

INSTITUTE OF SCIENCE, TECHNOLOGY & ADVANCED STUDIES (VISTAS)
(Deemed to be University Estd. u/s 3 of the UGC Act, 1956)
PALLAVARAM - CHENNAI
ACCREDITED BY NAAC WITH 'A' GRADE
Marching Beyond 30 Years Successfully
INSTITUTION WITH UGC 12B STATUS

POSTGRADUATE DEGREE PROGRAMME

M.Sc., BIOCHEMISTRY

Two Years

CURRICULUM & SYLLABUS

REGULATION 2024

Choice Based Credit System (CBCS)

&

Learning Outcomes Based Curriculum Framework (LOCF)

Effective from the Academic Year

2024 -2025

Department of Biochemistry
School of Life Sciences



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DEPARTMENT OF BIOCHEMISTRY

VISION OF THE DEPARTMENT
➢ To be recognized in the global scientific arena, with a marked specialization and excellence in Biochemistry. ➢ To provide an atmosphere for critical thinking to differentiate and interlink the various branches; cell biology, intermediary metabolism, clinical biochemistry, immunology, enzymology and endocrinology.

MISSION OF THE DEPARTMENT	
M1	To excel in the basic concepts and principles of Biochemistry
M2	To identify the problem in protocols in the thrust areas of research where the intervention of biochemist is essential
M3	To expose the students to the grooming areas of research with advanced instrumentation technique
M4	To correlate the anthropogenic inputs in the environment with the biochemical changes in the biological species and its impact on human life
M5	To understand the concepts in scientific learning for the process of experimentation and hypothesis testing.

PROGRAMME EDUCATIONAL OUTCOMES (PEO)	
PEO1	Compare and contrast the scope and profundity of scientific knowledge in the broad range of fields, including Cell biology, Intermediary metabolism, Clinical Biochemistry, Hormonal Biochemistry, Genetics, Nutritional Biochemistry, Immunology and Enzymology.
PEO2	An ability to gain knowledge and know-how for successful career in academia, industry and research.
PEO3	Describe the biochemical basis of human diseases, protein structure and conformation, non invasive diagnostics, biochemical pathway regulation and drug development and apply the same for a multitude of laboratory applications.
PEO4	Promoting lifelong learning to meet the ever-evolving professional demands by developing ethical, inter personal and team skills.

PROGRAMME OUTCOMES (PO)	
PO1	Life Sciences knowledge: Successful candidates will acquire current/recent specific knowledge in the respective discipline with proficiency in practical skills and leadership skills for a successful career.
PO2	Problem analysis: Successful candidates will be able to analyses, design standards, resolve and troubleshoot problems in implementation or standardization of Life sciences protocols.
PO3	Design/development of solutions: Successful candidates will develop creative and cognitive thinking and cooperate with each other to solve problems in the field of Life sciences.

PROGRAMME SPECIFIC OUTCOMES (PSO)	
PSO1	Demonstrate an understanding of structure and metabolism of macromolecules and understand the regulation and disorders of metabolic pathways.
PSO2	Gain proficiency in laboratory techniques in both biochemistry and molecular biology, and be able to apply the scientific method to the processes of experimentation and Hypothesis testing.

