURSE OUTCOMES:

CO. NO.	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Consider the role of various factors in designing enzymes with optimal activity for various applications	K1, K2, K3
CO 2	Comprehend the role of aminoacids in enzyme activity by various mechanisms and apply in the field of enzyme engineering.	K2, K3, K4
CO3	Predict the role of cofactors and multienzymes in living systems	K2,K3,K4
CO4	Apply the kinetics of enzyme as tool in the fields of industry, medicine and agriculture.	K2, K3,K4
CO5	Apply the knowledge in extraction and purification of new enzymes and for designing artificial enzymes. Use of biosensors in clinical diagnosis	K3, K4, K5

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	3	3	3	2
CO2	3	2	2	2	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
AVERAGE	**2.8**	**2.8**	**2.8**	**2.8**	**2.8**

KEY: STRONGLY CORRELATED – 3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED – 1, NO CORRELATION – 0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-LCD)
2. Blended Classroom-E Content, Videos
3. Quiz, Seminar
4. Peer Learning

QUESTION PAPER PATTERN:

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,K2	**A-10X2 marks**	**50**	**20**	**100**	Question number compulsory for all questions. Section A - Two questions from each unit Section B- Minimum of 1 question from each unit. Section C - 4 Questions from 4 different units**.**
K3,K4	**B-5/8x8 marks**	**500**	**40**		
K3,K4,K5	**C-2/4x20 marks**	**1200**	**40**		

SEMESTER II

METABOLISM AND METABOLIC DISORDERS

TEACHING HOURS: 60 **COURSE CODE:15SP21/2C/MMD**

CREDITS: 4 **L-T-P: 3-1-0**

COURSE OBJECTIVES:

1. To impart Knowledge about the basic metabolic pathway of carbohydrates.
2. To enlighten students about the general pathway of amino acidmetabolism .
3. To develop knowledge about metabolism of lipids.
4. To enable the students to understand the Bioenergetics and Electron transport chain.
5. To help students understand the metabolism of nucleic acid and metabolic integration.

COURSE OUTLINE:

UNIT I (12 Hours)

Carbohydrate metabolism:Glycolysis,Gluconeogenesis,Glycogenesis, Glycogenolysis (Hormonal influence on Glycogen metabolism) - Glycogen storage diseases. Citric acid cycle, HMP shunt & Uronic acid pathway(Regulation Included) . Metabolism of fructose ,Galactose& Mannose.

UNIT II (12 Hours)

Amino Acid metabolism:-General Pathways of amino acid degradation- transamination ,decarboxylation ,oxidative and non oxidative deamination. ureacycle.conversion of amino acids to special products. (Biosynthesis of phenylalanine, methionine epinephrine, nor epinephrine, SAM, serotonin, melanin.) Disorders of amino acid metabolism- phenylketonuria,Alkaptonuria& maple syrup urine diseases.

UNIT III (12 Hours)

Lipid metabolism : Oxidation of Fatty acids- Role of carnitine saturated, unsaturated ,odd and even numbered fatty acids, Alpha and Omega oxidation , Ketogenesis, Biosynthesis of saturated and unsaturated fatty acids ,fatty acid synthase complex-Metabolism of triacylglycerol, Phospholipid and Spingolipids, Cholesterol biosynthesis and degradation.Metabolism of lipoprotein &lipoproteinemias . Lipid storage diseases -Niemann Pick's disease, TaySach's Disease, Gaucher's disease, and fatty liver.

UNIT IV (12 Hours)

Bioenergies and Biological Oxidation: High energy phosphates,BiologicalOxidation,Electron transport chain- Organisation of Respiratory chain complexes & electron flow, Q cycle .Mechanism of ATP Synthesis ,Redox potential and free

energy calculation . Oxidative phosphorylation- chemiosmotic theory,inhibitors of respiratory chain oxidative phosphorylation ,uncouplers and ionophores.

UNIT V (12 Hours)

Nucleotide metabolism & Metabolic integration : De Novo synthesis and Salvage pathway of purine and pyrimidine nucleotides , Role of ribonucleotide Reductase, Degradation of purine and pyrimidine nucleotides, Inhibitors. Disorders of nucleic acid metabolism – LeschNyhan syndrome, Gout, Xanthinuria, OroticAciduria.

Integration of metabolism: Interconversion of major foodstuffs. Metabolic profile of liver,adipose tissue and brain . Altered metabolism in starvation .

RECOMMENDED TEXTBOOKS:

1. Harper's Biochemistry- Murray et al, 26th Edition, 2003
2. Text book of Biochemistry –JL Jain

REFERENCE BOOKS:

1. Principles of Biochemistry- Voet ,Voet & Pratt 4th Edition, John Wiley & Sons,2013
2. Biochemistry- Garrett & Grisham, Saunders College Publishing house, 2nd Edition, 1999.
3. Principles of biochemistry – Lehninger ,Nelson and Cox 4th Edition, W.H.Freeman and Co.2004
4. Biochemistry- Berg, Tymoczko&Stryer, 6th edition, W.H.Freeman and Co.2007, 1999
5. Text book of biochemistry- Zubay,4thEdition,WCB publishers, 1998

JOURNALS:

1. Indian Journal of Biochemistry & Biophysics
2. Biochemistry &Analytical Biochemistry
3. Biomolecules
4. Endocrinology &Metabolism International Journal
5. Molecular Genetics and Metabolism

E-LEARNING RESOURCES:

1. https://global.oup.com/us/companion.websites/fdscontent/uscompanion/us/static/companion.websites/9780199730841/McKee_Chapter8_Sample.pdf
2. http://www2.csudh.edu/nsturm/CHE452/11_A.A.%20Metabolism.htm
3. https://www.cureffi.org/2013/11/23/biochemistry-10-lipid-metabolism/
4. https://chem.libretexts.org/Bookshelves/Biological_Chemistry/Supplemental_Modules_(Biological_Chemistry)/Metabolism/Catabolism/Biological_Oxidation
5. https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/electron-transport-chain
6. https://www.lecturio.com/magazine/nucleotide-metabolism/
7. http://homepage.ufp.pt/pedros/bq/integration.htm
8. https://biolympiads.com/wp-content/uploads/2018/09/integration_of_metabolism.pdf

COURSE OUTCOMES:

CO . NO	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Explain biochemical energy generation through carbohydrate metabolism.	K1,K2
CO 2	Explain Energy yielding and energy requiring reactions in life and diversity of metabolic reactions in amino acid pathway	K2,K3
CO3	Outlines lipid metabolism with respect to several human diseases ,due to the defects in the metabolic pathway	K2,K3
CO4	Analyse the integration of biochemical processes with specific control sites and key junctions.	K2, K3
CO5	Explain nucleotide metabolism and apply the knowledge in molecular biology and metabolic integration.	K3

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	2	3
CO2	3	3	3	3	3
CO3	3	2	2	3	2
CO4	2	3	3	2	3
CO5	3	2	2	2	2
AVERAGE	**2.8**	**2.6**	**2.4**	**2.4**	**2.6**

KEY: STRONGLY CORRELATED – 3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED – 1, NO CORRELATION – 0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-LCD)

2. Blended Classroom-E Content, Videos
3. Quiz, Seminar
4. Peer Learning

QUESTION PAPER PATTERN:

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,K2	**A-10X2 marks**	**50**	**20**	**100**	Question number compulsory for all questions. Section A - Two questions from each unit Section B- Minimum of 1 question from each unit. Section C - 4 Questions from 4 different units**.**
K3,K4	**B-5/8x8 marks**	**500**	**40**		
K3,K4,K5	**C-2/4x20 marks**	**1200**	**40**		

SEMESTER II

HORMONES AND CELL SIGNALING

TEACHING HOURS: 60 **COURSECODE:15SP21/2C/HCS**

CREDITS: 4 **L-T-P: 3-1-0**

COURSE OBJECTIVES:

1. To introduce students to molecules involved in cell signalling
2. To revise different endocrine glands and their hormones.
3. To impart knowledge on cell surface receptors in signal transduction pathways.
4. To disseminate knowledge on nuclear receptor mediated pathways.
5. To expose students to interrelationship between various signaling pathways & molecules involved in signal transduction

COURSE OUTLINE:

UNIT I (12 Hours)

Introduction to Cell Signaling, Types of cell signaling, Overview of Molecules involved in cell Signaling - Ligands, Receptors, Second messengers, GTPase Switch proteins, Effectors, Protein Kinases, Protein Phosphatases, scaffold Proteins, Adapter proteins.

Hormones – Classification based on chemical nature, site of synthesis, solubility and mechanism of action; Receptors – Classification based on Cell surface and Intracellular receptors

UNIT II (12 Hours)

Structure, functions and associated disorders of Hypothalamic hormones – TRH, GnRH, GHRH, CRH, Somatostatin, Dopamine; Pituitary hormones – TSH, ACTH, Endorphins, Somatotropin, LH, FSH, Prolactin, Oxytocin, Vasopressin. Pancreatic hormones – Insulin, Glucagon.

UNIT III (12 Hours)

Structure, functions and associated disorders of Thyroid hormones (Biosynthesis), Parathyroid hormone, calcitonin, calcitriol; Adrenal hormones – Epinephrine, Cortisol, Aldosterone. Gonadal hormones – Estrogen, Progesterone, Testosterone.

UNIT IV (12 Hours)

GPCR, G proteins – Mechanism of action, their role in action of bacterial toxins; cAMP mediated signal transduction processes; Visual transduction Process; G proteins that regulate ion channels; G-protein and gene control. Role of Calcium and phosphoinositides in Signal transduction; IP3 – DAG pathway; PI-3 Kinase pathway; Interaction of Calcium calmodulin complex. NO signaling pathway.

UNIT V (12 Hours)

Ras Proteins and receptor Tyrosine kinase mediated Signal transduction – MAP Kinase pathway; Cytokine receptors - JAK/STAT, NFKB pathway, Wnt pathway, Notch-Delta signaling pathway.

Convergence, Divergence and Crosstalk between signaling pathways.

RECOMMENDED TEXTBOOKS:

1. Williams TextBook of Endocrinology – Larsen Kronenberg, Melmed and Polonsky, 10th Edition, 2003.
2. Molecular cell biology – Lodish , Harvey, Berk, Arnold, Zipursky , Lawrence, Matsudaira, Paul, Baltimore : 2006 , 4th Edition , W.H Freeman & Co .

