

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)

CHENNAI- 600008

PG DEPARTMENT OF BIOCHEMISTRY

M.Sc -REVISED SYLLABUS EFFECTIVE FROM 2018-19

• **PREAMBLE**

The PG Department of Biochemistry is revising syllabi with effect from the academic year 2018-19 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**

➤ **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 there to 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.

➤ **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.

➤ **Course of the study:**

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

➤ **Passing minimum:**

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

➤ **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.

PROGRAMME EDUCATIONAL OBJECTIVE

- Post graduates will acquire knowledge to pursue research in various fields of Biochemistry.
- Post graduates will be able to perform as successful Biochemists in Medical, Pharma and Food Industry
- Post graduates will demonstrate sufficient skill to handle instruments and will be able to work both individually & as a part of a team.
- Post graduates will be socially sensitised and will be able to communicate scientific information in an ethical manner to the society

PROGRAMME OUTCOMES (PO)

1. To understand the central features of the extra ordinary diverse fields of life sciences
2. To impart critical thinking and problem solving ability
3. To acquire and to apply knowledge for development of diagnostic methods
4. To inculcate aptitude towards research
5. To sensitise towards gender health and environmental related issues

PROGRAMME SPECIFIC OUTCOMES (PSO)

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

1. Explain the fundamental concepts of biomolecules, enzymes, cells, organ systems and metabolism.
2. Demonstrate practical skills and scientific knowledge in domains of Molecular Biology, Enzymology, Genetics, food analysis, Clinical Biochemistry, Immunology, Pharmacology and Bioinformatics.
3. Develop problem solving ability by utilizing the conceptual knowledge, analytical techniques, computational and statistical approaches.
4. Apply the knowledge and expertise in industries and diagnostic laboratories enhancing job prospects
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)

DEPARTMENT OF BIOCHEMISTRY (ID: SP15)

M.Sc BIOCHEMISTRY

SEMESTER I

PROGRAMME PROFILE

Se m	Course Code	Title of the Paper	Credits	Hours /Work	Total Hours	CA	SA	Total
I	15SP18/1C/CHL	Chemistry Of Life	4	4	60	40	60	100
I	15SP18/1C/ABC	Analytical Techniques	4	4	60	40	60	100
I	15SP18/1C/HPH	Human Physiology	4	4	60	40	60	100
I	15SP18/1E/GNT	Elective-Genetics	3	4	60	40	60	100
I	15SP18/1E/BBC	Elective- Biostatistics and Biochemical Calculations	3	4	60	40	60	100
I	PG18/1S/PEW	Soft Skill- Personality Enrichment for Women	2	2	30	-	50	50
I	15SP18/2C/PL1	Core Practical – I	-	4	60	-	-	-
I	15SP18/2C/PL2	Core Practical – II	-	4	60	-	-	-
II	15SP18/2C/EBY	Enzyme Biochemistry	4	4	60	40	60	100
II	15SP18/2C/MRG	Metabolism And Regulation	4	4	60	40	60	100
II	15SP18/2C/HST	Hormones And Signal Transduction	4	4	60	40	60	100
II	15SP18/2E/RMT	Elective- Research Methodology	3	4	60	40	60	100
II		Extra Disciplinary	3	4	60	40	60	100

		Elective						
II		Soft Skill- Foreign Language	2	2	30	-	50	50
II	15SP18/2C/PL1	Core Practical – I	4	4	60	40	60	100
II	15SP18/2C/PL2	Core Practical – II	4	4	60	40	60	100
II	II	Internship	2		2			
III	15SP18/3C/MOL	Molecular Biology	4	4	60	40	60	100
III	15SP18/3C/CBI	Clinical Biochemistry & Biomedical Instrumentation	4	4	60	40	60	100
III	15SP18/3E/PCY	Elective - Pharmacology	3	4	60	40	60	100
III		Extra disciplinary elective	3	4	60	40	60	100
III	15SP18/3S/CSK	Soft skill - Computing Skills	2	2	30	-	-	50
III	15SP18/4C/PL3	Core Practical- III	-	-	60	-	-	-
III	15SP18/4C/PL4	Core Practical- IV	-	-	60	-	-	-

III	15SP18/4C/PRO	Project		4	60	-	-	-
IV	15SP18/4C/IMG	Immunology	4	5	75	40	60	100
IV	15SP18/4C/BIT	Biotechnology	4	5	75	40	60	100
IV	15SP18/4E/BIF	Elective – Bioinformatics	3	4	60	40	60	100
IV	15SP18/4S/PSK	Soft skill- Presentation Skills	2	2	30	-	-	50
IV	15SP18/4C/PL3	Core Practical- III	4	5	75	40	60	100
IV	15SP18/4C/PL4	Core Practical- IV	4	5	75	40	60	100
IV	15SP18/4C/PRO	Project	4	4	60	40	60	100

ELECTIVE SUBJECTS FOR OTHER DEPARTMENTS

S.no	Course code	Course title	Credits	Hours/Work	Total Hours	CA	SA	Total
1	15SP18/2E/WAH	Women and Health	3	4	60	40	60	100
2	15SP18/3E/LFD	Lifestyle Associated Diseases	3	4	60	40	60	100

EVALUATION PATTERN FOR CONTINUOUS ASSESSMENT

THEORY

Test I	2hrs	50 marks	10marks
Test II	2hrs	50hrs	10marks
Quiz/Assignment/Semester/Field visit			10marks
Participatory Learning			

Total 10marks 40 marks

PRACTICAL

Model Exam	6hrs	20 marks
Internal VIVA		10 marks
Class Participation		10 marks
-----		40 marks

PROJECT

Periodical Submission	20 marks
Internal VIVA	10 marks
Participatory Learning	10 marks
-----	40 marks

• RUBRICS FOR CONTINUOUS ASSESSMENT EVALUATION.

- Assignment -Contents/Originality/Presentation /Schematic representation and Diagram/Bibliography (10marks).
- Seminar - Organisation/Subject knowledge/Visual Aids/Confidence level/Presentation (10marks).
- Participatory learning-Answering questions/Clearing doubts/Participation in discussion /Attendance /Communication and language (10marks).

TEMPLATE FOR EVALUATION PATTERN

Semester	Course Code	Course Title	Continuous assessment				Total
			Test I	Test II	Seminars /Quiz/Assignment/Field Visit	Participatory Learning	
I	Chemistry Of Life	15SP18/1C/CHL	10	10	10	10	40
I	Analytical Techniques	15SP18/1C/ABC	10	10	10	10	40
I	Human Physiology	15SP18/1C/HPH	10	10	10	10	40
I	Elective-Genetics	15SP18/1E/GNT	10	10	10	10	40
I	Elective-Biostatistics and Biochemical Calculations	15SP18/1E/BBC	10	10	10	10	40
II	Enzyme Biochemistry	15SP18/2C/EBY	10	10	10	10	40
II	Metabolism And Regulation	15SP18/2C/MRG	10	10	10	10	40
II	Hormones And Signal Transduction	15SP18/2C/HST	10	10	10	10	40
II	Elective-Research Methodology	15SP18/2E/RMT	10	10	10	10	40
III	Molecular Biology	15SP18/3C/MOL	10	10	10	10	40
III	Clinical Biochemistry & Biomedical Instrumentation	15SP18/3C/CBI	10	10	10	10	40
III	Elective - Pharmacology	15SP18/3E/PCY	10	10	10	10	40
IV	Immunology	15SP18/4C/IMG	10	10	10	10	40
IV	Biotechnology	15SP18/4C/BIT	10	10	10	10	40
IV	Elective – Bioinformatics	15SP18/4E/BIF	10	10	10	10	40

TEMPLATE FOR EVALUATION PATTERN

Semester	Course Code	Course Title	Continuous assessment			
			Model exam	Internal VIVA	Class Participation	Total
I & II	Core Practical I	15SP18/2C/PL1	20	10	10	40
I & II	Core Practical II	15SP18/2C/PL2	20	10	10	40
III & IV	Core Practical III	15SP18/4C/PL3	20	10	10	40
III & IV	Core Practical IV	15SP18/4C/PL4	20	10	10	40

ELECTIVE PAPERS OFFERED FOR OTHER DEPARTMENTS

Semester	Course Code	Course Title	Continuous assessment				
			Test I	Test II	Seminars /Quiz/Assignment/Field Visit	Participatory Learning	Total
II	15SP18/2E/WAH	Women and Health	10	10	10	10	40
III	15SP18/3E/LFD	Lifestyle Associated Diseases	10	10	10	10	40

EVALUATION PATTERN FOR CONTINUOUS ASSESSMENT-PG

INTERNAL VALUATION BY COURSE TEACHER/S

CORE/ELECTIVE-THEORY 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

CORE/ELECTIVE-PRACTICAL PAPERS

COMPONENT	MARKS
1. Model Exam	20
2. Internal Viva	10
3. Class Participation	10
Total	40

PROJECT:

COMPONENT	MARKS
1. Periodical Review	30
2. Internal Viva	10
Total	40

SOFT SKILL PAPERS

COMPONENT	TIME	MAX.MARKS
1. Semester Examination	2 Hrs	50

CA QUESTION PAPER PATTERN-PG

Knowledge Level	Section	Word Limit	Marks	Total
K1,K2	A-7x2	50	14	50
K3,K4	B - 2/3 x 8	500	16	
K3,K4, K 5	C -1/2 x 20	1200	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