BOARD OF STUDIES

List of Members

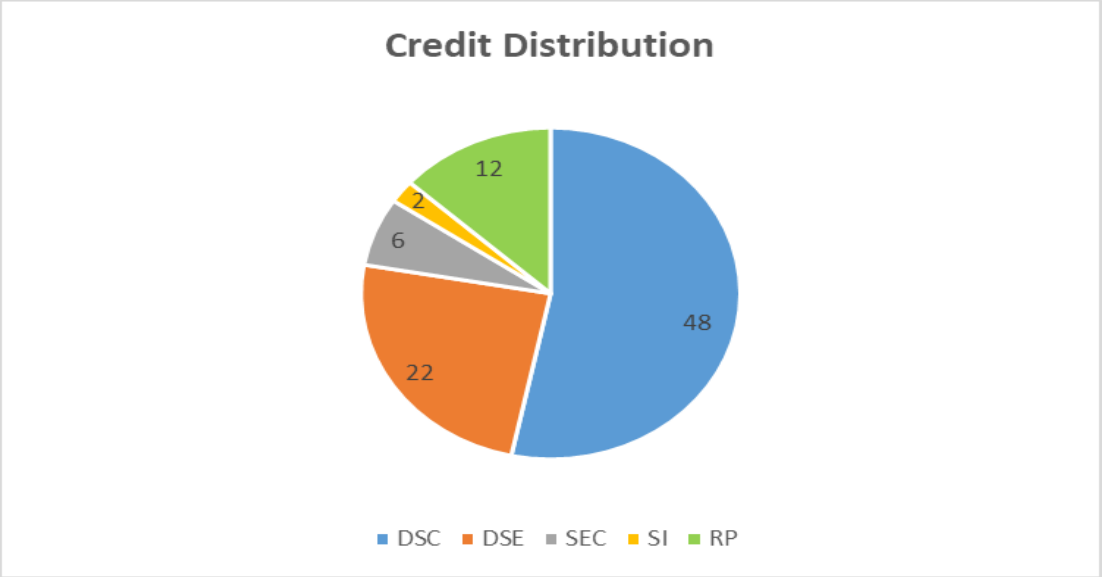
Department of Biochemistry

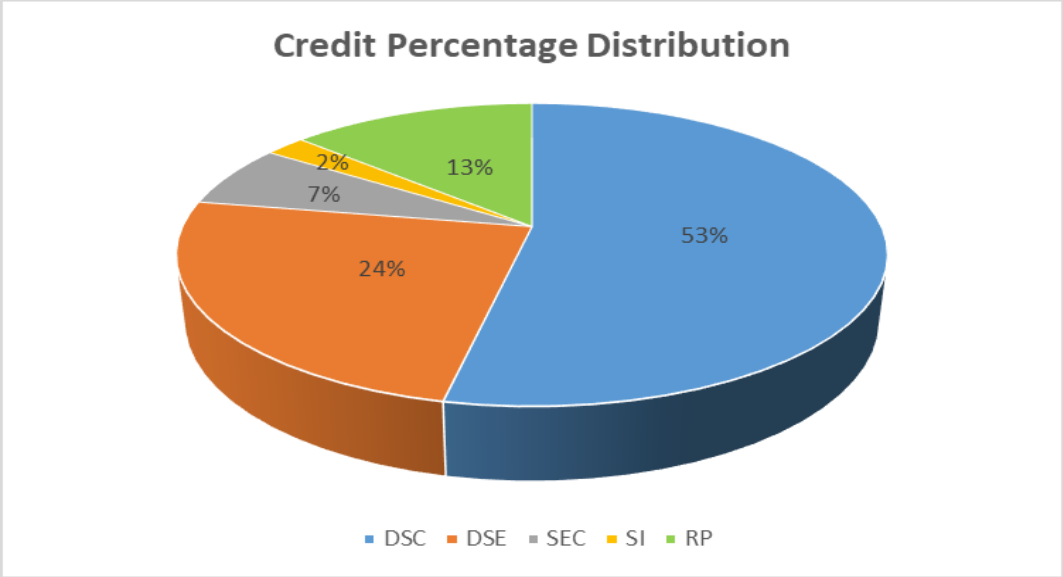
S. No	Name & Designation	Address	Role
1.	Dr. R. B.Usharani	Associate Professor & Head i/c, Department of Biochemistry, School of Life Sciences, VISTAS	Chair Person
2.	Dr. P. Kalaiselvi	Department of Medical Biochemistry, University of Madras	External Expert
3.	Dr.M.Ganesan	Managing Director, Microtherapeutics Research Labs No 6, Kamarajar St, East Tambaram, Selaiyur, Chennai 600059	External Expert
4.	Dr.R.Padmini	Associate Professor, Department of Biochemistry, School of Life Sciences, VISTAS	Member
5.	Dr.C.Shobana	Associate Professor, Department of Biochemistry, School of Life Sciences, VISTAS	Member
6.	Dr.R.Vidya	Assistant Professor, Department of Biochemistry, School of Life Sciences, VISTAS	Member
7.	Dr.P.Amudha	Assistant Professor, Department of Biochemistry, School of Life Sciences, VISTAS	Member
8.	Ms. Sathya	Medical coder, Omega Health Care, Chennai	Alumni member 2014-2016 batch