REFERENCE BOOKS:

1. Endocrine Physiology- Susan .Porterfield,Mosby Publishers,3rd Edition 2007.
2. Principles of Biochemistry- Voet ,Voet& Pratt 4th Edition, John Wiley & Sons,2013
3. Biochemistry of Signal transduction and regulation –Gehard Krauss, Wiley VCH; 4th edition, 2008.
4. Signal transduction –Bastien D Gomperts ,Academic Press; New edition,2003
5. Signal transduction Mechanism –JA Barnes , Springer; 2013

JOURNALS :

1. Cell communication &signaling
2. Indian Journal of Endocrinology and Metabolism
3. Journal of Cell Signaling
4. Journal of signal transduction
5. International Journal of Endocrinology and Metabolism

E-LEARNING RESOURCES:

1. www.ncbi.nlm.nih.gov › NCBI › Literature ›
2. www.merlot.org
3. http://www.hormone.org
4. http:// medlineplus.gov
5. https://nptel.ac.in/courses/102/103/102103012/

COURSE OUTCOMES:

CO . NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Outline basics of cell signaling and role of various signaling molecules	K1,K2
CO 2	Explain the biological role and pathological implications of various hormones	K2, K3
CO3	Discuss biological role and pathological implications of various hormones	K2,K3
CO4	Explain GPCR mediated signaling pathways and examine their role in bacterial infections; vision, calcium metabolism ,.....	K3, K4
CO5	Discuss the various signaling pathways and networks and Analyse signaling cross talk	K3, K4

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	3
CO2	3	3	2	2	3
CO3	3	2	3	3	3
CO4	2	2	3	3	2
CO5	3	3	3	3	3
AVERAGE	**2.8**	**2.6**	**2.6**	**2.8**	**2.8**

KEY: STRONGLY CORRELATED – 3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED – 1, NO CORRELATION – 0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-LCD)
2. Blended Classroom-E Content, Videos
3. Quiz, Seminar
4. Peer Learning

QUESTION PAPER PATTERN:

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,K2	**A-10X2 marks**	**50**	**20**	**100**	Question number compulsory for all questions. Section A - Two questions from each unit Section B- Minimum of 1 question from each unit. Section C - 4 Questions from 4 different units**.**
K3,K4	**B-5/8x8 marks**	**500**	**40**		
K3,K4,K5	**C-2/4x20 marks**	**1200**	**40**		

SEMESTER II

ELECTIVE - RESEARCH METHODOLOGY

TEACHING HOURS: 60 **COURSE CODE:15SP21/2E/REM**

CREDITS: 3 **L-T-P: 3-1-0**

COURSE OBJECTIVES:

1. To introduce students to research and thesis writing.
2. To introduce the various approaches in invitro research
3. To impart knowledge on experiments with animal & human subjects
4. To expose students to the preparation of plant extracts.
5. To impart knowledge on various types of spectroscopy and basics of nano technology.

COURSE OUTLINE:

UNIT I (12 Hours)

Types of Research - Fundamental & Applied, Descriptive & Analytical, Quantitative & Qualitative. Research funding agencies – Fellowships & Grants

Thesis writing - Introduction, Review of Literature (Use of citation databases), Aim and scope, Materials and Methods, Results and Discussion, Summary and Conclusion, Bibliography- Harvard and Vancouver systems, Scientific writing for journals - Preparation of Abstract, Impact factor of journals, H Index.

Intellectual property rights- Introduction, Patent, Basis of patentability, non patentable inventions, Methods to apply for patents. Research Ethics – Issue of plagiarism.

UNIT II (12 Hours)

General approaches to Biochemical Investigations - Introduction to *In vitro*, *In vivo* &*In silico* studies with examples

Preparation of Percentage solutions (w/w, w/v, v/v), Molar, Molal and Normal solutions. Osmolarity, Osmolality & Ionic strength. Dilution of solutions. Hydrogen ion concentration – pH & pOH, Henderson Hassel Balch equation and Preparation of buffers

Overview of Experiments with microorganisms,Microbial growth curve, Calculations based on doubling time and rate of growth.

Types of cell lines, Different cell lines used in Research, MTT assay, Calculation of IC50, Selectivity index

Cell sorting and Cell counting - Flow cytometry (FACS). Experiments with Cell isolates - Sequence analysis - DNA and Protein sequencer.

UNIT III (12 Hours)

Whole animal studies -Ethical Committee clearance-IAEC, CPCSEA. Maintenance of animals, Control and experimental groups, Experiments with animal models- Metabolism of xenobiotics, Experimental Induction of diseases to evaluate drug candidates, Assessment of Free radical induced damages- Lipid peroxidation, Assessment of Antioxidant status -Enzymic and Non enzymic.

Organ perfusion and tissue slice techniques.Histopathology

Experiments with human volunteers - Ethical clearance- Institutional Ethical committee, Consent form, Clinical trials.

UNIT IV (12 Hours)

Experiments with whole plants

Significance of Plant secondary metabolites- Terpenoids, Phenolics (Tannins, Flavonoids) & Alkaloids - Isolation and Characterization.

Preparation of plant extracts-Solvents used. Methods for extraction- Maceration, Infusion, Percolation, Digestion, Decoction, Hot continuous extraction (Soxhlet), Ultrasound extraction (sonication).

Overview of different types of studies with plant extracts,Phytochemicals as antioxidants, Methods to assess in vitro Antioxidant activity- DPPH scavenging assay, FRAP assay.

UNIT V (12 Hours)

Spectroscopy – Principle, Instrumentation and applications of -ESR, NMR spectroscopy, X ray diffraction, Circular Dichroism and Mass Spectroscopy

Nanotechnology – Classification based on dimension & composition, Preparation using biological material (Green synthesis), Characterisation - SEM, TEM, Zeta potential. Biological applications – Drug & DNA delivery (Dendrimers, Liposomes).

RECOMMENDED TEXTBOOKS:

1. BioPhysical Chemistry Principles and Techniques – Upadhyay & Upadhyay Nath, Himalaya Publishing House. Reprint2006
2. Scientific Thesis Writing and Paper Presentation - N. Gurumani, MJP Publishers.2010

REFERENCE BOOKS:

1. Instrumental methods of Chemical Analysis- Chatwal&Anand, Himalaya Publishing House. Reprint 2005.

2. Principles and techniques of practical Biochemistry – Keith Wilson and John Walker , 7th Edition, Cambridge University Press,2004.
3. Nanotechnology in Medicine (Nanotechnology in Life sciences)-Vishnu KirthiArivarasan (Editor), KarthikLoganathan (Editor), PushpamalarJanarthanan (Editor)Springer, 2021
4. Essentials of Botanical Extractions:principles and Applications -Subash C. Mandal, Vivekananda Mandal, Anup Kumar Das, Academic Press ,2015.
5. Title Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications-R. Ian Freshney,, John Wiley & Blackwell, 6th Edition , 2011.

JOURNALS:

1. International Journal of Science and Research Methodology
2 .Open Life Sciences
3. Journal of Life Sciences Research
4. Indian Journal of Medical Biochemistry
5. Journal of Ethnopharmacoclogy

E-LEARNING RESOURCES:

1. https://www.ldeo.columbia.edu/~martins/sen_sem/thesis_org.html
2. https://www.snc.edu/chemicalhygiene/docs/labsafety/SolutionPrep.pdf
3. http://biochem.du.ac.in/web/uploads/ Guidelines for Animal Facility.pdf
4. https://link.springer.com/content/pdf/Nanotechnology in Life Sciences
5. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7398001/
6. https://www.intechopen.com/books/plant-extracts/introductory-chapter-plant-extracts

COURSE OUTCOMES:

CO . NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Sufficient knowledge to apply for research funding, fellowship and grants and write thesis.	K1,K2
CO 2	Trained in calculations for reagent preparation, and planning for invitro experiments	K2, K3
CO3	Gaining knowledge about Maintaining animals for research, Stages of drug development and clinical trials and ethics inv	K3,K4
CO4	Learn the methods of extraction from plants, and invitro antioxidant assays	K3, K4
CO5	Acquire knowledge of principle instrumentation and applications of Advanced spectroscopic techniques	K4,K5

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	3	3	3	**3**
CO2	2	3	3	3	**3**
CO3	2	2	2	3	**3**
CO4	2	3	3	3	**3**
CO5	2	3	3	3	**3**
AVERAGE	**2**	**2.8**	**2.8**	**3**	**3**

KEY: STRONGLY CORRELATED – 3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED – 1, NO CORRELATION – 0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-LCD)
2. Blended Classroom-E Content, Videos
3. Quiz, Seminar
4. Peer Learning

QUESTION PAPER PATTERN:

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,K2	**A-10X2 marks**	**50**	**20**	**100**	Question number compulsory for all questions. Section A - Two questions from each unit Section B- Minimum of 1 question from each unit. Section C - 4 Questions from 4 different units**.**
K3,K4	**B-5/8x8 marks**	**500**	**40**		
K3,K4,K5	**C-2/4x20 marks**	**1200**	**40**		

SEMESTER I & II

CORE PRACTICAL I - FOOD ANALYSIS & CHROMATOGRAPHIC SEPARATIONS

TEACHING HOURS: 120 **COURSE CODE:15SP21/2C/CP1**

CREDITS:4 **L-T-P: 0-0-4**

COURSE OBJECTIVES:

1. To impart Knowledge on the principle of Food analysis.
2. To impart Knowledge on the working principle of various chromatographic techniques.
3. To train students in isolation and estimation of compounds from food sources.
4. To train students in using different instruments and kits.
5. Train students to separate biomolecules with appropriate chromatographic methods.

COURSE OUTLINE:

CHROMATOGRAPHIC SEPARATIONS

1. Paper chromatographic separation of Amino acids
2. Paper chromatographic separation of Sugars
3. Thin layer chromatographic separation of lipids
4. Separation of plant pigments by Adsorption chromatography
5. Gel permeation chromatography (Group Experiment)
6. Affinity Chromatography(Group Experiment)

7. HPLC (Demonstration)

FOOD ANALYSIS

8. Determination of moisture content
9. Determination of Ash content
10. Estimation of Iron content
11. Isolation and estimation of Glycogen
12. Extraction and Estimation of Sterol
13. Estimation of Flavonoids
14. Estimation of Riboflavin –Fluorimetry (Group Experiment)
15. Food sample Characterization- IR Spectroscopy (Group Experiment)

COURSE OUTCOMES:

CO . NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Analyse the Moisture and Ash content of foods	K4,K5
CO 2	Estimate Iron,, Glycogen, Sterol, flavinoids and Riboflavin in food samples	K4,K5
CO3	Separate Biomolecules by appropriate chromatographic methods	K4,K5

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PO	PSO1	POS2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3

CO3	3	3	3	3	3
AVERAGE	**3**	**3**	**3**	**3**	**3**

KEY: STRONGLY CORRELATED – 3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED – 1, NO CORRELATION – 0

TEACHING METHODOLOGY:

1. Hands on training on the experiments
2. Demonstration of the experiments

SEMESTER I & II

CORE PRACTICAL II -SEPARATION METHODS & ENZYMOLOGY

TEACHING HOURS: 120 **COURSE CODE:15SP21/2C/CP2**

CREDITS: 4 **L-T-P: 0-0-4**

COURSE OBJECTIVES:

1. Train students to isolate nucleic acids from biological sources
2. To enable students to carry out isolation of organelles like mitochondria, chloroplast from biological sources.
3. Train students in protein separation and blotting techniques.
4. To train students to analyze the Enzyme kinetics.
5. Train students in Enzyme isolation & purification

COURSE OUTLINE:

SEPARATION /DETECTION METHODS

1. Isolation of DNA (Identification by Diphenylamine) and Determination of melting temperature , GC content of DNA
2. Agarose Gel electrophoresis and Southern Blotting
3. Isolation of RNA and Identification by Absorption Spectrum
4. Isolation of Mitochondria – Differential Centrifugation
5. Isolation of Chloroplast- Density Gradient Centrifugation
6. Separation of serum proteins by SDS (Group Experiment)
7. Western Blotting (Demonstration)

ENZYMOLOGY

8. Assay of Serum Amylase
9. Assay of Invertase
10. Specific activity of ATPase
11. Determination of Optimum pH of Alkaline Phosphatase
12. Determination of Optimum Temperature of Alkaline Phosphatase
13. Determination of Km, Vmax of Alkaline phosphatase
14. Enzyme inhibition studies - Alpha amylase - Percentage inhibition Calculation.
15. Partial Purification of Acid Phosphatase from Mung Bean (Group Experiment)

COURSE OUTCOMES:

CO . NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Separate proteins ,isolate nucleic acids and organelles from biological sources	K4,K5
CO 2	Carry out enzyme kinetic assays . Understand the factors influencing enzyme activity, calculate Km,Vmax	K4,K5
CO3	ExpoExposed to the steps in isolating and purifying enzymes sed Ex	K4,K5

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PO	PSO1	POS2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
AVERAGE	**3**	**3**	**3**	**3**	**3**

KEY: STRONGLY CORRELATED – 3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED – 1, NO CORRELATION – 0

TEACHING METHODOLOGY:

1. Hands on training on the experiments
2. Demonstration of the experiments

SEMESTER III
MACRO MOLECULAR BIOLOGY

TEACHING HOURS: 60 **COURSE CODE:15SP21/3C/MMB**

CREDITS: 4 **L-T-P : 4-0-0**

COURSE OBJECTIVES:

1. To Impart Knowledge About Molecular Basis For Cell Division And Replication
2. To enlighten the students about the process of RNA & Protein synthesis and their segregation.