SEMSTER 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

SEMSTER I/II/III/IV

DOUBLE VALUATION BY COURSE TEACHER AND EXTERNAL EXAMINER

MAXIMUM MARKS: 100 TO BE CONVERTED TO 60

PASSING MARK:30

SOFT SKILLS PAPERS

SEMESTER I/II/III/IV

SINGLE VALUATION BY COURSE TEACHER

MAXIMUM MARKS: 50

PASSING MARKS:25

PROJECT PAPER

SEMESTER: IV semester

DOUBLE VALUATION BY RESEARCH SUPERVISOR AND EXTERNAL EXAMINER

DISSERTATION:40

VIVA: 20

MAXIMUM MARKS:60

PASSING MARKS:30

INTERNSHIP

YEAR IInd year

SEMESTER -III

M.Sc 19-20
(with OBE)

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)

DEPARTMENT OF BIOCHEMISTRY (ID: SP15)

M.Sc BIOCHEMISTRY

SEMESTER I

COURSE PROFILE

S.no	Course Code	Title of the Paper	Credits	Hours/Work	Total Hours	L-T-P	CA	SA	Total
1	15SP18/1C/CHL	Chemistry Of Life	4	4	60	3-1-0	40	60	100
2	15SP18/1C/ABC	Analytical Techniques	4	4	60	3-1-0	40	60	100
3	15SP18/1C/HPH	Human Physiology	4	4	60	3-1-0	40	60	100
4	15SP18/1E/GNT	Elective-Genetics	3	4	60	3-1-0	40	60	100
5	15SP18/1E/BBC	Elective- Biostatistics and Biochemical Calculations	3	4	60	3-1-0	40	60	100
6	PG18/1S/PEW	Soft Skill- Personality Enrichment for Women	2	2	30	2-0-0	-	50	50
7	15SP18/2C/PL1	Core Practical – I	-	4	60	0-0-4	-	-	-
8	15SP18/2C/PL2	Core Practical – II	-	4	60	0-0-4	-	-	-

SEMESTER II

S.no	Course Code	Title of the Paper	Credits	Hours /Work	Total Hours	L-T-P	CA	SA	Total
1	15SP18/2C/EBY	Enzyme Biochemistry	4	4	60	3-1-0	40	60	100
2	15SP18/2C/MRG	Metabolism And Regulation	4	4	60	3-1-0	40	60	100
3	15SP18/2C/HST	Hormones And Signal Transduction	4	4	60	3-1-0	40	60	100
4	15SP18/2E/RMT	Elective- Research Methodology	3	4	60	3-1-0	40	60	100
5		Extra Disciplinary Elective	3	4	60	3-1-0	40	60	100
6		Soft Skill- Foreign Language	2	2	30	2-0-0	-	50	50
7	15SP18/2C/PL1	Core Practical – I	4	4	60	0-0-4	40	60	100
8	15SP18/2C/PL2	Core Practical – II	4	4	60	0-0-4	40	60	100
9	II	Internship	2		2				

SEMESTER III

S.no	Course Code	Title of the Paper	Credits	Hours/Work	Total Hours	L-T-P	CA	SA	Total
1	15SP18/3C/MOL	Molecular Biology	4	4	60	4-0-0	40	60	100
2	15SP18/3C/CBI	Clinical Biochemistry & Biomedical Instrumentation	4	4	60	4-0-0	40	60	100
3	15SP18/3E/PCY	Elective - Pharmacology	3	4	60	4-0-0	40	60	100
4		Extra disciplinary elective	3	4	60	4-0-0	40	60	100
5	15SP18/3S/CSK	Soft skill - Computing Skills	2	2	30	1-1-0	40	60	100
6	15SP18/4C/PL3	Core Practical- III	-	4	60	0-0-5	-	-	-
7	15SP18/4C/PL4	Core Practical- IV	-	4	60	0-0-5	-	-	-
8	15SP18/4C/PRO	Project	-	4	60		-	-	-

The above Courses of the PG program enrich the skills in employability / Skill development / Entrepreneurship which cater the needs of the student

SEMESTER IV

S.no	Course Code	Title of the Paper	Credits	Hours/Work	Total Hours	L-T-P	CA	SA	Total
1	15SP18/4C/IMG	Immunology	4	5	75	5-0-0	40	60	100
2	15SP18/4C/BIT	Biotechnology	4	5	75	5-0-0	40	60	100
3	15SP18/4E/BIF	Elective – Bioinformatics	3	4	60	3-1-0	40	60	100
4	15SP18/4S/PSK	Soft skill- Presentation Skills	2	2	30	1-1-0	40	60	100
5	15SP18/4C/PL3	Core Practical- III	4	5	75	0-0-5	40	60	100
6	15SP18/4C/PL4	Core Practical- IV	4	5	75	0-0-5	40	60	100
7	15SP18/4C/PRO	Project	4	4	60	0-0-4	40	60	100

ELECTIVE SUBJECTS FOR OTHER DEPARTMENTS

S.no	Course code	Course title	Credits	Hours/Work	Total Hours	L-T-P	CA	SA	Total
1	15SP18/2E/WAH	Women and Health	3	4	60	3-1-0	40	60	100
2	15SP18/3E/LFD	Lifestyle Associated Diseases	3	4	60	3-1-0	40	60	100

SEMESTER I
CHEMISTRY OF LIFE

TOTAL HOURS: 60

COURSE CODE: 15SP18/1C/CHL

CREDITS: 4

LTP: 3-1-0

COURSE OBJECTIVES:

1. To explain the structure and role of carbohydrates and lipids.
2. To discuss about the molecular structure and interactions responsible for their function and organization proteins and nucleic acids in living systems.
3. To instill the structural features of molecules in establishing cell architecture.
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 process across the membrane.

COURSE OUTLINE:

UNIT-I:

(12hrs)

Carbohydrates - Classification, Structure and biological importance of Monosaccharides, Disaccharides, Homopolysaccharides, Mucopolysaccharides. Proteoglycans, glycoproteins, bacterial cell wall carbohydrates - peptidoglycan, teichoic acids, blood group oligosaccharides.

Lipids - Classification, Structure and functions of fatty acids, triglycerides, phospholipids, glycolipids, prostaglandins, thromboxanes and leukotrienes. Structure and functions of sterols and steroids.

UNIT-II:

(12hrs)

A, B and Z types of DNA, topology of DNA- writhe, twist and linking number, types of RNA- rRNA, tRNA, mRNA and other types – Structure and functions.

Protein - Classification based on structure and function, forces involved in the stabilization of protein structure, Ramachandran plot. Detailed account of primary, secondary, super secondary, tertiary and quaternary structure. Folding of proteins-Molecular chaperons (GroEL-ES system)

UNIT-III:

(12hrs)

Cellular Foundations-Origin of cells – Prokaryotes, Eukaryotes, Multicellularity in higher organisms, Cellular architecture, Extracellular matrix- Functions of Collagen and Hyaluronic acid. Cell- Cell Interactions - Cell adhesion proteins, Junctions, Cytoskeleton-Microtubules, Micro filaments, Intermediate filaments.

UNIT IV:

(12hrs)

Biological Membranes - Function of biomembranes, features - fluidity, cold acclimatization, self sealing nature, selective permeability. Membrane composition - Membrane lipids, lipid bilayer, Membrane carbohydrates, Membrane proteins, Membrane asymmetry, Flip flop movement- flippases, floppases, Membrane model-Fluid Mosaic model. RBC membrane as a model.

UNIT-V

(12hrs)

Transport process- Simple diffusion, Osmosis, Facilitated diffusion- gated channels, Active transport - Uniport, Symport, Antiport- Na^+ , K^+ ATPase, Ca^{2+} ATPase, Proton pump. Glucose transport in erythrocytes, Specialised membrane pores- Porins, Ionopores-Valinomycin-mobile carrier ionophore, Gramicidin-channel forming ionophores

RECOMMENDED TEXTBOOKS:

1. Lehninger Principles of Biochemistry- David L. Nelson & Michael M.Cox, 4th Edition, W. H. Freeman Publication, 2004
2. Biochemistry-Donald Voet & Judith G. Voet, 3rd Edition, John Wiley and Sons Publication, 2004

REFERENCE BOOKS:

1. Harper's Illustrated Biochemistry- Robert K. Murray, Darryl K. Granner, Peter A. Mayes, Victor W. Rodwell, 26th Edition, McGraw-hill, 2003
2. Biochemistry- Geoffrey Zubay, 4th Edition, Wm.C. Brown Publishers, 1998.
3. Biochemistry- Jeremy M Berg, John L Tymoczko, and Lubert Stryer, 6th Edition, Freeman Publications, 2006.
4. Textbook OF Biochemistry with clinical correlations- Thomas.M.Devlin 5th edition
5. Introduction to Biochemistry MaryK Campbel, Shawn O Farrel

JOURNALS:

1. Indian Journal of Biochemistry & Biophysics
2. Indian Journal of Experimental Biology
3. International Journal of Biological Macromolecules

e-LEARNING RESOURCES:

1. <https://youtu.be/iuW3nk5EADg>
2. <https://youtu.be/Fp1wKo72b2A>
3. <https://youtu.be/6AfRX6oh9-E>
4. <https://youtu.be/ufCiGz75DAk>
5. <https://youtu.be/g159zCnvpBs>

COURSE OUTCOMES:

CO. Number	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Harness the fundamentals of biological macro molecules in biological systems	K3,K4
CO 2	Apply the concept gained in modelling the structure of protein and nucleic acids in molecular research.	K4, K5
CO3	Interpret the role of various biological structures in cell to cell interactions	K3,K4,K5
CO4	Creatively comprehend the role of membrane components with their biological functions	K3, K4, K5
CO5	Apply the molecular mechanism behind the transport of solutes and signals across the membrane in drug delivery process	K4, K5,K6

MAPPING OF CO WITH PSO

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	3	3
CO2	2	3	3	3	2
CO3	3	3	3	3	3
CO4	3	3	3	2	2
CO5	3	3	3	3	3
AVERAGE	2.8	2.8	2.8	2.8	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	Sec A – 10 x 2	50	20	100	Question No.- is compulsory Section B/C-must be have 2 theory and 3problems(problems may be asked in revelant papers)
K3,K4	B – 5/8 x 8	500	40		
K3,K4,K5	C – 2/4 x 20	1200	40		

SEMESTER I

ANALYTICAL TECHNIQUES

TEACHING HOURS: 60 Hours

COURSE CODE: 15SP18/1C/ABC

CREDITS: 4

LTP: 3 1 0

COURSE OBJECTIVE

1. To Impart Knowledge about possible hazards in a laboratory and follow safety rules.
2. To expose the students to various separation techniques.
3. To explain electrochemical principles in separation of compounds.
4. To inculcate the fundamentals of radioactivity and microscopy.
5. To impart the principles and applications of spectroscopic methods.