CREDIT DISTRIBUTION

M.Sc., Biochemistry
Minimum credits to be earned: 90

Component	I Sem	II Sem	III Sem	IV Sem	Total credits
DSC	14	16	14	4	48
DSE	8	4	6	4	22
SEC	2	2	2	-	6
SI	-	2	-	-	2
RP	-	-	-	12	12
Total Credits	**24**	**24**	**22**	**20**	**90**





ABBREVIATIONS

DSC	Disciplinary Specific Core
DSE	Disciplinary Specific Elective
SEC	Skill Enhancement Courses
SI	Summer Internship
RP	Research Project

CURRICULUM STURCTURE

M.Sc., Biochemistry Two Years

Total number of Credits: 90

	M.Sc., Biochemistry Minimum Credits to be earned : 90									
	Hours/Week							Maximum Marks		
SEMESTER I										
Category	**Code**	**Course**	**L**	**T**	**P**	**O**	**C**	**CIA**	**SEE**	**Total**
DSC1	24CMBC11	CHEMISTRY OF BIOMOLECULES	4	0	0	2	4	40	60	100
DSC 2	24CMBC12	ADVANCED INSTRUMENTAL TECHNIQUES	4	0	0	2	4	40	60	100
DSC 3	24CMBC13	CELLULAR BIOCHEMISTRY	4	0	0	2	4	40	60	100
DSC 4 (Lab)	24PMBC11	PRACTICALS I - BIOCHEMISTRY & INSTRUMENTATION	0	0	4	1	2	40	60	100
DSE 1	24DMBC1-	DISCIPLINE SPECIFIC ELECTIVE-I	4	0	0	2	4	40	60	100
DSE 2	24DMBC1-	DISCIPLINE SPECIFIC ELECTIVE-II	4	0	0	2	4	40	60	100
SEC 1	24SSKP11	SOFT SKILL I/ SECTOR SKILL COURSE	2	0	0	1	2	40	60	100
			22	**-**	**4**	**-**	**24**			

CIA - Continuous Internal Assessment SEE - Semester End Examination

***L – Lecture, *T- Tutorial, *P- Practical, *O - Outside the class effort / self-study, , *C- Credits**

SEMESTER II										
Category	**Code**	**Course**	**L**	**T**	**P**	**O**	**C**	**CIA**	**SEE**	**Total**
DSC 5	24CMBC21	ENZYME & ENZYME TECHNOLOGY	4	0	0	2	4	40	60	100
DSC 6	24CMBC22	INTERMEDIARY METABOLISM	4	0	0	2	4	40	60	100
DSC 7	24CMBC23	CLINICAL BIOCHEMISTRY	4	0	0	2	4	40	60	100
DSC 8 (Lab)	24PMBC21	PRACTICAL ENZYMOLOGY	0	0	4	1	2	40	60	100
DSC 9 (Lab)	24PMBC22	PRACTICAL CLINICAL BIOCHEMISTRY	0	0	4	1	2	40	60	100
DSE 3	24DMBC2-	DISCIPLINE SPECIFIC ELECTIVE-III	4	0	0	2	4	40	60	100
SI	24INPG21	INTERNSHIP	0	0	2	1	2	40	60	100
SEC 2	24SSKP21	SOFT SKILL II/ SECTOR SKILL COURSE	2	0	0	1	2	40	60	100
			18	-	**10**	-	**24**			

CIA - Continuous Internal Assessment **SEE - Semester End Examination**

***L – Lecture, *T- Tutorial, *P- Practical, *O - Outside the class effort / self-study, , *C- Credits**

SEMESTER III										
Category	**Code**	**Course**	**L**	**T**	**P**	**O**	**C**	**CIA**	**SEE**	**Total**
DSC 10	24CMBC31	GENETICS & MOLECULAR BIOLOGY	4	0	0	2	4	40	60	100
DSC 11	24CMBC32	PHARMACEUTICAL BIOCHEMISTRY	4	0	0	2	4	40	60	100
DSC 12	24CMBC33	PLANT & ANIMAL TISSUE CULTURE	4	0	0	2	4	40	60	100
DSC 13 (Lab)	24PMBC31	PRACTICAL GENETICS & MOLECULAR BIOLOGY	0	0	4	1	2	40	60	100
DSE 4	24DMBC3-	Discipline Specific Elective-IV	3	0	0	2	3	40	60	100
DSE 5	24DMBC3-	Discipline Specific Elective-V	3	0	0	2	3	40	60	100
SEC 3	24SSKP31	SOFT SKILL III/ SECTOR SKILL COURSE	2	0	0	1	2	40	60	100
			20	**-**	4	-	**22**	40	60	100