3. To expose the students to the molecular mechanisms of Gene Regulation.
4. To enable the students to understand the molecular basis of Viral infections
5. To enable the students to understand the molecular basis of cancer and apply their understanding of molecular processes in disease diagnosis and treatments .

COURSE OUTLINE:

UNIT I (12 Hours)

Replication and Cell Division : Replication-Replication in Prokaryotes – overview, Eukaryotic DNA replication , Enzymes of DNA replication – DNA polymerase, Helicase, Ligase, Topoisomerase, Telomerase , Licensing factors , D-Loop replication , Inhibitors of replication with medical applications .

Cell cycle , Cell cycle control of DNA replication, Cyclins, Cyclin dependent kinases, Cell cycle checkpoints.

UNIT II (12 Hours)

Gene Expression : Transcription-Transcription in Prokaryotes – overview ,Eukaryotic Transcription , RNA polymerases, Promoters, Enhancers , Insulators, Silencers , Post Transcriptional modifications of t RNA, r RNA , mRNA – Capping, Tailing , Splicing, Reverse transcription.

Translation- Prokaryotic Translation (overview) , Eukaryotic translation , Post translational modifications , Inhibitors of translation with medical applications

Protein sorting- Targeting of proteins to ER, golgi, mitochondria, nucleus, Lysosomes.

Ubiquitin tagged Protein Degradation

UNIT III (12 Hours)

Gene Regulation : Prokaryotic Gene Regulation - Arabinose operon, Eukaryotic Gene Regulation – Molecular mechanisms of eukaryotic transcription control, DNA methylation, Chromatin remodelling, Histone modifications, Gene Regulation by hormone action - Response elements , RNA interference – Short Interfering RNAs (Si RNAs), Micro RNAs (miRNAs).

UNIT IV (12 Hours)

Molecular Basis of infectious Viral Diseases-AIDS, Chikungunya, Dengue, causative agent, pathogenesis, Diagnostics ,COVID-19 , Corona Viruses- Types, Structure,mode of transmission,virusreplication,mechanism of infection,Host -pathogen interaction,Diagnosis and Testing.

UNIT V (12 Hours)

Molecular Basis of non infectious disease - Cancer :Types of Cancer , Causes , Properties of Cancer cells ,Apoptosis and carcinogenesis ,Tumor viruses- Hepatitis B & C Virus, Adeno virus , Oncogenes – Proto Oncogenes ,Retro viral Oncogenes, Tumor Suppressors, Molecular cancer diagnostics and therapeutics.

RECOMMENDED TEXT BOOKS:

1. Lehninger Principles of Biochemistry – Nelson David and Cox Michael , W.H.Freeman& Co : New York, 2004
2. Essentials of Molecular Biology- V.Malathi, First Edition, Pearson Publishers, 2013.

REFERENCE BOOKS:

1. Molecular cell biology – Lodish, Harvey, Berk, Arnold, Zipursky, Lawrence, Matsudaira, Paul, Baltimore, W.H Freeman & Co, 4th Edition, 2006.
2. Lewin's Genes X– Krebs Jocelyn, Lewin Benjamin , Goldstein ,Eliottt , Kilpatrick ,Stephen, Jones and Bartlett., 2009.
3. Biochemistry - Voet Donald and Voet Judith : Wiley International Edition , John Wiley & Sons.3rd Edition, 2004.
4. The Cell: A Molecular Approach , 20 Aug 2003,by Geoffrey M. Cooper , Robert E. Hausman, Published August 15th 2003 by Sinauer Associates, ISBN 0878932151 (ISBN13: 9780878932153)
5. Essentials of Molecular Biology (Jones and Bartlett Series in Biology) - Jones and Bartlett Publishers, Inc; 2nd Revised edition edition (8 September 1992),ISBN-10: 0867201371,ISBN-13: 978-0867201376

JOURNALS:

1. International Journal of Genetics and Molecular Biology
2. International Journal of Biochemistry and Molecular Biology
3. Indian journal of genetics and molecular biology
4. BMC Molecular Biology
5. Cellular and Molecular Biology

E-LEARNING RESOURCES:

1. https://dnalc.cshl.edu/resources/3d/04-mechanism-of-replication-advanced.html
2. www.nature.com/nsmb
3. https://www.nature.com/scitable/topicpage/gene-expression-14121669/
4. https://www2.le.ac.uk/projects/vgec/highereducation/topics/geneexpression-regulation
5. https://www.nature.com/scitable/topicpage/epigenetic-influences-and-disease-895/

COURSE OUTCOMES:

CO . NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Explain the Molecular basis of Cell division,evaluate the use of Replication inhibitors , Identify the cell cycle checkpoints.	K1,K2
CO 2	Discuss the basis of protein formation & Segregation, analyze the use of translation inhibitors	K2,K5
CO3	Explain the Molecular mechanisms underlying Gene Regulations, compare the prokaryotic and eukaryotic gene regulation.	K3,K4
CO4	Understand the mechanism of infection of viruses,Explain the diagnosis and Treatment.Understand the molecular pathogenesis of COVID -19.	K4,K5
CO5	Discuss about molecular basis of cancer, Explain the role of tumor viruses, Assess the use of onco protein molecules in diagnosis and therapy.	K4,K5

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	3	2	3	3
CO2	3	3	2	3	3
CO3	2	3	3	3	3
CO4	2	3	2	3	3
CO5	3	3	3	2	2
AVERAGE	**2.4**	**3**	**2.4**	**2.8**	**2.8**

KEY: STRONGLY CORRELATED – 3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED – 1, NO CORRELATION – 0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-LCD)
2. Blended Classroom-E Content, Videos

3. Quiz, Seminar
4. Peer Learning

QUESTION PAPER PATTERN:

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,K2	**A-10X2 marks**	**50**	**20**	**100**	Question number compulsory for all questions. Section A - Two questions from each unit Section B- Minimum of 1 question from each unit. Section C - 4 Questions from 4 different units**.**
K3,K4	**B-5/8x8 marks**	**500**	**40**		
K3,K4,K5	**C-2/4x20 marks**	**1200**	**40**		

SEMESTER III

ADVANCED CLINICAL BIOCHEMISTRY & BIOMEDICAL INSTRUMENTATION

TEACHING HOURS: 60 **COURSE CODE:15SP21/3C/ACB**

CREDITS : 4 **L-T- P : 4-0-0**

COURSE OBJECTIVES:

1. To give an overview of diseases with emphasis on lifestyle and environmental diseases.
2. To impart knowledge on Blood disorders, cardiovascular and respiratory diseases.
3. To impart knowledge on common Kidney, liver, Intestinal and pancreatic diseases.
4. To expose students to various methods to diagnose different diseases.
5. To expose students to common therapeutic procedures.

COURSE OUTLINE:

UNIT I (12 Hours)

Introduction to Clinical terms; Overview of diseases: Infectious, Nutritional, Metabolic, Genetic, Immunological & Environmental diseases.

Diabetes - Types, pathophysiology, complications, diagnosis and treatment.

Environmental diseases - Thermoregulation, Disorders in Extremes of temperature (Hypothermia & Heat Stroke), Disorders of High Altitude - HACE,HAPE, Sleep Disorders - Metabolism in Sleep, Pathophysiology of Sleep disorders- Insomnia , Sleep apnoea. Anxiety Disorders - Panic disorder, Post-Traumatic Stress Disorder,

UNIT II (12 Hours)

Blood disorders - Anaemia – Overview , Sickle cell anaemia, Thalassemia,, Porphyria.

Cardiovascular diseases – Disorders of heart rate and rhythm, Diseases of the heart valves, Diseases of myocardium, Hypertension, Atherosclerosis, Myocardial infarction.

Respiratory diseases - Chronic obstructive pulmonary disease - Chronic Bronchitis & Emphysema, Interstitial lung disease.

UNIT III (12 Hours)

Kidney diseases - Renal stones, Glomerulonephritis, Renal failure; Liver diseases- Jaundice, Cirrhosis, Liver failure, Cholecystitis; Alimentary and Pancreatic diseases – Peptic ulcer, Coeliac sprue , Pancreatitis.

UNIT IV **(**12 Hours)

Diagnostic procedure**s** – Autoanalyzer for estimation of metabolites, Glucometer, Kinetic assay of enzymes, Overview of Immunofluorescence and Chemiluminescent methods for assay of hormones, Haematology Analyzer

Serological tests- Widal, ELISA; Microscopy and QBC for Malarial parasite

X-ray, Angiography. Types of Scan- Ultrasound, CT, PET, MRI; Endoscopy; Tests based on electrical activity – ECG, EEG; Blood pressure measurement Respiratory gas analyser.

UNIT V **(**12 Hours)

Therapeutic procedures – Blood banking, Dialysis unit- Hemo and Peritoneal dialysis, Pacemaker, Defibrillator, Artificial valves, Non invasive ventilation - Oxygen concentrator, Invasive ventilation -Ventilator, Heart lung machine, Lithotripters, Radiotherapy equipment.

RECOMMENDED TEXTBOOKS:

1. Davidson's Principles and Practice of Medicine-Boon, Colledge& Walker, Elsevier 20th Edition, 2006.
2. Handbook of Biomedical Instrumentation- R.S. Khandpur, Tata Mc GrawHill Publications Second Edition, 2003.

REFERENCE BOOKS:

1. Teitz Fundamentals of Clinical Chemistry – Burtis, Ashwood&Brunz 6 thEdition . Indian Reprint 2010.
2. Textbook of Biochemistry with Clinical Correlations - Thomas M. Devlin, , Wiley-Liss;7th Edition, 2010.
3. Clinical Biochemistry- Metabolic and Clinical aspects- William J Marshall; Churchill Livingstone; 2nd edition, 2008.
4. Practical clinical Biochemistry –Methods and interpretation –Ranjana Chawla, Jaypee Brothers Medical Publishers; 4th edition, 2014.
5. Clinical Biochemistry and metabolic medicine-Martin Andrew Crook; Hodder Arnold; 8th edition, 2012.