COURSE OUTLINE:

UNIT I

(12hrs)

Safe Laboratory practices - Protection from Physical, Chemical and Biological hazards, Hazardous waste disposal, Containment facility, Levels of Biosafety, GLP, GCP

Centrifugation Techniques - Basic principles of Sedimentation, Preparative and Analytical centrifugation, Differential and Density gradient centrifugation, Separation of sub cellular organelles.

UNIT II

(12hrs)

Chromatography - General principle and operational procedure of column chromatography, Gel permeation, Ion exchange, Affinity, Gas liquid and high performance liquid chromatography, Capillary electrochromatography

Electrochemical Techniques: Potentiometry - Ion selective Electrodes, Amperometry- Clarkes oxygen electrode, Biosensors, Polarography

UNIT III

(12hrs)

Electrophoresis- General principle, Factors affecting Electrophoretic separation, Isoelectric focussing, SDS PAGE, 2D PAGE, 3 D gel eletrophoresis, Estimation and recovery of proteins in gels Electrophoresis of nucleic acids, DNA sequencing gels, Pulse field gel electrophoresis, Immunoelectrophoresis, Blotting techniques.

UNIT IV

(12hrs)

Radioactivity - Detection and quantification of Radioactivity, GM counter, Scintillaation counter, Autoradiography, List of radioisotopes in Diagnosis, Prognosis and Research.

Microscopy – Principles and applications of phase contrast, fluorescence, scanning and transmission electron microscopy. Preparation of sample for histopathology- Fixing, processing, embedding and sectioning.

UNIT V

(12hrs)

Spectroscopy - General principles, UV-Visible Spectrophotometry, Fluorimetry, Atomic absorption spectroscopy, Flame emission spectroscopy, IR Spectroscopy, nephelometry, luminometry.

Magnetic particle Separation – SEP box

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& Upadhyay Nath, 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 ,Syrawood Publishing house ,2016
5. Analytical Biochemistry- Artie Weissberg, Syrawood Publishing house ,2016

JOURNALS:

1. Analytical Biochemistry
2. Biochemistry &Analytical Biochemistry
3. International Journal of Analytical Biochemistry Research
4. Analytical and Bioanalytical Chemistry

e-LEARNING RESOURCES:

1. www.springer.com › Home › Chemistry › Analytical Chemistry
2. <http://www.nature.com/subjects/analytical-biochemistry>
3. <https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/>
4. http://www.Fischer_sci.se/sc/en/scientific-products/
5. [http://www.cancer.umn.edu/for-researchers/shared resources/Analytical biochemistry.](http://www.cancer.umn.edu/for-researchers/shared_resources/Analytical_biochemistry)

COURSE OUTCOME:

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

MAPPING OF CO WITH PSO

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	Sec A – 10 x 2	50	20	100	Question No.- is compulsory Section B/C-must be have 2 theory and 3problems(problems may be asked in revelant papers)
K3,K4	B – 5/8 x 8	500	40		
K3,K4,K5	C – 2/4 x 20	1200	40		

SEMESTER I
HUMAN PHYSIOLOGY

TEACHING HOURS: 60 Hours

COURSECODE: 15SP18/1C/HPH

CREDITS: 4

LTP : 3 1 0

COURSE OBJECTIVE:

To Study about the composition and function of various body fluids , digestion process & dietary requirements.

1. To gain knowledge on Nervous system, Synaptic transmission , Brain and spinal cord.
2. To appreciate the functional Anatomy of kidney, Renin angiotensin system & Erythropoiesis.
3. To understand cardiac and Respiratory System.
4. To study the Female and male reproductive system.

COURSE OUTLINE:

Unit – I:

(12 Hrs)

Digestive system – Composition, functions and regulation of saliva, gastric, pancreatic, intestinal and bile secretions. Digestion and absorption of carbohydrates, lipids, proteins and nucleic acids. Dietary requirement and functions of carbohydrates, lipids and proteins. Biological value of proteins, NPU. Basal metabolism- basal metabolic rate, factors affecting BMR, RQ, SDA. Calorific values of food components.

Unit – II:

(12 Hrs)

Types of neuronal cells -Nerves: regeneration of nerve fibers, generation of nerve impulse, All or none principle. Mechanism of synaptic transmission, transmission of nerve impulse. Types of neurotransmitters and their receptor. CNS - Structure of the brain & Spinal Cord, PNS, ANS.

Unit – III:

(12 Hrs)

Functional anatomy of kidney, renal blood flow, its determination, regulation. GFR – definition, measurement, filtration membrane, control of GFR. Tubular function – reabsorption, secretion and concentration. Nerve supply to urinary bladder, Micturition, Non excretory functions of kidney – Renin-Angiotensin system, erythropoietin synthesis.

Unit – IV

(12 Hrs)

Structure of heart, cardiac cycle, heart sounds, vasomotor circulation, coronary circulation, blood pressure. Structure of muscle cells and muscle contraction. Respiratory system- Structure and Functions of the lungs - Gaseous exchange.

Unit – V

(12 Hrs)

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), 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. Text Book 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 – Sabya sachi sircar 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

e-LEARNING RESOURCES :

1. www.getbodysmart.com/ap/site/resourcelinks/links.html
2. advace.physiology.org/
3. <http://youtu.be/ousfdlrozQHC>
4. http://youtu.be/Zr4onA2K_LY
5. <http://youtu.be/AwAgZBYSjtk>

COURSE OUTCOME

CO .NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Explain the human digestive system and learn to calculate Basal metabolic rate to prevent obesity and maintain good health.	K2,K3
CO 2	Discuss the functions of brain and spinal cord and the mechanism of synaptic transmission.	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 problem . Significance of cord banking and therapeutic uses of stem cells.	K3 , K4

MAPPING OF CO WITH PSO

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	Sec A – 10 x 2	50	20	100	Question No.- is compulsory Section B/C-must be have 2 theory and 3problems(problems may be asked in revelant papers)
K3,K4	B – 5/8 x 8	500	40		
K3,K4,K5	C – 2/4 x 20	1200	40		

SEMESTER I

ELECTIVE-GENETICS

TEACHING HOUR: 60 Hours

COURSE CODE: 15SP18/1E/GNT

CREDITS: 3

LTP: 3 1 0

COURSE OBJECTIVE

1. To impart Knowledge about the organization, structure & function of chromosomes and the consequences of chromosomal anomalies.
2. To enlighten students about Mendelian Genetics .
3. To impart knowledge about chromosomal genetics, mapping and Inheritance of diseases.
4. To enable the students to understand the genetic basis of diseases of Heart, Aminoacid metabolism and other common Genetic diseases.
5. To help students understand the genetic basis of common neurological diseases and to help them understand the genetic differences in drug metabolism.

COURSE OUTLINE:

Unit I (12 hrs)

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

Unit II (12 hrs)

Contribution of Mendel, Mendel's laws of Inheritance- Law of Dominance, Law of Segregation, Law of Independent assortment, Incomplete Dominance, Co dominance , Test Cross, Back cross, Complementary and Supplementary Genes , Epistasis.

Unit III (12 hrs)

Chromosomal genetics - Linkage and crossing over, Chromosomal mapping, Autosomes, Autosomal linked diseases, Autosomal Dominant – Huntington Disease, Autosomal recessive- Cystic Fibrosis, Structure of sex chromosomes , Sex determination and Sex linked inheritance- Haemophilia, Epigenetics , Prenatal Dignosis and Genetic Counselling.

Unit I (12 hrs)

Genetic basics of Diseases of Aminoacid metabolism- Phenyl ketoneuria, Alkaptonuria, Maple Syrup Disease, Genetics of Heart Diseases-Genes of Coronary Heart disease, Human genetic diseases-Down's Syndrome, Klinefelter's Syndrome, Turner's Syndrome.

Unit V

(12 hrs)

Neurogenetics-Genetic basis of Schizophrenia , Alzhemiers Disease, Parkinson's Disease
Pharmacogenetics-Genes and Drugs, Dose determination, Multi drug resistance gene polymorphisms, SNPs.

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 , Michael Connor , 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

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.msmanuals.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 OUTCOME

CO . NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Discuss about the chromosomal organization , structure , function and identify chromosomal anomalies both structural and numerical.	K1,K2
CO 2	Explain and analyze Mendelian Genetics & Deviation from Mendelian Genetics.	K1,K2,K3
CO3	Identify the reason for inheritance of genetic diseases and predict the nature of inheritance.	K2,K3,K4
CO4	Explain the genetic basis of diseases of Aminoacid metabolism, 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	K4,K5

MAPPING OF CO WITH PSO

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	Sec A – 10 x 2	50	20	100	Question No.- is compulsory Section B/C-must be have 2 theory and 3problems(problems may be asked in revelant papers)
K3,K4	B – 5/8 x 8	500	40		
K3,K4,K5	C – 2/4 x 20	1200	40		

SEMESTER I

ELECTIVE- BIOSTATISTICS AND BIOCHEMICAL CALCULATIONS

TEACHING HOUR: 60 Hours

COURSE CODE: 15SP18/1E/BBC

CREDITS: 3

LTP: 3 10

COURSE OBJECTIVES:

- To study the role of statistical analysis in Interpretation of experimental results.
- To develop competency and expertise in the application of statistical methods applied to biological data
- To enable students use appropriate statistical softwares
- To learn calculations for preparation of solutions and solve numerical problems

COURSE OUTLINE:

UNIT I

(12 hours)

Biostatistics- An outline of statistical investigations, types of data- based on source and nature of data, individual observations, discrete and continuous frequency data, Methods of data collection – experimental, survey and observation methods; Population and sample - Types of sampling- Advantages & disadvantages .Presentation of data in the form of tables – types of tables. Presentation of data in the form of diagrams and graphs.