CIA - Continuous Internal Assessment **SEE - Semester End Examination**

***L – Lecture, *T- Tutorial, *P- Practical, *O - Outside the class effort / self-study, , *C- Credits**

SEMESTER IV										
Category	**Code**	**Course**	**L**	**T**	**P**	**O**	**C**	**CIA**	**SEE**	**Total**
DSC 14	24CMBC41	TOXICOLOGY & FORENSIC BIOCHEMISTRY	4	0	0	2	4	40	60	100
DSE 6	24DMBC4-	Discipline Specific Elective-VI	4	0	0	2	4	40	60	100
RP1	24RMBC41	RESEARCH PROJECT I	0	0	12	10	12	40	60	100
			8	**0**	**12**	-	**20**			

CIA - Continuous Internal Assessment **SEE - Semester End Examination**

***L – Lecture, *T- Tutorial, *P- Practical, *O - Outside the class effort / self-study, *C- Credits**

DISCIPLINE SPECIFIC CORE COURSES

Category	Code	Course	L	T	P	O	C
DSC 1	24CMBC11	CHEMISTRY OF BIOMOLECULES	4	0	0	2	4
DSC 2	24CMBC12	ADVANCED INSTRUMENTAL TECHNIQUES	4	0	0	2	4
DSC 3	24CMBC13	CELLULAR BIOCHEMISTRY	4	0	0	2	4
DSC 4 (Lab)	24PMBC11	PRACTICALS I - BIOCHEMISTRY & INSTRUMENTATION	0	0	4	1	2
DSC 5	24CMBC21	ENZYME & ENZYME TECHNOLOGY	4	0	0	2	4
DSC 6	24CMBC22	INTERMEDIARY METABOLISM	4	0	0	2	4
DSC 7	24CMBC23	CLINICAL BIOCHEMISTRY	4	0	0	2	4
DSC 8 (Lab)	24PMBC21	PRACTICAL ENZYMOLOGY	0	0	4	1	2
DSC 9 (Lab)	24PMBC22	PRACTICAL CLINICAL BIOCHEMISTRY	0	0	4	1	2
DSC 10	24CMBC31	GENETICS & MOLECULAR BIOLOGY	4	0	0	2	4
DSC 11	24CMBC32	PHARMACEUTICAL BIOCHEMISTRY	4	0	0	2	4
DSC 12	24CMBC33	PLANT & ANIMAL TISSUE CULTURE	4	0	0	2	4
DSC 13 (Lab)	24PMBC31	PRACTICAL GENETICS & MOLECULAR BIOLOGY	0	0	4	1	2
DSC 14	24CMBC41	TOXICOLOGY & FORENSIC BIOCHEMISTRY	4	0	0	2	4

DISCIPLINE SPECIFIC ELECTIVE COURSES

Category	Code	Course	L	T	P	O	C
DSE 1	24DMBC11	BIOTECHNOLOGY AND IPR	4	0	0	2	4
	24DMBC12	NANOTECHNOLOGY	4	0	0	2	4
DSE 2	24DMBC13	HUMAN PHYSIOLOGY	4	0	0	2	4
	24DMBC14	STEM CELL TECHNOLOGY	4	0	0	2	4
DSE 3	24DMBC21	PLANT BIOCHEMISTRY	4	0	0	2	4
	24DMBC22	CANCER BIOLOGY	4	0	0	2	4
DSE 4	24DMBC31	ENDOCRINOLOGY	3	0	0	2	3
	24DMBC32	ENVIRONMENTAL SCIENCES	3	0	0	2	3
DSE 5	24DMBC33	IMMUNOLOGY AND MICROBIOLOGY	3	0	0	2	3
	24DMBC34	PHYTOCHEMISTRY, PHARMACOGNOSY AND QUALITY CONTROL	3	0	0	2	3
DSE 6	24DMBC41	MODERN LIFESTYLE ASSOCIATED DISEASE	4	0	0	2	4
	24DMBC42	NEUROBIOLOGY	4	0	0	2	4