JOURNALS:

1. Clinical Biochemistry
2. Annals of Clinical Biochemistry
3. Journal of Medical Biochemistry
4. Clinical Chemistry & Laboratory Medicine
5. Molecular aspects in Medicine

E-LEARNING RESOURCES:

1. https://www.ncbi.nlm.nih.gov › books ›
2. https://www.mayoclinic.org
3. https://my.clevelandclinic.org › health › diseases ›
4. https://www.webmd.com
5. https://www.msdmanuals.com
6. https://www.medscape.com

COURSE OUTCOMES:

CO . NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Compare different diseases etiologically.	K1,K2
CO 2	Discuss the etiology, pathology and manifestations of disorders, cardiovascular and respiratory diseases.	K2, K3
CO3	Explain theetiology, pathology and manifestations of common Kidney, liver, Intestinal and pancreatic diseases.	K2, K3
CO4	Discuss the principle and working of various diagnostic tools: identify and use appropriate diagnostic methods for each disease and interpret the results.	K3,K4
CO5	Explain the principle and working of various therapeutic instruments; identify and use appropriate therapeutic methods for each disease.	K3, K4

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	2	2	2	2
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
AVERAGE	**2.8**	**2.8**	**2.8**	**2.8**	**2.8**

KEY: STRONGLY CORRELATED – 3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED – 1, NO CORRELATION – 0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-LCD)
2. Blended Classroom-E Content, Videos
3. Quiz, Seminar
4. Peer Learning

QUESTION PAPER PATTERN:

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,K2	**Sec A – 10 x 2**	**50**	**20**	**100**	Question number compulsory for all questions. Section A - Two questions from each unit Section B- Minimum of 1 question from each unit. Section C - 4 Questions from 4 different units.
K3,K4	**B – 5/8 x 8**	**500**	**40**		

K3,K4,K5	**C – 2/4 x 20**	**1200**	**40**		

SEMESTER III

ELECTIVE - PHARMACOLOGY

TEACHING HOURS : 60 **COURSE CODE:15SP21/3E/PRY**

CREDITS : 3 **L-T- P : 4-0-0**

COURSE OBJECTIVES:

1. To introduce the pharmacokinetic, pharmacodynamic and drug development processes
2. To expose the students to the mechanism of action and the adverse effects of various anti infective agents,helminthic drugs,drugs for tuberculosis and supplementary drugs
3. To sensitise the students to the different types of cardiac and gastrointestinal drugs
4. To enable the students to understand the drugs acting on central and peripheral nervous system
5. To impart knowledge on the various types of anaesthetics, respiratory disorder drugs,hormone replacement therapy and chemotherapeutic agents

COURSE OUTLINE:

UNIT I (12 Hours)

Introduction to Pharmacology – Preview of Drug development and Regulations. Pharmacokinetics – Routes of Drug administration, Absorption , Distribution , Metabolism – Microsomal cytochrome P 450 system, Excretion, Factors modifying effects of drugs. Pharmacodynamics – Types of Drug receptors, Drug- receptor interaction and Drug tolerance, Drug- Drug Interactions.

UNIT II (12 Hours)

Anti Infective agents- Antibiotics - classification, β lactam antibiotics, Antifungal agents, Antiviral agents, Antiprotozoal agents, Antiretroviral drugs.

Drugs for helminthiasis, Anti mycobacterial drugs for Tuberculosis. Antidiabetic drugs.Vitamin and Mineral Supplements.

UNIT III (12 Hours)

Cardiovascular Drugs- Drugs for Hypertension, Hyperlipoproteinemias, Ischemic heart diseases. Drugs for renal function- Diuretics and antidiuretics.Drugs for haematopoietic system- Coagulants and anticoagulants.

Drugs for Gastrointestinal system – Drugs for Peptic ulcer , Diarrhoea, Irritable Bowel Syndrome and Constipation.

UNIT IV (12 Hours)

Drugs for Central Nervous system – Sedatives, Hypnotics and Antiepileptics. Analgesics – Opioids & Non Opioids, Drugs for CNS degenerative disorders – Parkinson's and Alzhemier's disease. Drugs for Autonomic nervous system disorders- Agonist and Antagonists of Cholinergic and Adrenergic systems.

UNIT V (12 Hours)

Anaesthetics – Definition –Classification –volatile anaesthetics -N2O, ethers, halohydrocarbons, and chloroform . Intravenous anaesthetics - Thiopental sodium.Local anaesthetics - Articaine and Epinephrine.

Drugs for Respiratory disorders – Drugs for Bronchial Asthma and Cough.. Drugs affecting fertility and reproduction-.Hormone replacement therapy –androgens, estrogens, antiandrogens, antiestrogens and contraceptives .Chemotherapeutic agents.

RECOMMENDED TEXTBOOKS:

1. Pharmacology(III edition)- George.M Brenner and Craig.W.Stevans. Elsevier Publication, 2010.
2. Pharmacology and Pharmacotherapeutics - R.SatoskarandSDBhandkar, Saurabh Printers, Revised XIX Edition, 2005.

REFERENCE BOOKS:

1. Pharmacology- Don.ABallington,Mary.MLaughlin.CBS publisher III edition First Indian Reprint 2008.
2. Essentials of Medical Pharmacology – Tripathi. JP Publishers, 7th Edition 2013.
3. Pharmacology – Anthony J.Trevor,12th Edition,2018.
4. Basic and Clinical Pharmacology – Betram G.kartzuyng,14th edition,2018.
5. Pharmaceuticals and Pharmacokinetics – J.S.Kulkarni,A.P.Power,2nd Edition,2008

JOURNALS:

1. Journal of Pharmacy and Pharmacology

2. Journal of Clinical & Experimental Pharmacology
3. International Journal of Pharmacy and Pharmaceutical Sciences
4. International Journal of Pharmacological Research
5. Pharmacology and Therapeutics

E- LEARNING RESOURCES:

1. https://www2.bc.edu/~anderswb/pharmacologyonlineresources.html
2. libguides.utep.edu › UTEP Library Research Guides › Pharmacology
3. https://www.news-medical.net/health/Cardiovascular-Drugs.aspxhttps://you tu.be/QVO8fm- 3AE
4. https://www.springer.com/journal/40263
5. https://rtmagazine.com/products-treatment/pharmaceuticals/us-pharmaceuticals/pharmacological- reatment-of-respiratory-disorders/

COURSE OUTCOMES:

CO . NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Explain the various stages of drug development processes, regulations, pharmacokinetic and pharmacodynamic parameters	K1, K2, K4
CO 2	Discuss the mechanism of action and the adverse effects of Anti infective agents viz Antibiotics, Antifungal agents, Antiviral agents, Antiprotozoal agents, Antiretroviral drugs,drugs for helminthiasis, Anti mycobacterial drugs for Tuberculosis, Antidiabetic drugs.Importance of Vitamin and Mineral Supplements	K2,K3
CO3	Explain the pharmacokinetics and pharmacodynamics of Cardiovascular Drugs like drugs for Hypertension, Hyperlipoproteinemias, Ischemic heart diseases. Drugs for renal function like Diuretics and antidiuretics.Drugs for haematopoietic systems like Coagulants and anticoagulants. Drugs for Gastrointestinal system like drugs for Peptic ulcer , Diarrhoea, Irritable Bowel Syndrome and Constipation	K2,K3

CO4	Discuss the drugs for Central Nervous system like Sedatives, Hypnotics, Antiepileptics. Analgesics likeOpiods& Non Opiods, Drugs for CNS degenerative disorders like Parkinson's and Alzhemier's disease. Drugs for Autonomic nervous system disorders- Agonist and Antagonists of Cholinergic and Adrenergic system.	K3,K4
CO5	Discuss about the various types of Anaesthetics like -N2O, ethers, halohydrocarbons,chloroform,Thiopentalsodium,Articaine and Epinephrine. Drugs for Respiratory disorders like drugs for Bronchial Asthma and Cough..Hormone replacement therapy, contraceptives and Chemotherapeutic agents.	K3,K4,K5

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	3	2	3	2	3
CO2	2	2	2	2	3
CO3	2	3	2	3	2
CO4	3	2	2	2	3
CO5	2	3	2	3	2
AVERAGE	**2.4**	**2.4**	**2.2**	**2.4**	**2.6**

KEY: STRONGLY CORRELATED – 3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED – 1, NO CORRELATION – 0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-LCD)
2. Blended Classroom-E Content, Videos

3. Quiz, Seminar
4. Peer Learning

QUESTION PAPER PATTERN:

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,K2	**A-10X2 marks**	**50**	**20**	**100**	Question number compulsory for all questions. Section A - Two questions from each unit Section B- Minimum of 1 question from each unit. Section C - 4 Questions from 4 different units**.**
K3,K4	**B-5/8x8 marks**	**500**	**40**		
K3,K4,K5	**C-2/4x20 marks**	**1200**	**40**		

SEMESTER III

SOFT SKILL-COMPUTING SKILLS

TEACHING HOURS: 30 **COURSE CODE:15SP21/3S/COS**

CREDITS: 2 **L-T-P: 1-1-0**

COURSE OBJECTIVES :

1. To introduce the fundamentals of computers - Hardware & Software
2. To expose the students to features of MS Word and MS Excel
3. To expose the features of MS PowerPoint and basics of the Internet.

COURSE OUTLINE:

UNIT I (10 Hours)

Computer fundamentals - Basic architecture, Hardware – Input & Output devices, CPU-Processor, Volatile memory (RAM) & Non-volatile memory, Auxiliary storage devices.

Software - Operating system (Windows) and application software - MS Office, Keyboard keys and commands

UNIT II (10 Hours)

MS Word – Demonstration of basic features of Word with special reference to References and mailings tabs

MS Excel –Demonstration of basic features of Excel with special reference to Data sort, Data filters, Functions, inserting formulae, Creating charts, & Statistical analysis using Data analysis pack

MS PowerPoint- Demonstration of basic features of PowerPoint with special reference to Inserting graphs/pictures/tables, shapes, Smart arts, Animations & Slide show.

UNIT III (10 Hours)

Basics of Internet: IP address, URL, www, Web Browsers, Search Engines, Networks, Communication protocols – TCP/IP, FTP, HTTP.

Google docs, sheets & slides

RECOMMENDED TEXTBOOKS:

1. Essentials of MS office – Sanjay Saxena, Vikas Publications, First Edition, 2002.

2. Fundamentals of Information Technology – Alexis Leon & Francis Leon, Tech World, 1999.

REFERENCE BOOKS :

1. Computer Fundamentals – Anita Goel ,Pearson publication,2010
2. Computer Fundamentals and Internet basics- RohitKhurana,APH Publishing Corporation,2010
3. Computer fundamentals: Concepts, Systems & Applications – Priti Sinha & Pradeep K., Sinha, BPB Publications, 2004

JOURNALS:

1. Computers (MDPI)
2. Journal of information technology (SAGE Journals)
3. Malaysian journal of Computer science

E-LEARNING RESOURCES:

1. https://support.microsoft.com/
2. https://www.wiley.com/en-us/Computing+Fundamentals+Digital+Literacy+Edition-p-9781118974742
3. https://www.merlot.org/merlot/materials.htm

COURSE OUTCOME:

CO . NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Explain the concept of Computer Architecture -hardware and software .	K1, K2
CO 2	knowledge of features of Word & Analyse data with Excel sheets	K2,K3
CO3	Enables to make presentations with powerpoint and Discuss the concept of Internet and utilize internet for academic activities	K2,K3

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	3	3	3	3
CO2	2	3	3	3	3
CO3	2	3	3	3	3
AVERAGE	**2**	**3**	**3**	**3**	**3**

KEY: STRONGLY CORRELATED – 3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED – 1, NO CORRELATION

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-LCD)

2. Blended Classroom-E Content, Videos
3. Quiz, Seminar
4. Peer Learning

QUESTION PAPER PATTERN:

Knowledge Level	Section	Word Limit	Marks	Total
K1,K2,K3	**A-5X10**	**350**	**50**	**50**

SEMESTER III

SELF STUDY-ECOLOGY AND ENVIRONMENTAL TOXICOLOGY

CREDITS: 2 **COURSE CODE:15SP21/3SS/ECE**

COURSE OBJECTIVES:

1. To enable students to understand basic structure , function and features of the ecosystem.
2. To provide a deep understanding of different ecosystems and incredible diversity of life.
3. To impart knowledge on harmful effects of different types of pollution
4. To enable students to understand the methods to test different types of pollutants.
5. To impart knowledge on various bioremediation methods

COURSE OUTLINE

UNIT I

Introduction to Ecology - Definition, Basic concepts and terminologies, Major divisions of Ecology based on habitat and level of organization. Structure of Ecosystem - Abiotic (Climatic, topographic and edaphic factors) and biotic components.Productivity of ecosystem,food chain in ecosystem,Ecological pyramids.

Biogeochemical cycles in Ecosystem - Carbon, Nitrogen, Phosphorus & Sulphur cycle.