UNIT II

(12 hours)

Descriptive Statistics- Measures of Central tendency- Mean, Median, Mode(Individual data, discrete series & continuous series) – merits and demerits. Measures of variability- Range, Quartile deviation, Standard deviation (Individual data, discrete series & continuous series) – merits and demerits, Skewness and kurtosis

UNIT III

(12 hours)

Inferential Statistics- Correlation – types ; Pearsons and Rank correlation coefficient , Regression equations and regression lines; Testing of hypothesis – steps involved, Level of significance, Type I & Type II errors. Student's t test – one tailed and two tailed, paired and unpaired, ANOVA (One way), Duncan multiple range test, Chisquare test.

UNIT IV

(12 hours)

Units of measurement of concentration of solutions. Percentage solutions (w/w, w/v, v/v), Mole concept, Calculation of Molarity, Molality, equivalent concept, Normality, Osmolarity, Osmolality, Ionic strength. Hydrogen ion concentration – pH & pOH -Henderson Hasselbalch equation and related calculations. Calculations based on radioactivity- Half life & Isotope dilution, Calculations based on Beer Lambert's law.

UNIT V

(12 hours)

Problems based on microbial growth - number of divisions, growth rate and doubling time; Enzymes – problems based on K_m and V_{max} , Specific activity and enzyme purification. Biomolecules – problems based on length of the protein in extended and folded conformations, number of aminoacids in a given molecular weight, number of nucleotides, codons in a given DNA

RECOMMENDED BOOKS

1. Biochemical calculations– Irwin Segal 2nd edition, 1975
2. Introduction to Biostatistics – N. Gurumani, MJP publishers , 2nd Edition, 2005

Reference Books :

1. Biostatistical analysis – Jerrold H Zar, Pearson Publishers Fourth Edition , First Indian Reprint 2003
2. Trueman's specific series UGC-CSIR .Life science (Biology), New edition 2012
3. Instrumental Methods of Analysis by Willard. CBS Publishers & Distributors; 7 edition edition , 2004
4. Statistical Methods, by S. P. Gupta (Author) ,Sultan Chand & Sons (2012), ISBN-10: 8180549313, ISBN-13: 978-8180549311
5. Bioinstrumentation by MJ Reilly CBS PUBLISHERS AND DISTRIBUTORS PVT LTD. 1 edition (1 March 2016) ISBN-10: 9788123928395, ISBN-13: 978-8123928395

JOURNALS

1. PLOS Computational Biology.
2. Journal of Biophysical Chemistry

e-LEARNING RESOURCES

1. www.stat.isu.edu
2. www.inderscience.com
3. www.degruyter.com
4. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5453888/>
5. https://www.eecs.umich.edu/courses/bme458/download/bme458_notes1.pdf

COURSE OUTCOME

CO .NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Apply the knowledge in identifying Data characteristics and form of distribution of data structure and its role in determining inferences	K1,K2
CO 2	Recognize when and why statistical tests are needed and use technology to perform descriptive and inferential data analysis	K2,K3,K4
CO3	Determine the exact method of Data analysis for problem under investigation and make use of appropriate statistical software.	K2,K3,K4
CO4	Apply the knowledge in the preparation chemical reagents used in laboratories and industries	K3,K4,K5
CO5	Apply the knowledge in eliminating the contamination by identifying the microbial growth studies and problems of biomolecules	K3,K4,K5

MAPPING OF CO WITH PSO

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

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 No.- is compulsory Section B/C-must be have 2 theory and 3problems(problems may be asked in revelant papers)
K3,K4	B – 5/8 x 8	500	40		
K3,K4,K5	C – 2/4 x 20	1200	40		

SEMESTER II

ENZYME BIOCHEMISTRY

TOTAL HOURS: 60

COURSE CODE: 15SP18/2C/EBY

CREDITS: 4

LTP : 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 enzyme regulation.
5. To explain the methods adopted for extraction and purification of enzymes.

COURSE OUTLINE:

UNIT-I

(12hrs)

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, Modulators, Applications of enzymes in food and pharmaceutical industries.

UNIT-II

(12hrs)

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, structure and mechanism of action of Chymotrypsin.

UNIT-III

(12hrs)

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

UNIT-IV

(12hrs)

Michaelis Menten equation, Line -Weaver Burk plot, Eadie Hofstee plot, Hanes plot, Eisenthal and Cornish Bowden plot, Briggs Haldane modifications. Determination of K_m and V_{max} , Enzyme turn over. Bisubstrate reactions-single and double displacement reactions. 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

(12hrs)

Homogenization technique for enzyme isolation, separation methods of cellular organelles, purification of enzymes-chromatography, electrophoresis, dialysis, criteria of purity of enzymes. Methods to investigate the kinetics – Rapid reaction technique (stopped and continuous flow technique). Immobilized enzymes- methods of immobilization and applications. Abzymes, Ribozymes, Isoenzymes (LDH, CK), Artificial enzymes.

RECOMMENDED TEXTBOOKS:

1. Understanding Enzymes- Trevor Palmer, East West Press Reprint Edition 2004
2. Principles of Biochemistry- Lehninger, 4th Edition, W.H. Freeman and Co. 2004

REFERENCE BOOKS:

1. Biochemistry- Donald Voet & Judith G. Voet, 3rd Edition, John Wiley and Sons Publication, 2004.
2. Biochemistry- Geoffrey Zubay, 4th Edition, Wm.C. Brown Publishers, 1998.
3. Enzyme Technology- Anusha Bhaskar, MJP publishers, 2014
4. Textbook OF Biochemistry with clinical correlations- Thomas.M.Devlin 5th edition
5. Introduction to Biochemistry MaryK Campbel, Shawn O Farrel

JOURNALS:

1. Indian Journal of Biochemistry and Biophysics
2. Enzyme Research
3. Enzyme and Microbial Technology

e-LEARNING RESOURCES:

1. <https://youtu.be/f7jRpniCsaw>
2. <https://youtu.be/KCG5fDKr9HQ>
3. https://youtu.be/jUUEr4o_2-0
4. <https://youtu.be/2HaFHUAwVyQ>
5. <https://www.youtube.com/watch?v=PVvpEKeOzEM>

COURSE OUTCOMES:

CO. Number	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Consider the role of various factors in designing enzymes with optimal activity for various applications	K3,K4
CO 2	Comprehend the role of aminoacids in enzyme activity by various mechanisms and apply in the field of enzyme engineering.	K4, K5
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.	K4, K5,K6
CO5	Apply the knowledge in extraction and purification of new enzymes and for designing artificial enzymes.	K3, K4, K5

MAPPING OF CO WITH PSO

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	Sec A – 10 x 2	50	20	100	Question No.- is compulsory Section B/C-must be have 2 theory and 3problems(problems may be asked in revelant papers)
K3,K4	B – 5/8 x 8	500	40		
K3,K4,K5	C – 2/4 x 20	1200	40		

SEMESTER II

METABOLISM AND REGULATION

TEACHING HOURS : 60 hours

COURSE CODE: 15SP18/2C/MRG

CREDITS: 4

LTP: 3 1 0

COURSE OBJECTIVE

1. To impart Knowledge about the basic metabolic pathway of carbohydrates.
2. To enlighten students about general pathway of aminoacid metabolism .
3. To develop knowledge about metabolism and regulation of lipids.
4. To enable the students to understand the inter relation ship of carbohydrates, proteins and fat metabolism.
5. To help students understand the metabolism of nucleic acid and regulation.

COURSE OUTLINE:

Unit I

(12 hrs)

Carbohydrate metabolism and regulation-Glycolysis (Aerobic and Anaerobic), 2,3 Bisphospho glycerate cycle. Pasteur effect, Shuttle systems ,Gluconeogenesis, Glycogenesis, Glycogenolysis, Citric acid cycle, HMP shunt , Uronic acid pathway

Unit II

(12 hrs)

Aminoacid metabolism and regulation-General Pathways of aminoacid degradation, mechanism of transamination ,decarboxylation ,oxidative and non oxidative deamination , Biosynthesis of phenylalanine, methionine and specialized products-epinephrine, norepinephrine, SAM, serotonin, melanin. Glucose –alanine cycle, urea cycle.

Unit III

(12 hrs)

Lipid metabolism and regulation–Oxidation of saturated, unsaturated ,odd and even numbered fatty acids, Alpha and Omega oxidation , Ketogenesis, Biosynthesis of saturated and unsaturated fatty acids , mitochondrial chain elongation,Glucose- Fatty acid cycle

Unit IV

(12 hrs)

Lipid Metabolism and regulation- Metabolism of triacylglycerol, Phospholipid and Spingolipids, Cholesterol biosynthesis and degradation.Lipoprotein metabolism.

Interrelationship of carbohydrate ,protein and fat metabolism –Central role of Acetyl CoA .Electron transport chain and Oxidative phosphorylation.