SUMMER INTERNSHIP

Category	Code	Course	L	T	P	O	C
SI	24INPG21	INTERNSHIP	0	0	2	1	2

SKILL ENHANCEMENT COURSES

Category	Code	Course	L	T	P	O	C
SEC 1	24SSKP11	SOFT SKILL I/ SECTOR SKILL COURSE	2	0	0	1	2
SEC 2	24SSKP21	SOFT SKILL II/ SECTOR SKILL COURSE	2	0	0	1	2
SEC 3	24SSKP31	SOFT SKILL III/ SECTOR SKILL COURSE	2	0	0	1	2

RESEARCH PROJECT

Category	Code	Course	L	T	P	O	C
RP1	24RMBC41	RESEARCH PROJECT I	0	0	12	10	12

SEMESTER I

24CMBC11 CHEMISTRY OF BIOMOLEULES

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVE:

The objective is to study about the structure and biological functions of macromolecules such as proteins, polysaccharides, lipids, and nucleic acids, as well as small molecules such as primary metabolites, secondary metabolites, and natural products.

UNIT- I CARBOHYDATES 12

Carbohydrates: Classification of Carbohydrates. Structure and functions of Monosaccharides, Disaccharides and Polysaccharides. Structure and biological importance of sugar derivatives, Glycosaminoglycan's, Proteoglycans, Glycoproteins and Lipopolysaccharides.

UNIT-II PROTEINS 12

Classification, structure and properties of amino acids and proteins. Structural organization of proteins(1^0 structure, 2^0 Structures, 3^0 Structures and Quaternary Structure). Peptide Synthesis. Isolation and purification of proteins. Conformational study on the structure of keratin, collagen and hemoglobin .

UNIT-III LIPIDS 12

Lipids- Classification, structure and functions of fatty acids, alcohols and lipids. Physical and chemical properties of fatty acids. Structure and function of Eicosanoids, Lipoproteins-classes, transport and functions. Steroids.

UNIT – IV NUCLEIC ACIDS 12

Structure of Nucleic acids (DNA & RNA) . A, B and Z forms of DNA. DNA super coiling and linking number. Properties of DNA – buoyant density, viscosity, hypochromicity, denaturation, renaturation, Cot curve. Chemical synthesis of Nucleic acids. Chemical and enzymatic methods of Nucleic acids sequencing. Major classes of RNA, their structure and biological role. Types of RNA, Si RNA, Micro RNA

UNIT– V VITAMINS 12

Vitamins- Definition and classification. Source, Structure and biological role, daily requirement and deficiency manifestation of the fat soluble vitamins A,D,E & K. Water soluble vitamins-Ascorbic acid, thiamine, riboflavin, pyridoxine, niacin, pantothenic acid, lipoicacid, biotin, folic acid and vitamin B12.

Total: 60 Hours

Course Outcome:

At the end of this course students will be able to,

CO 1: Understand the properties of carbohydrates, proteins, lipids, cholesterol, DNA, RNA, glycoproteins and glycolipids and their importance in biological systems

CO 2: Describe the chemistry of carbohydrates ,lipids, amino acids and proteins and nucleic acids

CO 3: Explain organization and working principles of various components present in living cell.

CO 4: Interpret molecular structure and interactions present in proteins, nucleic acids, carbohydrates and lipids

CO 5: Develop skills to determine amino acid and nucleotide structures using the sequences of proteins and DNA respectively

Text Books:

1. J.L.Jain et al. (1994), S.Chand and Company, 4th edition, Fundamentals of Biochemistry.

2. M.N.Chatterjea and Ranashinde (2005), Text book of Medical biochemistry, 6th edition, Jaypee Brothers Medical Publisher (P) Ltd.