Adaptations - Aquatic adaptation,volant adaptation and desert adaptation

UNIT II

Ecosystem-freshwater communities- physiochemical nature, Lentic-biotic communities, distribution of oxygen and dissolved nutrients. Lotic –characteristics of lotic and its inhabitants

Estuaries -Types of estuaries, physicochemical aspects of estuaries. Biotic communities

Marine - Physicochemical stratification, currents, marine communities (biotic), coral reef as a specialized oceanic ecosystem

Terrestrial Ecosystems - Classification, biomes, tundra, alpine, forest, grassland, desert, wetland biomes and tropical savanna biomes

UNIT III

Air Pollution - Pollutants -Oxides of Carbon, Nitrogen & Sulphur, Photochemical products, Particulate matter, Effects- Acid rain, Ozone hole, Photochemical smog,Greenhouse effect, Global warming and Climate change Measurement of air quality, Prevention & Control of air pollution.

Radioactive pollution- Sources of radioactive pollution. Effect of radioactive pollution, Protection and control of radiation, Disposal of radioactive waste

UNIT IV

Soil & water pollution - Sources of pollution, Solid waste (biodegradable and Nonbiodegradable) pollution & management;

Eutrophication, Measurement of water quality - BOD, COD, Turbidity ; Prevention & control of water pollution.

Heavy metals - Toxic effects of lead, cadmium, mercury and nickel. Techniques employed for estimation of toxic metals. Toxicity of pesticides - Toxic effects of halogenated hydrocarbons, organophosphates and Chlorinated phenoxy substances.

UNIT V

Bioremediation -Intrinsic bioremediation (natural attenuation), Enhanced bioremediation - Biostimulation, Bioaugmentation

Insitu and Ex-situ-Bioremediation, Phytoremediation Types - Phytoextraction,Phytoaccumulation, Phytodegradation or Phytotransformation, Phytovolatilization, Microbial degradation of xenobiotics

RECOMMENDED TEXTBOOKS:

1. Environmental Biology: Principles of Ecology-Verma and Agarwal,S Chand Publisher,2001.
2. Environmental chemistry-B.K.Sharma,Goel Publishing house,2014.

REFERENCE BOOKS:

1. Principles of Ecotoxicology. C.H. Walker, R.M. Sibly, R.M. Sibly, D.B. Peakall CRC press, 4th edition, 2012.
2. Principles of Environmental Toxicology – I Shaw,J Chadwick,CRC press, First edition,1983**.**
3. Ecology: From Individuals to Ecosystems by Michael Begon, Colin R. Townsend,John L. Harper, Wiley Blackwell publisher,4th edition
4. Ecology and Environment by Pd Sharma**.** Rastogi Publications,2011.

5. Hayes' Principles and Methods of Toxicology - A Wallace Hayes (Editor), Claire L. Kruger (Editor),6th edition, CRC press,2014

JOURNALS:

1. https://www.frontiersin.org › journals › environmental-science › sections › environment
2. https://www.springer.com › ... › Environmental Sciences › Environmental Toxicology
3. Ecotoxicology
4. Environmental toxicology and Pharmacology
5. Journal of toxicology and environmental health

E-LEARNING RESOURCES:

1. https://www.yourarticlelibrary.com/environment/ecosystem/ecosystems-concept-structure-and-functions-of-ecosystems-with-diagram/28211
2. https://youmatter.world/en/definition/ecosystem-definition-example/
3. https://www.conserve-energy-future.com/radioactive-pollution-causes-effects-solutions.php
4. https://www.sciencedirect.com/topics/pharmacology-toxicology-and-pharmaceutical-science/pesticide-toxicology
5. https://www.sciencedirect.com/topics/earth-and-planetary-sciences/bioremediation

COURSE OUTCOMES:

CO. NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Understanding of the components of ecosystem and biogeochemical cycles	K1,K2
CO 2	Get in depth knowledge of different types of ecosystems.	K2,K3
CO3	Grasp of the harmful effects of different types of pollutants and measures Control pollution	K2,K3,K4
CO4	Learning methods of estimation of toxic metals , and effects of heavy metal and pesticide pollution	K2,K3,K4
CO5	Apply the knowledge in the disposal of waste by various bioremediation methods	K2,K3,K4

QUESTION PAPER PATTERN:

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1	Sec A – 10 x 2	50	20	100	Question number compulsory for all questions. Section A – Two questions from each unit Section B- Minimum of 1 question from each unit. Section C - 4 Questions from 4 different units.
K1,K2	B – 5/8 x 8	500	40		
K2,K3	C – 2/4 x 20	1200	40		

SEMESTER III

SELF STUDY- BIOETHICS

CREDITS: 2 **COURSE CODE:15SP21/3SS/BIE**

COURSE OBJECTIVES:

1. To instil ethical values in students
2. To create awareness on UNESCO Bioethics principles
3. To sensitize students about ethics in environmental protection.
4. To sensitize students about ethical issues concerning birth, life and death.
5. To impart knowledge on the ethical issues in biomedical research.

COURSE OUTLINE:

UNIT I

Ethics - Introduction; Types - Meta ethics, Applied ethics, Descriptive ethics, Normative ethics; Principles – Beneficence, Non-Maleficence, Respect to Autonomy, Justice; Theories – Deontological Ethics, Utilitarian Ethics & Virtue Ethics . Ethical dilemma, Objectivity and subjectivity, Decision making and ethics - ADPIE model of decision making

UNIT II

Bioethics - Introduction and Significance

UNESCO Universal declaration on Bioethics & Human rights - Bioethical principles - Human dignity and human rights, Benefit and harm, Autonomy and individual responsibility , Consent , Persons without the capacity to consent, Respect for human vulnerability and personal integrity , Privacy and confidentiality.

UNIT III

UNESCO Bioethical principles -Equality, justice and equity Non-discrimination and non-stigmatization, Respect for cultural diversity and pluralism , Solidarity and cooperation , Social responsibility and health ,Sharing of benefits , Protecting future generations , Protection of the environment, the biosphere and biodiversity

UNIT IV

Ethical issues concerning birth, life and death: Reproductive technologies - Gamete donation, In Vitro Fertilisation, Embryo transfer, surrogacy, prenatal diagnosis, sex-selection; Genetic Screening (Eugenics), Abortion, Organ transplantation, withholding and withdrawing medical treatment- Euthanasia.

UNIT V

Ethical issues in Biotechnology and Biomedical Innovations - Cloning- Case of cloned cats , Gene therapy,Genetically modified organisms - Golden rice and hybrid corn, Enviro pigs; Use of stem cells, Fetal tissue research.

Clinical Ethics - CPR (James Elam experiment), Research Ethics - Tuskegee syphilis experiment, Willowbrook experiment . Copyrights & Licencing

RECOMMENDED TEXTBOOKS:

1. Bioethics,Shaleesha. A.Stanley, Wisdom Educational Service, 2008
2. Bioethics, S. Ignacimuthu, Alpha Science International Ltd, 2009

REFERENCE BOOKS:

1. Bioethics: Introduction to History, Methods, and Practice, Nancy S. Jecker, Jones & Bartlett Publishers , Second edition ,2007.
2. Biotechnology and Intellectual Property Rights - Kshitij Kumar Singh,Springer Nature publications ,2015.
3. Principles of Biomedical Ethics, Tom L. Beauchamp, Oxford University Press,USA, Seventh Edition,2013.
4. Bioethics: The Basics, Alastair.V.Campbell, Routledge Publishings,Second edition,2017.
5. Intellectual property rights and copyrights – S V Satakar, ESS publication, New Delhi, 2002

JOURNALS:

1. Bioethics
2. Journal of Medical Ethics
3. Journal of Bioethical inquiry
4. The American Journal of Bioethics
5. Journal of Clinical research and bioethics

E-LEARNING RESOURCES:

1. https://www.onlineethics.org/resources
2. http://www.mondialisations.org/medias/pdf/cours_bioethique_en.pdf
3. https://bioethics.msu.edu/what-is-bioethics
4. https://samples.jbpub.com/9781284059502/Chapter_2_Sample.pdf
5. https://ocw.mit.edu/courses/linguistics-and-philosophy/24-06j-bioethics-spring-2009/study-materials/

COURSE OUTCOMES:

CO No	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Understanding the basic principles of Ethics	K2,K3
CO2	Grasp of UNESCO's bioethical principles	K2,K3
CO3	Realizing importance of Environmental & Biodiversity protection	K2,K3
CO4	Following ethical practices in aspects pertaining to life	K3,K4
CO5	Following ethical practices in aspects in research	K3,K4

QUESTION PAPER PATTERN:

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1	**Sec A – 10 x 2**	**50**	**20**	**100**	**Question number compulsory for all questions.** **Section A – Two questions from each unit**
K1,K2	**B – 5/8 x 8**	**500**	**40**		

K2,K3	**C – 2/4 x 20**	**1200**	**40**		**Section B- Minimum of 1 question from each unit.** **Section C - 4 Questions from 4 different units.**

SEMESTER IV

ADVANCED IMMUNOLOGY

TEACHING HOURS: 75 **COURSE CODE:15SP21/4C/AIM**

CREDITS : 4 **L-T-P : 5-0-0**

COURSE OBJECTIVES:

1. To understand the types of immunity,cells,organs,inflammatory response of the immune system and the details of various antigens and cross reactivity
2. To enable students to understand the classes and subclasses of antibodies,multigene organization, generation of antibody diversity and Complements
3. To sensitise the students to learn about the presentation of antigens,T cell mediated and B cell mediated immunity.
4. To impart the knowledge on MHC,autoimmune diseases, hypersensitivity and diagnostic immunology.
5. To study the different types,importance of vaccines, tumour antigens & immunotherapy for cancer

COURSE OUTLINE:

UNIT I (15 Hours)

Overview of Immunity and its types, Cells and organs of immune system.Virus and bacterial recognition by innate immune system, Inflammation and its types- Acute ,Chronic ,Local & Systemic inflammation.Acute phase protein,Interferon, Interleukins and cytokines. Antigens – Viral antigens and Bacterial antigens,Factors affecting antigenicity, Epitopes - B and Tcell epitopes .Adjuvants, Haptens,Cross reactivity.

UNIT II (15 Hours)

Antibodies- Structure and classes - Isotypes, Allotypes and Idiotypes, Subclasses,Effector functions. B cell development, B cell receptor - Multigene organization and DNA rearrangements. Generation of Antibody diversity - Mechanisms.Clonal selection, Monoclonal antibody-Production and applications.Complement system – Complement activation- Classical, Alternative and Lectin pathway , Complement deficiencies.

UNIT III (15 Hours)

Antigen processing and presentation – Cytosolic and Endocytic pathway. T cell mediated immunity- TCR and accessory membrane molecules, Tcell differentiation, activation and Cell mediated cytotoxicity. B cell mediated immunity-B cell Activation, T & B cooperation,Plasma and memory cells..Class switching

UNIT IV (15 Hours)

Major Histocompatibility complex – General organization and HLA antigens.MHC complex and Disease susceptibility.

Diagnostic Immunology -Coombs test, Complement fixation test,ELISA, and Immunohistochemistry.

Overview of Hypersensitivity reactions. Autoimmunity- Organ specific- Insulin dependent DiabetesMellitus ,Graves disease. Systemic- Systemic lupus erythematosus, Multiple sclerosis.

UNIT V (15 Hours)

Vaccines – Importance and Challenges in production. Types- Whole organism vaccines - Live attenuated and Inactivated vaccines. Purified macromolecular vaccines - Inactivated exotoxins,Capsular polysaccharides and surface antigens, Recombinant vector vaccines, DNA vaccines and Multivalent subunit vaccines.

Clinical transplantation- Graft rejection- Acute & Chronic. Immunosuppression and Immune tolerance. Cancer and Immune system- tumours of the Immune system- Tumour antigens, Cancer Immuno therapy.