Detoxification mechanism-Oxidation ,Reduction ,Hydrolysis and Conjugation

Unit V

(12 hrs)

Nucleotide metabolism and regulation- Denovo synthesis and Salvage pathway of purine and pyrimidine nucleotides , Degradation of purine and pyrimidine nucleotides , Inhibitors

RECOMMENDED BOOKS

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,4th Edition,WCB publishers, 1998

JOURNAL

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

e-LEARNING RESOURCES

1. www.ncbi.nlm.nih.gov › NCBI › Literature › Bookshelf
2. Biochemical-pathways.com
3. [Biochemistry-Elsiever .com](http://Biochemistry-Elsiever.com)
4. Cellular-metabolism /tocrisbioscience
5. <http://homepage.ufp.pt/pedros/bq/integration.htm>

COURSE OUTCOME.

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 intergration of biochemical process with specific control sites and key junctions.	K2, K3
CO5	Explain nucleotide metabolism and apply the knowledge in molecular biology.	K3

MAPPING OF CO WITH PSO

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	Sec A – 10 x 2	50	20	100	Question No.- is compulsory Section B/C-must be have 2 theory and 3problems(problems may be asked in revelant papers)
K3,K4	B – 5/8 x 8	500	40		
K3,K4,K5	C – 2/4 x 20	1200	40		

SEMESTER II

HORMONES AND SIGNAL TRANSDUCTION

TEACHING HOURS: 60
CREDITS: 4

COURSE CODE: 15SP18/2C/HST
LTP: 3 1 0

COURSE OBJECTIVE

1. To introduce students to endocrinology in general.
2. To introduce different endocrine glands and their hormones.
3. To expose students to the various molecules involved in signal transduction with special emphasis on receptors.
4. To impart knowledge on cell surface receptors in signal transduction pathways.
5. To impart knowledge on nuclear receptor mediated pathways.

COURSE OUTLINE:

Unit I: (12 hours)

Endocrine glands; hormones – Classification, circulation in blood. Hypothalamus – TRH, GnRH, GHRH, CRH, Somatostatin, Dopamine; Pituitary hormones – TSH, ACTH, Endorphins, Somatotropin, LH, FSH, Prolactin, Oxytocin, Vasopressin. Pancreatic hormones – Insulin, Glucagon. (structure, functions and associated disorders.)

Unit II: (12 hours)

Thyroid hormones (Biosynthesis), **Parathyroid hormone**, calcitonin, calcitriol; Regulation of Calcium and phosphorus homeostasis. **Adrenal hormones** – Epinephrine, Cortisol, Aldosterone. **Gonadal hormones** – Estrogen, Progesterone, Testosterone.

Unit III: (12 hours)

Receptors – Classification; Cell surface and Intra cellular receptors, Role of Calcium and phosphoinositides in Signal transduction; IP3 – DAG pathway; PI-3 Kinase pathway; Calcium – cellular levels, transport, calmodulin, TroponinC; Interaction of Calcium calmodulin complex.

Unit IV: (12 hours)

Molecules involved in Signal transduction, GPCR, G proteins – Mechanism of action, Role in bacterial toxin action; cAMP mediated signal transduction processes; Visual transduction – Role of cGMP and rhodopsin

Unit V: (12 hours)

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

RECOMMENDED TEXTBOOKS:

1. Williams Text Book 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,2006
4. Signal transduction –Bastien D Gomperts ,2003
- 5.Signal transduction Mechanism –JA Barnes ,2013

JOURNALS :

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

e-LEARNING RESOURCES :

1. www.ncbi.nlm.nih.gov > NCBI > Literature > Bookshelf
2. <http://www.springer.com/medicine/internal/journal/12020>
3. <http://www.homone.org>
4. <http://medlineplus.gov>
5. <http://www.mun.ca/biology/desmid/brain/biol2060/biol/2060-14/cb14.html>

COURSE OUTCOME

CO .NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Outline basics of endocrinology; communicate relationships between nervous and endocrine system	K1,K2
CO 2	Explain the biological role and pathological implications of various hormones	K2, K3
CO3	Discuss receptors and signal processes which regulate calcium metabolism	K2,K3
CO4	Explain GPCR mediated signaling pathways and examine their role in bacterial infections	K3, K4
CO5	Discuss the MAP kinase and nuclear receptor mediated pathway and Analyse signaling cross talk	K3, K4

MAPPING OF CO WITH PSO

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	Sec A – 10 x 2	50	20	100	Question No.- is compulsory Section B/C-must be have 2 theory and 3problems(problems may be asked in revelant papers)
K3,K4	B – 5/8 x 8	500	40		
K3,K4,K5	C – 2/4 x 20	1200	40		

SEMESTER II

ELECTIVE - RESEARCH METHODOLOGY

TEACHING HOURS: 60
CREDITS: 3

COURSE CODE: 15SP18/2E/RMT
LTP: 3 1 0

COURSE OBJECTIVE

1. To introduce students to research and thesis writing.
2. To introduce the various approaches to biochemical investigations.
3. To expose students to the preparation of plant extracts.
4. To impart knowledge on different cell line cultures used in research.
5. To impart knowledge on various types of spectroscopy.

COURSE OUTLINE:

Unit I : (12 HRS)

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

Thesis writing- Introduction, Review of Literature, 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.

Unit II : (12 HRS)

General approaches to Biochemical Investigations - Whole animal studies -Ethical Committee clearance-IAEC, CPCSEA. Maintenance of animals , Control and experimental groups , Experimental design- CRD, RBD and latin square design..Experiments with animals models- Metabolism of xenobiotics, Toxicity studies, Experimental Induction of diseases. Organ perfusion and tissue slice techniques. Experiments with human volunteers -, Ethical clearance, Institutional Ethical committee., Consent form, Stages of drug development, Clinical trials

Unit III : (12 HRS)

Preparation of plant extracts-Solvents used. Methods for extraction- Maceration, Infusion, Percolation, Digestion ,Decoction, Hot continuous extraction (Soxhlet), Ultrasound extraction (sonication). Plant secondary metabolites- Tannins, Flavanoids & Alkaloids - Isolation and Characterization

Free radicals, Free radical induced damages , Lipid peroxidation , Antioxidants , Enzymic and Non enzymic antioxidants, Phytochemicals as antioxidants, Methods to assess Antioxidant activity- FRAP, ABTS, DPPH.

Unit IV :**(12 HRS)**

Different Cell lines and Current research using cell lines, MTT assay. Cell sorting and Cell counting - Flow cytometry (FACS and Coulter counter). Experiments with Cell isolates - Sequence analysis-DNA and Amino acid sequencer, Comet Assay

Nanotechnology – Classification, Preparation using biological material, Characterisation- Zeta potential, AFM, DLS and Biological applications – Drug delivery (Dendrimers, Liposomes)

Unit V:**(12 HRS)**

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

RECOMMENDED TEXTBOOKS

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

REFERENCE TEXTBOOKS

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. Research methodology step by step guide for beginners –Ranjith kumar
4. Research methodology in social behavioural and life sciences-Herman J Ader .
5. Hand book of Research methodology- Shanti Bhusan Misra

JOURNALS :

- 1.International Journal of Science and Research Methodology
- 2.International Journal of Advances in Software Engineering &Research Methodology

e-LEARNING RESOURCES

1. processresearchmethods.org/
2. <https://explorable.com/research-methodology>
3. <http://www.scribbr.com>
4. <http://www.open.edu>
5. <http://www.macmillan .ihe.com>

COURSE OUTCOME

CO .NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Apply for research funding, fellowship and grants and write thesis.	K2,K3
CO 2	Explain stages of drug development and clinical trials .Maintain animals for research and toxicity studies ethically.	K3, K4
CO3	Discuss the methods of extraction from plants, free radical damage, lipid peroxidation and asses them.	K3,K4
CO4	Outline the fundamentals of nanotechnology, cell line studies, sequence analysis-DNA and amino acid sequencer.	K3, K4
CO5	Explain principle instrumentation and applications of spectrosocopy.	K1, K2

MAPPING OF CO WITH PSO

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	Sec A – 10 x 2	50	20	100	Question No.- is compulsory Section B/C-must be have 2 theory and 3problems(problems may be asked in revelant papers)
K3,K4	B – 5/8 x 8	500	40		
K3,K4,K5	C – 2/4 x 20	1200	40		

SEMESTER I & II

CORE PRACTICAL -I

TEACHING HOURS: 120 Hours
CREDITS:4

COURSE CODE: 15SP18/2C/PLI
LTP: 0 0 4

Course Objectives:

1. To impart Knowledge on the principle of Food analysis.
2. To impart Knowledge on the 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. Estimation of Copper content
12. Isolation and estimation of Starch
13. Isolation and estimation of Glycogen
14. Extraction and Estimation of Sterol
15. Estimation of Riboflavin –Fluorimetry (Group Experiment)
16. Food sample Characterization- IR Spectroscopy (Group Experiment)

COURSE OUTCOME

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

MAPPING OF CO WITH PSO

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

TEACHING HOURS: 120 Hours
CREDITS: 4

COURSE CODE: 15SP18/2C/PL2
LTP 0 0 4

COURSE OBJECTIVES:

1. Train students in protein separation and blotting techniques.
2. Train students in isolation of nucleic acids from biological sources
3. To enable students to carry out isolation of organelles like mitochondria, chloroplast from biological sources.
4. To expose and train students in Enzyme kinetic studies.
5. Train students in Phytochemical analysis.

COURSE OUTLINE

ISOLATION / SEPARATION METHODS

1. Separation of serum proteins by SDS –PAGE
2. Western Blotting
3. Isolation of DNA
4. Agarose Gel electrophoresis and Southern Blotting
5. Isolation of RNA (Identification by Absorption Spectrum)
6. Isolation of Mitochondria – Differential Centrifugation
7. Isolation of Chloroplast- Density Gradient Centrifugation

ENZYME ANALYSIS

8. Assay of Amylase
9. Specific activity of ATPase
10. Kinetic Studies- Alkaline Phosphatase – Optimun pH and Temperature, Km, Vmax

PHYTOCHEMICAL ANALYSIS

11. Qualitative Analysis of Phytochemicals
12. Estimation of Tannins
13. Estimation of Flavanoids
14. Estimation of Alkaloids

COURSE OUTCOME

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	K4,K5
CO3	Analyze and identify phyto constituents	K4,K5

MAPPING OF CO WITH PSO

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
MOLECULAR BIOLOGY

TEACHING HOURS : 60
CREDITS: 4

COURSE CODE: 15SPI8/3C/MOL
LTP : 4 0 0

COURSE OBJECTIVE

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 impact of environment on genes
5. To enable the students to understand the molecular basis of cancer and apply their understanding of molecular processes in disease diagnosis .

COURSE OUTLINE:

Unit I :

(12 hrs)

Replication and Cell Division : Replication-Replication in Prokaryotes – over view, 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 check points.

Unit II :

(12 hrs)

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- Genetic code , Ribosomes, Prokaryotic Translation (over view) , Eukaryotic translation , Post translational modifications , Inhibitors of translation with medical applications

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

Unit III:

(12 hrs)

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:

(12hrs)

Epigenetics : Hetero chromatin and Histone interactions , Telomeric Silencing , Polycomb, Trithorax, CpG islands, Genomic Imprinting, Epigenetics and inheritance , Prions, Prion diseases in mammals.

Unit V :

(12 hrs)

Molecular Oncology :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 : 2004 .
W.H.Freeman & Co : New York
2. Essentials of Molecular Biology- V.Malathi, 2013 , First Edition, Pearson Publishers.

REFERENCE BOOKS

1. Molecular cell biology – Lodish , Harvey, Berk, Arnold, Zipursky , Lawrence, Matsudaira, Paul, Baltimore : 2006 , 4th Edition , W.H Freeman & Co .
2. Lewin's Genes X– Krebs Jocelyn, Lewin Benjamin , Goldstein ,Eliottt , Kilpatrick ,Stephen : 2009 . Jones and Bartlett.
3. Biochemistry - Voet Donald and Voet Judith : 2004. Wiley International Edition , 3rd Edition : John Wiley & Sons.
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

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 OUTCOME

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 check points.	K1,K2
CO 2	Discuss the basis of protein formation & Seggregation, 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	Analyze the role of histone & DNA methylation in gene expression, discuss about epigenetics and inheritance	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 OF CO WITH PSO

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	Sec A – 10 x 2	50	20	100	Question No.- is compulsory Section B/C-must be have 2 theory and 3problems(problems may be asked in revelant papers)
K3,K4	B – 5/8 x 8	500	40		
K3,K4,K5	C – 2/4 x 20	1200	40		

SEMESTER III

CLINICAL BIOCHEMISTRY & BIOMEDICAL INSTRUMENTATION

TEACHING HOURS : 60

COURSE CODE: 15SP18/ 3C/CBI

CREDITS : 4

LTP : 4 0 0

COURSE OBJECTIVE

1. To give an overview of diseases with emphasis on metabolic 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

(12hrs)

Overview of diseases: Infectious, Nutritional, Metabolic & Environmental diseases. Metabolic diseases – Carbohydrate metabolism (Galactosemia, Glycogen storage diseases) - Diabetes – Aetiology, Pathogenesis and investigations. Long term complications and management. Lipid metabolism (Niemen Pick's disease, Taylach's diseases, Gaucher's disease, Hyper and Hypolipoproteinemias). Nucleotide metabolism (Gout, LeschNyhan syndrome, Orotic aciduria). Environmental diseases - Extremes of temperature (Hypothermia & Heat Stroke), High Altitudes.

Unit – II

(12hrs)

Blood disorders- Anaemia –Iron deficiency anaemia, Megaloblastic anaemia, Aplastic anaemia, 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, Diffuse pulmonary lung disease.

Unit – III

(12 hrs)

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

Unit – IV

(12 hrs)

Diagnostic procedures – X-ray, Angiography. Types of Scan- Ultrasound, CAT, PET, MRI, Tests based on electrical activity – ECG, EEG, Blood pressure measurement, Respiratory gas analyzer, Spirometry.

Unit – V

(12hrs)

Therapeutic procedures – Blood banking, Dialysis unit- Hemo and Peritoneal dialysis, Ventilator, Pacemaker, Defibrillator, Artificial valves, Heart lung machine, Lithotrippers, Radiotherapy equipment.

RECOMMENDED BOOKS

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 6th Edition . Indian Reprint 2010
2. Clinical Biochemistry- Metabolic and Clinical aspects- William J Marshall 2nd Edition.
3. Practical clinical Biochemistry –Methods and interpretation –Ranjana Chawla
4. Hand book of clinical Biochemistry –Swaminathan Ramaswamy Iyer
5. Clinical Biochemistry and metabolic medicine-Martin Andrew Crook

JOURNALS

1. Journal of Medical and Biological Engineering
2. Journal of Bioengineering & Biomedical Science
3. International Journal of Biomedical and Clinical Engineering
4. International Journal of Biomedical Engineering and Technology

e-LEARNING RESOURCES

1. <http://www.journals.elsevier.com/journal-of-pharmaceutical-and-biomedical-analysis>
2. <http://www.aami-bit.org/>
3. <http://Elsiever.com>
4. <http://Longdom.org>
5. <http://www.manchester.ac.uk.list>

COURSE OUTCOME

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 the etiology, 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 method for each disease and interpret the results.	K3,K4
CO5	Explain the principle and working of various therapeutic instruments; identify and use appropriate therapeutic method for each disease.	K3, K4

MAPPING OF CO WITH PSO

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 No.- is compulsory Section B/C-must be have 2 theory and 3problems(problems may be asked in revelant papers)
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
CREDITS : 3

COURSE CODE: 15SP18/ 3E/PCY
L T P : 4 0 0

COURSE OBJECTIVE

1. To introduce the pharmacokinetic, pharmacodynamic and drug development processes
2. To expose the students to the mechanism of action and the toxic effects of various anti infective agents
3. To sensitise the students to the different types of cardiac and gastrointestinal drugs
4. To enable the students to understand CNS , adrenergic and cholinergic drugs.
5. To impart knowledge on the respiratory disorder drugs and chemotherapeutic agents

COURSE OUTLINE:

UNIT- I

(12 hrs)

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 hrs)

Anti Infective agents- Sulfonamides- β lactam antibiotics , Amino glycosides, Antifungal agents, Antiviral agents, Antiprotozoal agents, Antiretroviral drugs

Drugs for helminthiasis. Anti mycobacterial drugs for TB. Drugs acting on haemopoietic system – Anti coagulants and coagulants.

UNIT- III

(12 hrs)

Cardiovascular Drugs- Drugs for Hypertension, Hyperlipoproteinemias, Ischemic heart diseases. Drugs for renal function- Diuretics and antidiuretics. Antidiabetic dfrugs

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

UNIT- IV

(12 hrs)

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 system .

UNIT- V

(12 hrs)

Drugs for Respiratory disorders – Drugs for Bronchial Asthma and Cough. Drugs for Endocrine disorders- Drugs for Thyroid dysfunction, Adrenocorticosteroids and their antagonists. Drugs affecting fertility and reproduction-Classification.Hormone replacement therapy –androgens, estrogens, antiandrogens, antiestrogens and contraceptives .Chemotherapeutic agents.

RECOMMENDED BOOKS

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

REFERENCE BOOKS

1. Pharmacology- Don.A Ballington,Mary.M Laughlin.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.kartzuyn,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

e - LEARNING RESOURCES

1. <https://www2.bc.edu/~anderswb/pharmacologyonlineresources.html>
2. libguides.utep.edu › UTEP Library Research Guides › Pharmacology
3. <https://you.tu.be/Qtd6RhfUA>
4. <https://you.tu.be/QVO8fm-3AE>
5. <https://you.tu.be/n7GCSKMBMVM>

COURSE OUTCOME

CO .NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Explain the pharmacokinetic, pharmacodynamic and drug development processes	K1, K2, K4
CO 2	Discuss the mechanism of action and the toxic effects of various anti infective agents	K2,K3
CO3	Explain the different types of cardiac and gastrointestinal drugs	K2,K3
CO4	Discuss the adrenergic, cholinergic and CNS drugs.	K3,K4
CO5	Discuss the respiratory disorder drugs, hormone and chemotherapeutic agents	K3,K4,K5

MAPPING OF CO WITH PSO

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	Sec A – 10 x 2	50	20	100	Question No.- is compulsory Section B/C-must be have 2 theory and 3problems(problems may be asked in revelant papers)
K3,K4	B – 5/8 x 8	500	40		
K3,K4,K5	C – 2/4 x 20	1200	40		

SEMESTER III

COMPUTING SKILLS

TEACHING HOURS: 30 Hours
CREDITS: 2

COURSE CODE: 15SP18/3S/CSK
LTP: 1 1 0

COURSE OBJECTIVE

1. To introduce fundamentals of computers and MS-Word.
2. To expose the students to MS Excel and MS Powerpoint.
3. To expose the basics of internet.

COURSE OUTLINE:

UNIT I (10 hours)

Computer fundamentals - Basic architecture , Memory units, Auxiliary storage devices , Input devices, Output devices.

Windows Operating system, MS Office - MS Word – Basics

UNIT II (10 hours)

MS Excel – Basics , Data sort ,Data filters , Functions ,Inserting formulae, Creating charts, & Statistical analysis.

MS Powerpoint- Creating presentation, Inserting graphs/pictures/tables, Smart arts, Slide show.