. RECOMMENDED TEXTBOOKS:

1. Immunology – Janis Kuby, 6th edition, 2007.
2. Immunology –Roitt , Brostoff and Male, Mosby Publishers, 3rd Edition 1993.

REFERENCE BOOKS:

1. Immunology: A Short Course-RichardCoico,Geoffrey Sunshine,7th Edition,Wiley Blackwell, 2015.
2. Immunology- Peter ,Alex and Micheal,2nd edition,2004
3. Cellular and Molecular Immunology- Abul.K.Abbas, Andrew, Shivpillai, 9th Edition 2017.
4. Case studies in Immunology, 7th Edition- RaifGeha, Luigi Notarangeto, 2017.

5. Clinical Immunology- Helen Chapel, ManrelHaeney& Neil Snowden, 6th Edition, 2016

JOURNALS:

1. Journal of Immunology Research.
2 Journal of Immunology
3 International Journal of Immunology
4. International Journal of Immunology and Immunotherapy
5. Research & Reviews: A Journal of Immunology

E- LEARNING RESOURCES:

1. www.whfreemen.com/kuby
2. www.immunologylink.com
3. https://www.frontiersin.org/articles/10.3389/fimmu.2018.01941/full
4. https://www.ncbi.nlm.nih.gov/books/NBK27155/
5. https://www.msdmanuals.com/home/immune-disorders/transplantation/overview-of-transplantation

COURSE OUTCOMES:

CO . NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Explain the types of immunity, immune organs, Virus and bacterial recognition by innate immune system, Inflammation and its types,Interferon Interleukins and cytokines, Viral antigen,Bacterialantigens,Factors affecting antigenicity, B and Tcellepitopes,Adjuvants, Haptens and cross reactivity.	K1 K3
CO 2	Discuss on the Antibodies Isotypes, Allotypes and Idiotypes, Subclasses, Effector functions, B cell development, B cell receptor, Multigene organization , mechanism of Generation of Antibody diversity,.Clonal selection, Monoclonal antibody-Production and applications,Complement system and Complement deficiencies.	K3, K4,K5
CO3	Explain the Antigen processing and presentation, T cell mediated immunity, TCR and accessory membrane molecules, T cell differentiation, activation, Cell mediated cytotoxicity, B cell mediated immunity,B cell Activation, T & B cooperation,Plasma and memory cells and Class switching	K3,K4,K5
CO4	Outline the Major Histocompatability complex, HLA antigens.MHC complex and Disease susceptibility, Coombs, CFT, ELISA,	K4

	Immunofluoresence tests, Immunohistochemistry, Hypersensitivity reactions, Autoimmune Organ specific and. systemic disorders.	K2
CO5	To learn about the importance and Challenges in vaccine production, Live attenuated and Inactivated vaccines, Inactivated exotoxins,Capsular polysaccharides and surface antigens, Recombinant vector vaccines, DNA vaccines and Multivalent subunit vaccine, Acute & Chronic rejection, Immunosuppression, Immune tolerance, Tumour antigens, Cancer Immunotherapy	K3 K4,K5

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	2	3	3	3
CO2	3	3	2	3	3
CO3	3	2	3	3	3
CO4	3	2	3	3	3
CO5	2	3	3	2	2
AVERAGE	**2.6**	**2.4**	**2.8**	**2.8**	**2.8**

KEY: STRONGLY CORRELATED – 3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED – 1, NO CORRELATION – 0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-LCD)
2. Blended Classroom-E Content, Videos
3. Quiz, Seminar
4. Peer Learning

QUESTION PAPER PATTERN:

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,K2	**Sec A – 10 x 2**	**50**	**20**	**100**	Question number compulsory for all questions. Section A - Two questions from each unit Section B- Minimum of 1 question from each unit. Section C - 4 Questions from 4 different units.
K3,K4	**B – 5/8 x 8**	**500**	**40**		
K3,K4,K5	**C – 2/4 x 20**	**1200**	**40**		

SEMESTER-IV

ADVANCED BIOTECHNOLOGY

TEACHING HOURS: 75 **COURSE CODE:15SP21/4C/ABI**

CREDITS : 4 **L-T-P : 5-0-0**

COURSE OBJECTIVES:

1. To expose students to the tools of Recombinant DNA technology
2. To enable students to understand the methods & steps in Gene cloning and about Recombinant protein production.
3. To expose students to animal cell culturing , enable them to understand and appreciate applications of biotechnology in medicine, Introduce the concepts of Regenerative medicine and Synthetic Biology
4. To impart the knowledge about plant Biotechnology and enable students to understand its applications in crop improvement ,disease and drought resistance.
5. To impart knowledge about the applications of biotechnology to handle environmental issues and to enrich the learning about the production of industrially important products with scope for entrepreneurial development

COURSE OUTLINE:

UNIT I (15 Hours)

Recombinant DNA Technology – Toold of r – DNA technology – Enzyme DNA ligase, Reverse transcriptase, Restriction endonuclease, Terminal transcriptase, Nuclease, DNA polymerase, Ribonuclease – H, Alkalinephosphatase, Polynucleotide kinase, Linkers ,Adaptors, Vectors –

Plasmid(PUC18) Phage vectors (λ phage vector, M 13),Cosmids ,Phagemids,Fosmids ,Viral vector-(Adenovirus). ,Artificial chromosome vector(BAC,,HAC), Shuttle vectors(YEP, YAC), Expression vectors. Selection of host- Prokaryotic and Eukaryotic host.

UNIT II (15 Hours)

Molecular Cloning -Isolation of gene of interest, r-DNA production, Natural and Artificial methods of gene transfer. Selection of recombinants - Marker gene, Reporter gene, Insertional inactivation, α complementation,Colony hybridization method, Plaque lifting method, Immunological method. Expression of cloned gene, Collection and Purification of recombinant proteins.Gene library-Genomic and c-DNA Library.DNA Probes , RNA Probes, Screening of Gene libraries with oligo probe.

Cell free expression Systems,Recombinational Cloning- GATEWAY cloning Technology,BP ,LR reaction.

Gene Amplification – PCR ,Types- Real time, RT PCR, Nested & Multiplex PCR, RAPD,RFLP.STR Amplification, Gene Knockout - Global Knockout and Conditional knockout, Genome Editing - GEEN, CRISPR/Cas 9

UNIT III (15 Hours)

Tissue Engineering and Synthetic Biology.

Tissue Engineering - Animal cell culture. Culture media- Natural, artificial, serum and serum free media, Embryonic stem cells,Bone marrow derived stem cells, Cord Stem cells, Biomaterials , Scaffolds, Tissue modeling, Regenerative medicine.

Synthetic Biology-Definition, Cell Based Therapeutics - Synthetic biology for Solid Tumor treatment,Engineering approaches to Viral infections ,Designer Proteins, Non natural Nucleic acids-Aptamers , Threose Nucleic acid (TNA), Drug delivery platforms - Synthetic microbes.

UNIT IV (15 Hours)

Plant Biotechnology

Biotechnology in Plant Breeding- Plant tissue culture, Micropropagation, Somoclonal variation, Embryo rescue and Cryopreservation., Hydroponics, GMO, Transgenic plants- Gene constructs ;vectors-Ti ,Ri plasmids, TMV, Reporter genes - GFP, GUS,CAT, Transgenic crops -- Insect resistant crops, Viral resistant crops ,Salinity and Drought resistant crops , Cultivation of medicinal plants in India and Government Support- NMPB ,AYUSH

UNIT V (15 Hours)

Industrial Biotechnology : Fermentation, Bioreactors- types. Downstream processing. Production of Single cell protein- Spirulina ,Production of Cheese, Production of Biofuels,-Bio gas ,Biodiesel and Bioethanol

Environmental Biotechnology – Bioremediation – Extrinsic and Intrinsic. Phytoremediation, Sewage/Waste water treatment,Solid waste management,Bioplastics ,Carbon Sequestration, Green Energy

RECOMMENDED TEXTBOOKS:

1. Biotechnology – U.Sathyanarayana , Books and Allied Pvt Ltd, 8th Print, 2013.
2. Textbook of Biotechnology- Dr.PRakash S. Lohar, MJP publisher, 2012
3. Textbook of Biotechnology 4th Rev. Edn. 2006 Edition, by R C Dubey

REFERENCE BOOKS :

1. Molecular Biotechnology- Glick and Pasternick, 3rd Edition, ASM Press, 2003.
2. Principles of Gene Manipulation- Old & Primrose, 5th Edition, Blackwell Science, 1996.
3. Gene Cloning and DNA Analysis: An Introduction – T. A. Brown; Publisher: Wiley-Blackwell; 7th edition, 2016.
4. Plant Biotechnology and Genetics: Principles, Techniques, and Applications - Stewart Jr., C. Neal, 2nd Edition, ISBN-13: 978-1118820124
5. Recombinant DNA: Genes and Genomes – James D. Watson, Amy A. Caudy, Richard M. Myers and Jan A. Witkowski; Publisher: WH Freeman; 3rd ed, 2007.

JOURNALS:

1. International Journal of Biotechnology
2. International Journal of Biotechnology& Biochemistry
3. Indian Journal Of Biotechnology (Ijbt)
4. Nature Biotechnology
5. Journal of Biotechnology-Elsevier

E-LEARNING RESOURCES:

1. Biotechlearn.org.nz/
2. Www.ms-biotech.wisc.edu/biotech-webs
3. http://www.actabp.pl/pdf/Supl4_11/Session_15.pdf
4. www.gate2biotech.com/instantnotes-
5. https://nptel.ac.in/courses/102/106/102106081/
6. https://nptel.ac.in/courses/102/104/102104056/

COURSE OUTCOMES:

CO. NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Discuss about the various tools of rDNA technology compare various vectors , select suitable hosts for cloning.	K1,K2
CO 2	Explain about gene isolation and amplification,Compare various gene amplification techniques, Discuss the steps in Cloning, collection ,Expression & purification of proteins, Explain the use of Probes, Explain about RecombinationalCloning,Gene knock outs and Genome Editing.	K2,K3.K4
CO3	Discuss about Tissue engineering, Regenerative medicine ,Explain the applications of Synthetic Biology	K3,K4,K5
CO4	Assess the use of Plant tissue cultures, Apply the knowledge to produce improved crop varieties, Discuss about the importance of medicinal plant cultivation and the support from AYUSH	K3,K4
CO5	Apply the knowledge about Bioremediation towards solving common environmental pollution , Discuss about Green energy, Demonstrate the Industrial production of biofuels, SCPs.Cheese and Explore Entrepreneurial opportunities in the aforementioned production strategies	K3,K4

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	3	2	3	3
CO2	2	3	2	3	3
CO3	2	3	3	3	3
CO4	3	3	3	3	3
CO5	2	3	2	3	3

AVERAGE	**2.2**	**3**	**2.4**	**3**	**3**

KEY: STRONGLY CORELATED -3, MODERATELY CORELATED -2, WEAKLY CORELATED -1, NO CORELATION-0

TEACHING METHODOLOGY:

1. Lecture (Chalk A0nd Talk)
2. E Content ,Videos
3. Group Discussion
4. Quiz-Seminar

QUESTION PAPER PATTERN:

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,K2	**A-10X2 marks**	**50**	**20**	**100**	Question number compulsory for all questions. Section A - Two questions from each unit Section B- Minimum of 1 question from each unit. Section C - 4 Questions from 4 different units**.**
K3,K4	**B-5/8x8 marks**	**500**	**40**		
K3,K4,K5	**C-2/4x20 marks**	**1200**	**40**		

SEMESTER IV

ELECTIVE - BIOINFORMATICS

TEACHING HOURS: 60 **COURSE CODE:15SP21/4E/BIN**

CREDITS : 3 **L-T-P : 3-1-0**

COURSE OBJECTIVES:

1. To impart the fundamentals of Bioinformatics and various biological databases.
2. To expose the students to various methods of sequence analysis and its applications.
3. To introduce the principles of Genomics and High-throughput technologies.
4. To introduce the fundamentals of Proteomics with special reference to Protein structure Prediction.
5. To Impart knowledge on the role of insilico tools in Drug designing and development.