UNIT III (10 hours)

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

RECOMMENDED BOOKS:

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
2. Computing fundamentals-Faithe Wempen
3. Computer Fundamental and Internet basis- Rohit Khurana
4. Computrer fundamentals – Sinha
5. Using Microsoft office - Faithe Wempen

JOURNALS

1. Computers- Open Access Journal
2. Journal of information technology
3. Malaysian journal of computer science

e-LEARNING RESOURCES :

1. Academic.brooklyn.cuny.Edu
2. www.open.ac.uk
3. Job cluster.com
4. Big choice .com
5. www.microsoft.com

COURSE OUTCOME

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

MAPPING OF CO WITH PSO

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	A-5X10	350	50	50

SEMESTER IV

IMMUNOLOGY

TEACHING HOURS: 75

CREDITS : 4

COURSE CODE: 15SP18/4C/IMG

L T P : 5 0 0

COURSE OBJECTIVE

1. To expose students to lymphoid organs, lymphocytes and types of immunity
2. To enable students to understand the antigens, antibodies, development of T and B cells, multigene organization and generation of antibody diversity
3. To sensitise the students to learn about diagnostic aspects of immunology and about HLA &MHC
4. To impart the knowledge on B&T cell cooperation, autoimmune diseases, hypersensitivity and activation of complements
5. To study the different types of vaccines, tumour antigens & immunotherapy for cancer

COURSE OUTLINE:

Unit – I

(15 hrs)

Types of Immunity- Native Immunity – Determinants, Anatomical, Physiological Barriers , Phagocytosis. Inflammation – Acute ,Chronic , Local & Systemic inflammation. Anti inflammatory agents. Adaptive Immunity – types. Organs of the Immune system – Structure & function –Thymus, Bone marrow , Lymph node, Spleen, MALT , GALT, and Lymphatic circulation.

Unit – II

(15 hrs)

Antigens – Nature, Factors affecting antigenicity ,Epitopes ,Adjuvants and Haptens. Antibodies-Structure, Effector functions, Classes and biological activities. B cell development, B cell receptor - Multigene organization , DNA rearrangements and generation of Antibody diversity. Clonal selection theory

Unit – III

(15 hrs)

Over view of Diagnostic Immunology-Precipitation and Agglutination tests. Coombs, CFT, ELISA, Immunofluorescence, Immunohistochemistry. Major Histocompatibility complex – General organization and HLA antigens.MHC complex and Disease susceptibility.

Antigen processing and presentation – Cytosolic and Endocytic pathway. T cell mediated immunity-TCR- Structure, Rearrangement, Maturation ,Differentiation, Activation and Cell mediated cytotoxicity.

Unit – IV

(15 hrs)

B-cell mediated immunity-B cell Activation, T & B cooperation. Monoclonal antibody Production and applications.

Complement system – Complement activation- Classical, Alternative and Lectin pathway . Complement deficiencies. Hypersensitivity reactions- Type I , II, III &IV. Autoimmunity- Organ specific- Insulin dependent DiabetesMellitus , Graves disease. Systemic- Systemic lupus erythematosus, Multiple sclerosis.

Unit – V

(15 hrs)

Vaccines – Types- Whole organism vaccines, Purified macromolecules, Recombinant vector vaccines, DNA vaccines and Multivalent sub unit vaccines.

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

Reference Books

1. Immunology –Roitt , Brostoff and Male, Mosby Publishers, 3rd Edition 1993.
2. Cellular and Molecular Immunology- Abul.K.Abbas, Andrew, Shivpillai, 9th Edition 2017
3. Case studies in Immunology, 7th Edition- Raif Geha, Luigi Notarangeto, 2017
4. Clinical Immunology- Helen Chapel, Manrel Haeney & Neil Snowden, 6th Edition, 2016
5. How the Immune System Work- Lauren Sompayrae, 4th Edition, 2017

JOURNALS

1. Journal of Immunology Research.
2. Journal of Immunology
3. International Journal of Immunology
4. International Journal of Immunology and Immunotherapy

e- LEARNING RESOURCES

1. www.whfreemen.com/kuby
2. www.immunologylink.com
3. <https://youtube/ESQYCHS41BY>
4. <https://youtube/8iyrbvlsauy>
5. <https://youtube/74gKBLnJz3A>

COURSE OUTCOME

CO .NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Explain the types of immunity, immune organs, lymphatic circulation and determinants of immunity	K1 K3
CO 2	Discuss on the antigenic nature, factors affecting antigenicity, epitopes, adjuvants, haptens, multigene organization, the concepts of gene rearrangements in antibody diversity and clonal selection	K3, K4,K5
CO3	Explain the Immunological techniques, T cell receptor structure and rearrangement, cell mediated immunity, presentation of endogenous and exogenous antigens, MHC and HLA	K3,K4,K5
CO4	Outline the importance of Mab production, B cell mediated immunity, activation of complements, Complement deficiencies, genetic basis of immunological disorders, different types of hypersensitivity and autoimmune diseases	K4 K2
CO5	Analyse the Importance of vaccination in children and adult, types of vaccination, production of vaccines by recombinant technology, tumour antigens and chemotherapeutic agents	K3 K4,K5

MAPPING OF CO WITH PSO

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 No.- is compulsory Section B/C-must be have 2 theory and 3problems(problems may be asked in revelant papers)
K3,K4	B – 5/8 x 8	500	40		
K3,K4,K5	C – 2/4 x 20	1200	40		

SEMESTER- IV

BIOTECHNOLOGY

TEACHING HOURS : 75

CREDITS : 4

COURSE CODE: 15SP18/4C/BIT

L T P : 5 0 0

COURSE OBJECTIVE

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 about animal cell culturing , enable them to understand and appreciate applications of biotechnology in medicine.
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

Introduction to Biotechnology, r-DNA technology – Methodology ,Enzymes, Linkers (15hrs)
,Adaptors and Vectors – Plasmid(PBR 322, PUC18) Phage vectors (λ phage vector, M 13)Viral vector-(SV40, Adenovirus). Plant vectors (Ti & Ri) ,Artificial chromosomal vector(BAC, YAC), Shuttle vectors, Expression vectors. Selection of host- Prokaryotic and Eukaryotic host.

UNIT-II

Isolation of gene of interest. Gene library- c-DNA, Amplification of gene- Designing of Primers (15 hrs)
PCR- RAPD,RFLP. Natural and Artificial methods of gene transfer. Selection of recombinants in plants and animals- 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.

UNIT-III:

Tissue Engineering- Animal cell culture. Culture media- Natural, artificial, serum and serum free (15hrs)
media, Cell support materials, Tissue modeling, Embryonic stem cell engineering, Transgenic mice, Gene knock out.

Medical Biotechnology- Production of insulin, Interferon, Hepatitis B Vaccine. Gene therapy , DNA Probes in diagnosis of Tuberculosis, Malaria, HIV.

UNIT-IV:**(15 hrs)**

Plant Biotechnology- Plant tissue culture- Types of culture, Application of plant tissue cultures- Micropropagation, Somoclonal variation, Embryo rescue and Cryopreservation. Transgenic plants and application- Insect resistant crops, Viral resistant crops, Salinity and Drought resistant crops. Improvement of crop yield and quality- longer shelf life of fruits and vegetables

UNIT-V:**(15hrs)**

Industrial Biotechnology : Fermentation, Bioreactors- types. Downstream processing. Production of Vitamin B12, Penicillin, Single cell protein. Bio fuels- Methane, Bio diesel and Bio hydrogen.

Environmental Biotechnology – Bioremediation – Extrinsic and Intrinsic. Phytoremediation, Sewage/Waste water treatment.

RECOMMENDED BOOKS:

1. Biotechnology – U.Sathyanarayana, Books and Allied Pvt Ltd, 8th Print, 2013.
2. Textbook of Biotechnology- Dr.PRakash S. Lohar, MJP publisher, 2012

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. A Textbook of Biotechnology 4th Rev. Edn. 2006 Edition, by R C Dubey
4. Animal Biotechnology, 2nd Edition. Models in Discovery and Translation, Ashish Verma Anchal Singh, Hardcover ISBN: 9780128117101
5. Plant Biotechnology and Genetics: Principles, Techniques, and Applications 2nd Edition, by Stewart Jr., C. Neal, ISBN-13: 978-1118820124

JOURNALS:

1. International Journal of Biotechnology
2. International Journal of Biotechnology & Biochemistry
3. Indian Journal Of Biotechnology (Ijbt)

e-LEARNING RESOURCES:

1. Biotechlearn.org.nz/
2. Wwww.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/>

COURSE OUTCOME

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, demonstrate the collection and purification of proteins	K2,K3
CO3	Discuss about cell cultures, gene knock outs ,predict the use of DNA probes, Analyze the use of r DNA in production of insulin,interferon,vaccines.	K3,K4,K5
CO4	Assess the use of Plant tissue cultures, Apply the knowledge to produce improved crop varieties,	K3,K4
CO5	Apply the knowledge about Bioremediation towards solving common environmental pollution , Demonstrate the Industrial production of biofuels, vitamins B12, SCPs.	K3,K4

MAPPING OF CO WITH PSO

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	Sec A – 10 x 2	50	20	100	Question No.- is compulsory Section B/C-must be have 2 theory and 3problems(problems may be asked in revelant papers)
K3,K4	B – 5/8 x 8	500	40		
K3,K4,K5	C – 2/4 x 20	1200	40		

SEMSETER IV

ELECTIVE- BIOINFORMATICS

TEACHING HOURS : 60
CREDITS : 3

COURSE CODE: 15SP18/ 4E/BIF
L T P : 3 1 0

COURSE OBJECTIVE

1. To impart knowledge on 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 the role of insilico tools in Drug designing and development.

COURSE OUTLINE:

Unit I

(12 hrs)

Introduction to Bioinformatics: Principles, Challenges and Applications. Major Bioinformatics Resources: NCBI, ExPASy; Biological databases - Nucleic acid sequence databases: 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.

Unit II

(12 hrs)

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&Wunchsh, Smith & Waterman algorithms), Hash coding algorithm, **Heuristic tools - FASTA, BLAST. MSA** – Progressive alignment algorithms for MSA – CLUSTAL W. 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 - (Phylip). Motif and Domain analysis - SMART, ProDom

Unit III (12 hrs)

Genomics: Structural genomics - Genome mapping, Sequencing, Assembly, Annotation (Gene prediction methods), comparison. Functional Genomics (EST, SAGE, Microarray) Human Genome Project; RNA Secondary structure prediction

Unit IV (12 hrs)

Proteomics: Fundamentals of 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, Abinitio Method. 3-D structure visualization - Rasmol.

Unit V (12 hrs)

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

RECOMMENDED BOOKS :

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

JOURNALS:

1. Journal of Bioinformatics and Computational Biology
2. Journal of Proteomics & Bioinformatics
3. American Journal of Bioinformatics Research
4. Journal of Bioinformatics and Computational biology
5. Bioinformatics and Computational biology

e-LEARNING :

1. www.ncbi.nlm.nih.gov

2. www.ebi.ac.uk
3. www.bioinformatics.org/
4. www.Expasy.org
5. www.Scripps.edu

COURSE OUTCOME

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	K2,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 OF CO WITH PSO

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

Lecture (Chalk A0nd Talk)

E Content ,Videos

Group Discussion

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 No.- is compulsory Section B/C- must be have 2 theory and 3problems(problems may be asked in revelant papers)
K3,K4	B – 5/8 x 8	500	40		
K3,K4,K5	C – 2/4 x 20	1200	40		

SEMSETER IV
PRESENTATION SKILLS

TEACHING HOURS : 30
CREDITS : 2

COURSE CODE: 15SP18/ 4S/PSK
L T P : 1 1 0

OBJECTIVE:

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

COURSE OUTLINE:

Unit – I **(10hrs)**

Language & Communication – Verbal & Non Verbal communication , Distinctive features of speech , Listening skills .Oral and Poster presentation.

Unit – II **(10hrs)**

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 **(10hrs)**

Technical Writing- Laboratory and Field book maintenance . Scientific report writing.
Recording minutes of the meeting, Preparation of case studies . Scientific editing , Preparation of proposal for grants.

RECOMMENDED BOOKS

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-Astrategic guide for successful interview by Stanley Bellbrook
3. Scientific Thesis Writing and Paper Presentation . MJP Publishers.2010

JOURNALS

Birmingham Business Journal

e-LEARNING RESOURCES

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

COURSE OUTCOME

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 OF CO WITH PSO

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

SEMESTER III & IV

CORE PRACTICAL III

TEACHING HOURS: 135

CREDITS : 4

COURSE CODE: 15SP18/ 4C/PL3

L T P : 0 0 5

COURSE OBJECTIVES:

1. To have hands on training in hematological parameters
2. To estimate the minerals using flame photometry
3. To use the diagnostic kits and Uristix
4. To demonstrate ELISA
5. To determine the levels of biological compound using colorimeter and spectrophotometer

COURSE OUTLINE

GROUP EXPERIMENTS

- a) Hematology – Total RBC, WBC, Platelet count , Differential count
- b) ESR, PCV, Hb (Hb Indices – MCV, MCH, MCHC)
- c) Blood grouping
- d) Urine analysis – Uristix
- e) Serum sodium & Potassium – Flame photometry
- f) Enzyme assay – LDH (Kit based)

g) ELISA (demo)

2 COLORIMETRY

- a) Urea (kit based)
- b) Bilirubin (kit based)
- c) Total Cholesterol (kit based)
- d) HDL (kit based)
- e) Uric acid (kit based)
- f) Estimation of Protein
- g) Estimation of Phospholipid
- h) Estimation of free fatty acids
- i) Estimation of Triglyceride
- j) Estimation of Glucose by OT method
- k) Estimation of Creatinine

COURSE OUTCOME

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

MAPPING OF CO WITH PSO

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

TEACHING HOURS: 135

CREDITS:4

COURSE CODE: 15SP18/ 4C/PL4

LTP: 0 0 5

OBJECTIVES:

1. To Analyze Biological compounds using Immunological Techniques.
2. Hands on training in Molecular Biology Techniques.
3. To use the diagnostic kits for Transformation.
4. To demonstrate PCR
5. To determine the levels of Antioxidants using colorimeter and spectrophotometer

COURSE OUTLINE:

1. IMMUNOLOGY (GROUP EXPERIMENTS)

- Ouchterlony – Double diffusion
- Cross over Immunoelectrophoresis

2. MOLECULAR BIOLOGY (GROUP EXPERIMENTS)

- Isolation of Genomic & Plasmid DNA
- Restriction digestion & Ligation
- PCR
- Transformation

3. COLORIMETRY : ASSAY OF ANTIOXIDANTS

- Estimation of Reduced glutathione
- Estimation of TBARS
- Estimation of Vitamin C
- Estimation of Vitamin E
- Assay of Catalase
- Assay of Superoxide dismutase

4.ANTIOXIDANT ACTIVITY OF PHYTOCHEMICALS

- DPPH assay
- Nitrogen oxide scavenging assay
- FRAP assay

COURSE OUTCOME

CO .NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Explain Oucterlony double diffusion Cross over Immunoelectrophoresis,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 OF CO WITH PSO

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

ELECTIVE - WOMEN AND HEALTH

(FOR OTHER DEPARTMENTS)

TEACHING HOURS: 60

CREDITS: 3

COURSE CODE: 15SP18/2E/WAH

LTP: 3 1 0

COURSE OBJECTIVE

1. To provide basic understanding about the physiology of 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 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 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 and still birth, Nutrition during pregnancy. Development of foetus in different trimesters.

UNIT III:

(12 hours)

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

UNIT IV:

(12 hours)

Health problems in women – Anemia, Varicose veins, Skin and hair problems, 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 – Carbohydrates, Lipids, Proteins, 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 BOOKS :

1. Human Anatomy and Physiology-Elaine N. Marieb Pearson publisher 3rd edn, 1995.
2. Understanding nutrition- Eleanor, Noss, Whitney. Wadsworth Publishing; 10 edition

REFERENCE BOOKS:

1. Women and Health 1st Edition by Marlene Goldman Maureen Hatch
2. Nutrition- Dr. M. Swaminathan, Kalyani Publishers
3. Encyclopedia of Women health-Parvesh Handa Atlantic Publishers and Distributors Pvt Ltd
4. Women and Health by Marlene B. Goldman, Kathryn M. Rexrode, Rebecca Trois
5. Reproductive Tract Infections: Global Impact and Priorities for Women's Reproductive Health by Peter Piot, King K. Holmes

JOURNALS:

1. Women's Health Issues
2. Journal of Women's health care
3. International Journal of Women's health
4. Health care for Women International

e-LEARNING RESOURCES

1. www.healthywomen.org/
2. www.womenshealthmag.com/
3. <https://www.mayoclinic.org>
4. <https://www.healthline.com>
5. <https://www.emedicinehealth.com>

COURSE OUTCOME

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
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 OF CO WITH PSO

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	2	3	3
CO5	2	3	3	3	2
AVERAGE	2.6	2.8	2.4	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

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 No.- is compulsory Section B/C-must be have 2 theory and 3problems(problems may be asked in revelant papers)
K3,K4	B – 5/8 x 8	500	40		
K3,K4,K5	C – 2/4 x 20	1200	40		

SEMESTER III

ELECTIVE-LIFESTYLE ASSOCIATED DISEASES

(For other departments)

TEACHING HOURS :60

CREDITS: 3

COURSE CODE: 15SP18/ 3E/LFD

LTP: 4 0 0

COURSE OBJECTIVE

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 heart, lungs and kidney.

COURSE OUTLINE:

Unit I

(12hrs)

Modern lifestyle habits- Sedentary lifestyle-Obesity and hypertension, Stress related disorders- Causes ,Complications and Management, Sleeping disorders- Types ,Causes and Complications, Smoking, Alcoholism, Drugs- Risk factors, Electronic gadgets- Radiation and Health.

Unit -II

(12hrs)

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

(12hrs)

Health hazards of Costumes and Cosmetics- Tight clothing, High heels, Hair coloring, Tattooing and Face bleach, Types and Complications of Breast implant and Liposuction.

Unit-IV

(12hrs)

Lifestyle diseases- Causes, symptoms and treatment of Breast, Cervical and Prostate cancer, Liver cirrhosis, Hepatitis, Diabetes Mellitus, Free radicals and Anti oxidants.

Unit-V

(12hrs)

Lifestyle diseases- Causes, Symptoms and Treatment of kidney diseases- Nephritis, Pulmonary diseases- COPD, Allergic sinusitis, Rhinitis, 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
2. Encyclopedia of Women health – Parvesh Handa
3. Lifestyle Medicine: Lifestyle, the Environment and Preventive Medicine in Health and Disease by Garry Egger, Andrew Binns, Stephan Rossner, Michael Sagner
4. Nutrition in Lifestyle Medicine by edited by James M. Rippe
5. Healthful Eating As Lifestyle (HEAL): Integrative Prevention for Non-Communicable Diseases by edited by Shirin Anil

JOURNALS

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

e-LEARNING RESOURCES

1. www.livestrong.com > Diseases and Conditions
2. www.med-health.net/Lifestyle-Diseases.html
3. <https://www.mayoclinic.org>
4. <https://www.healthline.com>
5. <https://www.medicalnewstoday.com>

COURSE OUTCOME

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

MAPPING OF CO WITH PSO

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	2	3	3	2	3
CO2	2	2	3	3	3
CO3	2	2	2	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
AVERAGE	2.4	2.6	2.8	2.8	3

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

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 No.- is compulsory Section B/C-must be have 2 theory and 3problems(problems may be asked in revelant papers)
K3,K4	B – 5/8 x 8	500	40		
K3,K4,K5	C – 2/4 x 20	1200	40		