COURSE OUTLINE:

UNIT I (12 Hours)

Introduction to Bioinformatics**:** Principles, Challenges and Applications. Major Bioinformatics Resources: NCBI, ExPASy; Biological databases - Nucleic acid sequence databases: INSDC - GenBank, EMBL, DDBJ; Protein sequence databases: Uniprot, Prosite; Structure Databases: PDB, NDB, Genome Databases – SGD, ACeDB; Metabolic pathway database (KEGG); Literature databases - PubMed, Public Library of Sciences (PLoS); Data retrieval systems - Entrez, DBget. (Demonstration of the use of above databases)

UNIT II (12 Hours)

Sequence Analysis: Basic concepts of Sequence analysis; Gap penalties, Scoring matrices - PAM and BLOSUM. Global and Local alignment; Pairwise alignment – Dot plot, Dynamic programming (Needleman &Wuncsh, Smith & Waterman algorithms), Hash coding algorithm, Heuristic tools - FASTA, BLAST. MSA – Progressive alignment algorithms for MSA – CLUSTAL Omega. Phylogenetic analysis - Definition and description of phylogenetic trees and various types of

trees, Method of construction of Phylogenetic trees - Distance based method (UPGMA) and Maximum Parsimony; Bootstrapping, Phylip. Motif and Domain analysis - SMART, ProDom. (Demonstration of the use of above Tools)

UNIT III (12 Hours)

Genomics: Structural genomics - Genome mapping - Types - genetic and physical. Molecular markers for mapping - RFLPs, SNPs and FISH. Genome Sequencing - Whole genome and Hierarchical sequencing. Assembling a physical map of the genome - chromosome walking and jumping. Annotation - Gene prediction concepts. Functional Genomics - EST, SAGE, DNA Microarray; comparative Genomics; Human Genome Project; RNA Secondary structure prediction.

UNIT IV (12 Hours)

Proteomics: Fundamentals of proteomics - 2D PAGE, Differential InGel Electrophoresis & Protein Microarray in Proteomics; Prediction of Protein sorting, modification and interaction. Protein secondary structure prediction methods (Chou-Fasman).Protein secondary structure classification databases: CATH, SCOP. Protein Tertiary structure prediction methods: Homology Modeling, Fold Recognition, *Abintio* Method. 3-D structure visualization - Rasmol.

UNIT V (12 Hours)

Drug Discovery and design: Steps in drug development. Chemical Structure Representation (SMILE).Chemical databases: PUBCHEM. Lipinski's rule of five. Quantitative Structure Activity Relationship.Computer aided rational drug design – SBDD, LBDD. Pharmacogenomics.

RECOMMENDED TEXTBOOKS:

1. Text book of Bioinformatics – Sharma &Munjal, Rastogi Publications, 1st Edition 2008.
2. Bioinformatics Data bases & Algorithms- N.Gautham, Narosa Publishing, Reprint 2009.

REFERENCE BOOKS:

1. Essential Bioinformatics – JinXiong, Cambridge University Press, 2006.
2. Bioinformatics: Sequence and Genome Analysis by Mount D., Cold Spring Harbor Laboratory Press, New York. 2004.
3. Bioinformatics- a Practical Guide to the Analysis of Genes and Proteins by Baxevanis, A.D. and Francis Ouellellette, B.F., Wiley India Pvt Ltd. 2009.
4. Introduction to bioinformatics by Teresa K. Attwood, David J. Parry-Smith. Pearson Education. 1999.
5. Understanding Bioinformatics- Jeremy O. Baun and Marketa.J. Garland Science; 1st edition, 2007.

JOURNALS:

1. Journal of Bioinformatics and Computational Biology
2. Journal of Proteomics & Bioinformatics
3. American Journal of Bioinformatics Research
4. Computers in Biology & Medicine

5. Bioinformatics and Computational biology

E-LEARNING RESOURCES:

1. www.ncbi.nlm.nih.gov
2. www.ebi.ac.uk
3. www.bioinformatics.org/
4. www.Expasy.org
5. www.Scripps.edu
6. www.merlot.org

COURSE OUTCOMES:

CO . NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Explain the computational methods in Biology; retrieve information from Biological databases.	K1,K2, K3
CO 2	Analyse sequences and find relationships using computational tools	K2, K3, K4
CO3	Discuss genomic data and Use appropriate tools in genomic research	K3, K4,K5
CO4	Explain the concepts in proteomics; Predict protein structure and chacterise it.	K3, K4,K5
CO5	Discuss the steps in drug development; use of appropriate insilico tools in each step.	K3, K4,K5

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	2	3	3	2
CO2	2	3	2	3	3
CO3	2	3	3	2	3

CO4	2	3	3	3	3
CO5	2	3	3	3	3
AVERAGE	**2**	**2.8**	**2.8**	**2.8**	**2.8**

KEY: STRONGLY CORELATED -3, MODERATELY CORELATED -2, WEAKLY CORELATED -1, NO CORELATION-0

TEACHING METHODOLOGY:

1. Lecture (Chalk A0nd Talk)
2. E Content ,Videos
3. Group Discussion
4. Quiz-Seminar

QUESTION PAPER PATTERN:

Knowledge Level	**Section**	**Word Limit**	**Marks**	**Total**	**Special Instructions if any**
K1,K2	**Sec A – 10 x 2**	**50**	**20**	**100**	Question number compulsory for all questions. Section A - Two questions from each unit
K3,K4	**B – 5/8 x 8**	**500**	**40**		

K3,K4,K5	**C – 2/4 x 20**	**1200**	**40**		Section B- Minimum of 1 question from each unit. Section C - 4 Questions from 4 different units.

SEMESTER IV
SOFT SKILL-PRESENTATION SKILLS

TEACHING HOURS : 30 **COURSE CODE:15SP21/4S/PRS**

CREDITS : 2 **L- T-P : 1-1-0**

COURSE OBJECTIVES:

1. To improve the language and communication skills of students.
2. To equip students with necessary skills to face interviews.
3. To impart knowledge about technical writing with special emphasis on scientific report writing.

COURSE OUTLINE:

UNIT I (10 Hours)

Language & Communication – Verbal & Non Verbal communication, Distinctive features of speech, Listening skills .Effective Oral preparation,Presentation of PPT for oral presentation , Poster presentation.

UNIT II (10 Hours)

Resume preparation .Participation in Group discussion. Preparation and facing an Interview. Difference between Speech and Writing-Distinct features of Writing Descriptive, Narrative , Expository & Argumentative writing .

UNIT III (10 Hours)

Technical Writing- Laboratory and Field book maintenance. Scientific report writing. Recording minutes of the meeting, Preparation of case studies. Scientific editing, Research proposal for grant, Preparation and types of e content- content writing for website.

RECOMMENDED TEXTBOOKS:

1. L.Hamp-Lyone&B.Heasely ; study writing; a course in written English for academic and Professional purpose, Cambridge union press.
2. Daniel G Riovdan Steven A panley " Technical Report & writing today – Biztaentric

REFERENCE BOOKS:

1. Contemporary Business Communication, Scot offer, Biztantre 5 edition (2004)
2. system Design Interview-A strategic guide for successful interview by Stanley Bellbrook
3. Scientific Thesis Writing and Paper Presentation . MJP Publishers.2010

JOURNALS:

1. Birmingham Business Journal

E-LEARNING RESOURCES:

1. www.Scripps.edu
2. www.open.ac.uk
3. www.microsoft.com

COURSE OUTCOMES:

CO . NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Communicate their thoughts and ideas without fear.	K1

CO 2	Face Interview confidently ;	K2,K3
CO3	Discuss scientific report writing and preparation of case studies. Scientific editing and preparation of proposal for grants were also thought.	K3,K4,K5

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PO	PSO1	POS2	PSO3	PSO4	PSO5
CO1	3	2	2	2	3
CO2	3	2	2	2	3
CO3	3	2	2	2	3
AVERAGE	**3**	**2**	**2**	**2**	**3**

KEY: STRONGLY CORELATED -3, MODERATELY CORELATED -2, WEAKLY CORELATED -1, NO CORELATION-0

TEACHING METHODOLOGY:

1. Lecture (Chalk A0nd Talk)
2. E Content ,Videos
3. Group Discussion
4. Quiz-Seminar

QUESTION PAPER PATTERN:

Knowledge Level	Section	Word Limit	Marks	Total
K1,K2	**A-5X10**	**350**	**50**	**50**

SESTER III & IV

CORE PRACTICAL III - IMMUNOLOGY & CLINICAL BIOCHEMISTRY

TEACHING HOURS: 135 **COURSE CODE:15SP21/4C/CP3**

CREDITS : 4 **L-T-P : 0-0-4 (Semester III)**

L-T-P : 0-0-4 (Semester IV)

COURSEOBJECTIVES:

1. To equip the students to collect collect and process blood samples
2. To train the students in immunology experiments
3. To have hands on training in hematological parameters
4. To learn the use the diagnostic kits and Uristix
5. To determine the levels of metabolites using colorimeter and spectrophotometer

COURSE OUTLINE:

IMMUNOLOGY (GROUP EXPERIMENTS)

1. Ouchterlony – Double diffusion
2. Cross over Immunoelectrophoresis, Rocket Immunoelectrophoresis
3. ELISA (demo)

CLINICAL BIOCHEMISTRY

4. Estimation of Protein
5. Estimation of Phospholipid
6. Estimation of Triglyceride
7. Estimation of Glucose
8. Estimation of Creatinine
9. Estimation of Urea

(GROUP EXPERIMENTS)

10. Hematology – Total RBC, WBC, Platelet count , Differential count, ESR, PCV, Hb (Hb Indices – MCV,MCH,MCHC)
11. Blood grouping
12. Urine analysis – Uristix
13. Serum sodium & Potassium – Flame photometry
14. Enzyme assay – LDH (Kit based)
15. KIT BASED - Bilirubin, Total Cholesterol, Uric acid

COURSE OUTCOMES:

CO . NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Training in Immunological experiments	K4,K5
CO 2	Estimate the total RBC, WBC, Platelet count , Differential count, ESR, PCV, Hb (Hb Indices – MCV,MCH,MCHC) and Blood grouping	K4,K5
CO3	Use Colorimeter, Spectrophotometer, Flame photometer to estimate compounds in the biological specimens	K4,K5

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PO	PSO1	POS2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3

CO3	3	3	3	3	3
AVERAGE	**3**	**3**	**3**	**3**	**3**

KEY: STRONGLY CORELATED -3, MODERATELY CORELATED -2, WEAKLY CORELATED -1, NO CORELATION-0

TEACHING METHODOLOGY:

1. Hands on training on the experiments
2. Demonstration of the experiments

SEMESTER III & IV

CORE PRACTICAL IV - MOLECULAR BIOLOGY & ANTIOXIDANT STUDIES

TEACHING HOURS: 135 **COURSE CODE:15SP21/4C/CP4**

CREDITS:4 **L-T-P: 0-0-4(Semester III)**

L-T-P: 0-0-5(Semester IV)

COURSE OBJECTIVES:

1. Hands-on training in Molecular Biology Techniques.
2. Collect and process blood samples for antioxidant studies
3. Assess the antioxidant status of human subjects
4. To learn qualitative and quantitative analysis of phytochemicals.
5. To determine the antioxidant potential of plant extracts.

COURSE OUTLINE:

MOLECULAR BIOLOGY (GROUP EXPERIMENTS)

1. Isolation of Genomic & Plasmid DNA
2. Restriction digestion & Ligation
3. PCR (Demonstration)
4. Transformation

ANTIOXIDANTS STATUS

5. Estimation of Reduced glutathione
6. Estimation of TBARS
7. Estimation of Vitamin C
8. Estimation of Vitamin E
9. Assay of Catalase

ANTIOXIDANT STUDY OF PHYTOCHEMICALS

10. Qualitative Analysis of Phytochemicals
11. Estimation of Tannins
12. Estimation of Alkaloids
13. DPPH scavenging assay
14. Nitrogen oxide scavenging assay
15. FRAP assay

COURSE OUTCOMES:

CO . NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Explain Isolation of Genomic and Plasmid DNA,Restriction digestion and Ligation,PCR and transformation.	K4,K5
CO 2	Assay Antioxidants in serum	K4,K5
CO3	To Analyse antioxidant activity of Phytochemicals.	K4,K5

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PO	PSO1	POS2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
AVERAGE	**3**	**3**	**3**	**3**	**3**

KEY: STRONGLY CORELATED -3, MODERATELY CORELATED -2, WEAKLY CORELATED -1, NO CORELATION-0

TEACHING METHODOLOGY:

1. Hands on training on the experiments
2. Demonstration of the experiments

SEMESTER II

EXTRA DISCIPLINARY ELECTIVE - WOMEN AND HEALTH

(FOR OTHER DEPARTMENTS)

TEACHING HOURS: 60 **COURSE CODE:15SP21/2E/WOH**

CREDITS: 3 **L-T-P: 3-1-0**

COURSE OBJECTIVES:

1. To provide basic understanding about the physiology of the female reproductive system and associated ailments.
2. To inculcate knowledge about fetal development, vaccines and diagnostic tests during pregnancy and possible complications of pregnancy
3. To educate on post pregnancy stages in maternal neonatal care, contraceptive methods,Family planning and STD
4. To create awareness about breast, cervical and ovarian cancers and common health issues of women
5. To emphasize on healthy living with a balanced diet and physical fitness.

COURSE OUTLINE:

UNIT I (12 Hours)

Study of the female reproductive system, Female hormones, Menarche, Menstrual cycle, Menopause. Problems associated – Premenstrual syndrome, Amenorrhoea, Dysmenorrhoea, Polycystic ovary and fallopian tube obstruction. Nutrition during adolescence.

UNIT II (12 Hours)

Pregnancy-Vaccines and diagnostic tests during pregnancy. Foetal testing – amniocentesis, foetal blood sampling – diseases identified. Complications associated with pregnancy – Gestational diabetes, Ectopic pregnancy, Eclampsia, Miscarriage, still birth andNutrition during pregnancy. Development of foetus in different trimesters.

UNIT III (12 Hours)

Parturition – different types. Significance of breastfeeding, Nutrition during lactation, Vaccination for infants, Infant nutrition. Contraception and family planning-Reversible and irreversible methods.Sexually transmitted diseases-AIDS, Syphilis, Gonorrhoea-Symptoms, Diagnosis and Treatment.

UNIT IV (12 Hours)

Health problems in women – Anemia, Varicose veins,Thyroid diseases-hypothyroidism and hyperthyroidism, Cancers – Breast cancer, Cervical cancer and Ovarian cancer - Symptoms, Diagnosis and Treatment.Socio economic factors affecting Women's health

UNIT V (12 Hours)

Balanced diet for Women – Nutrition and Guidelines for good health,Functions of nutrient-Carbohydrates, Lipids, Protein, fibre and water.Vitamins and Minerals – Sources, Requirements and Deficiency diseases. Physical activity – Calorific value of food, Food pyramid and food groups , Fitness and Health-Aerobics and Yoga.

RECOMMENDED TEXT BOOKS:

1. Human Anatomy and Physiology-Elaine .N marieb Pearson publisher 3rdedn, 1995.
2. Understanding nutrition- Eleanor,noss,Whitrney. Wadsworth Publishing; 10 edition
3. Nutrition and Dietetics second edition-Shubhangini A Joshi.

REFERENCE BOOKS:

1. Women and Health - Kathryn M. Rexrode, Marlene B. Goldman, Rebecca Troisi, Elsevier science, 2nd Edition, 2012.
2. Handbook of Food and Nutrition - Dr. M. Swaminathan , Banglore Press, 1St edition,2018
3. Encyclopedia of Reproduction- Michael K. Skinner (Editors), Elsevier science publisher, ,2nd edition , 2018.
4. Sexually Transmitted Diseases: Vaccines, Prevention, and Control - Lawrence R. Stanberry(Editor), Susan L Rosenthal(Editor),Academic Press; 2nd edition ,2012.
5. Mayo Clinic Guide to a Healthy Pregnancy - Dr. Myra J. Wick M.D. Ph.D.(Author), Mayo Clinic Press; Revised 2nd Edition, 2018.

JOURNALS:

1. Women's Health Issues
2. Health care for Women International
3. International Journal of Women's Health
4. Journal of Women's Health and Gynecology
5. Journal of Womens Health Care and Management

E-LEARNING RESOURCES:

1. https://www.cdc.gov/reproductivehealth/contraception/index.htm
2. https://www.rxlist.com/stages_of_pregnancy_slideshow/article.htm
3. https://my.clevelandclinic.org/health/diseases/4148-dysmenorrhea
4. https://my.clevelandclinic.org/health/diseases/9687-ectopic-pregnancy

5. https://www.webmd.com/breast-cancer/stages-grades-breast-cancer
6. https://www.britannica.com/video/192622/Human-embryonic-development-birth-fertilization

COURSE OUTCOMES:

CO . NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Discuss and explain the organs and hormones of female reproductive system and utilize knowledge in identifying various ailments associated with it	K2,K3
CO 2	Outline on various tests and vaccine during pregnancy ,explain the development of fetus in trimester and utilize the knowledge in identifying the complications of pregnancy	K3,K4
CO3	Explain the various parturition methods and discuss neonatal care in terms of feeding and vaccine schedules .Also apply the knowledge of STD in selecting the proper prevention methods	K3,K4,K5
CO4	Discuss the common health issues and cancers of women, utilize the knowledge in identifying proper diagnostic methods and preventive measures	K3,K4,K5
CO5	Apply the knowledge in selecting healthy nutrient rich foods and create awareness on physical fitness	K2,K3

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	2	3	2	3	3
CO2	3	3	3	2	2
CO3	3	2	2	2	3

CO4	3	3	3	3	3
CO5	3	3	3	3	2
AVERAGE	**2.8**	**2.8**	**2.6**	**2.6**	**2.6**

KEY: STRONGLY CORELATED -3, MODERATELY CORELATED -2, WEAKLY CORELATED -1, NO CORELATION-0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-LCD)
2. Blended Classroom-E Content, Videos
3. Quiz, Seminar
4. Peer Learning
5.Google classroom

QUESTION PAPER PATTERN:

Knowledge Level	**Section**	**Word Limit**	**Marks**	**Total**	**Special Instructions if any**
K1,K2	**Sec A – 10 x 2**	**50**	**20**	**100**	Question number compulsory for all questions. Section A - Two questions from each unit Section B- Minimum of 1 question from each unit. Section C - 4 Questions from 4 different units**.**
K3,K4	**B – 5/8 x 8**	**500**	**40**		
K3,K4,K5	**C – 2/4 x 20**	**1200**	**40**		

SEMESTER III

EXTRA DISCIPLINARY ELECTIVE - LIFESTYLE ASSOCIATED DISEASES

(For other departments)

TEACHING HOURS: 60 **COURSE CODE:15SP21/3E/LIF**

CREDITS: 3 **L-T-P: 4-0-0**

COURSE OBJECTIVES:

1. To impart knowledge on complications associated with lifestyle habits
2. To educate about the ailments of unhealthy food habits and emphasize on healthy eating
3. To create awareness on health hazards of costumes and chemical cosmetics
4. To develop knowledge on understanding free radicals ,antioxidants ,cancer, liver disease, and DM
5. To educate students about prevention and treatment for lifestyle diseases that affect the heart, lungs and kidney.

COURSE OUTLINE:

UNIT I (12 Hours)

Modern lifestyle habits- Sedentary lifestyle-Obesity, Stress-Causes,Complications and

Management, , Sleeping disorders- insomnia, sleep apnea, covid 19 sleep habits - complications and management, Health effects of Smoking, Alcoholism,

UNIT II (12 Hours)

Food habits and health- Junk food- Facts and ill effects, Carbonated drinks, Ready to eat foods, Acidity, Obesity, Eating disorders- Anorexia, Bulimia nervosa. Amoebiasis, Irritable bowel Syndrome. Constipation and Piles- Causes, Symptoms and Treatment.

UNIT III (12 Hours)

Health hazards of Costumes and Cosmetics- Tight clothing High heels, Hair coloring, Tattooing Face bleach,Facemask,hand sanitizer-benefits and risks. Types and Complications of Breast Implant and Liposuction.

UNIT IV (12 Hours)

Lifestyle diseases- Causes, symptoms and treatment of Breast, Cervical and Prostate cancer, Liver cirrhosis,fattyliver,gallstones, Diabetes Mellitus, Free radicals and Antioxidants.

UNIT V (12 Hours)

Lifestyle diseases- Causes, Symptoms and Treatment of kidney diseases- Nephritis,kidney stones, Pulmonary diseases- COPD,Allergic sinusitis, Heart disease- Atherosclerosis.

RECOMMENDED TEXT BOOKS:

1. Guide to prevention of life style diseases- M.Kumar & R.Kumar
2. Human physiology – Elaine N.Marieb, 3rd Edition, 1995.

REFERENCE BOOKS:

1. Understanding Nutrition – Eleanor, Noss,Whitney,Sharon Rady Rolfes, Cengage Learning, 14th edition.
2. Encyclopedia of Women health – Parvesh Handa,Gyan Publishing House,2006
3. Lifestyle Medicine: Lifestyle, the Environment and Preventive Medicine in Health and Disease - Garry Egger, Andrew Binns, Stephan Rossner, Michael Sagner, Elsevier science, 3rd edition,2017.
4. Lifestyle Medicine - James M. Rippe, CRC Press, 3rd edition,2019.
5. Healthful Eating As Lifestyle (HEAL): Integrative Prevention for Non-Communicable - Shirin Anil, CRC Press; 1st edition,2016.

JOURNALS:

1. Journal of Lifestyle diseases and management
2. National Journal of Integrated Research in Medicine
3. American Journal of Preventive Medicine
4. American Journal of lifestyle medicine

5. Journal of Academy of Nutrition and Dietetics

E-LEARNING RESOURCES:

1. https://www.slideshare.net/LianneDias/eating-disorders-24134152
2. https://www.slideshare.net/PauLmartus17/smoking-and-alcoholism
3. https://www.slideshare.net/manalihsolanki/breast-cancer-ppt-17274120
4. https://www.slideshare.net/jagdishsamabd/hyperthyroidism-hypothyrodism
5. https://www.slideshare.net/AnilKumarGowda/chronic-obstructive-pulmonary-disorders-copd-79676919

COURSE OUTCOMES:

CO . NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Discuss and explain the various health complications of lifestyle diseases like obesity, hypertension, stress, smoking and alcohol	K2,K3
CO 2	Outline on various junk foods and apply the knowledge in elimination of disorder like acidity, obesity, eating disorders, constipation and piles	K2,K3
CO3	Utilize the knowledge in eliminating chemical based cosmetics and selecting suitable attire	K2,K3,K4
CO4	Apply the knowledge in identifying lifestyle diseases like cancer and liver disorder and create awareness about the generation of free radicals and importance of antioxidants	K2,K3,K4
CO5	Discuss and explain various diseases of kidney, lungs and heart and create awareness on healthy life style modification	K3,K4,K5

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