Reference Books:

1. Champe and Harvey (2007), Lippincott's illustrated biochemistry, 6th edition.

2. D.Voet and J.G. Voet (2004), Biochemistry, John Wiley & Sons, USA.

Web Sources:

1. https://www.chem.uci.edu/~unicorn/243/papers/MSlec1.pdf

2. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://unacademy.com/content/wp-content/uploads/sites/2/2022/10/32.-Biomolecule-Notes.pdf

24CMBC12 ADVANCED INSTRUMENTAL TECHNIQUES

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVE:

Advanced instrumental techniques are used to understand the theoretical principles involved in Bioinstrumentation which may be used for the determination of nutrients, major ions and trace elements, biological samples together with the analytical techniques.

UNIT- I MICROSCOPY AND CYTO TECHNIQUES 12

Microscopy - Principles of Microscopy – bright and dark field, fluorescence, phase contrast, scanning and transmission electron microscopy. Cytotechniques – tissue homogenization and Cell disruption, cell counting and sorting, cell culture techniques, preservation of cell and tissues.

UNIT-II RADIOACTIVITY AND BIOSENSORS 12

Radioactivity- introduction, types, Detection and measurements - GM counter, Scintillation counter. Safety aspects. Biological applications: assessing the metabolic pathways, radio dating, isotope dilution technique, and autoradiography. Biosensors - Introduction to Biosensors: Concepts and applications. Biosensors for diabetes management. Noninvasive Biosensors in Clinical Analysis.

UNIT-III CENTRIFUGATION AND ELECTROPHORESIS 12

Centrifugation: Basic Principles of Centrifugation. Instrumentation and applications of Preparative - Differential and Density Gradient Centrifugation, Analytical Ultracentrifugation – ultra centrifuge, applications. Electrophoresis: Principles and Factors Affecting Electrophoresis. Principle, methodology and applications of PAGE, SDS-PAGE, IEF, 2D PAGE, Agarose Gel Electrophoresis, PFGE.

UNIT – IV CHROMATOGRAPHY 12

Chromatography: Principles, Instrumentation and Applications of Paper Chromatography, TLC, Column Chromatography, LPLC, HPLC, Gel filtration Chromatography, Ion-Exchange Chromatography, Affinity Chromatography and GLC.

UNIT– V SPECTROSCOPY 12

Spectroscopy: Basic Principles of Electromagnetic Radiation, Beer-Lambert's Law. Principle, instrumentation, operation and applications of UV-Visible, IR, Spectrofluorimetry,

Flame Photometry, AAS, NMR, ESR, X-Ray Diffraction, Mass spectrometry. To Visit an industry with advanced instruments pertaining to the techniques for demonstration.

Total: 60 Hours

Course Outcome:

At the end of this course students will be able to,

CO 1: Evaluate the applicability, advantages, limitations and sources of error of current analytical instruments through an understanding of the working principles of these instruments and the underlying biochemical basis

CO 2: Conduct biochemical analyses and instrument evaluations in the laboratory and link the practical applications to the theoretical background

CO 3: Interpret and critically evaluate analytical data and communicate the results of biochemical analyses in the form of formal scientific reports

CO 4: Work collaboratively in a team environment to discuss and solve mathematically-based biochemical problems

CO 5: Understanding the principles of Electrophoresis, Spectrophotometry and their applications in biological investigations/experiments.

Text Books:

1. Keith Wilson and John Walker (2010), Principles and techniques of Practical Biochemistry, Seventh edition, Cambridge University Press.
2. Asokan P (2009), Analytical Biochemistry, Chinna publication.

Reference Books:

1. Chatwal**,** G & Anand**,** S (2005)**,** Instrumental methods of chemical analysis, Himalaya Publishing House.
2. S. K. Sawhney & Randhir Singh (2014), Introductory Practical Biochemistry, Narosa Publications House.

Web Sources:

1. http://www.freebookcentre.net/Chemistry/Analytical-Chemistry-Books.html
2. https://www.chem.uwec.edu/chem406_f06/pages/lectnotes.html

24CMBC13 **CELLULAR BIOCHEMISTRY**

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVE:

The objectives of the course are to learn and understand the fundamentals of cell biology like cell organelles, cytoskeleton, cellular transport, cell-extracellular matrix interaction, cell division, and protein trafficking and signal transduction etc.

UNIT- I PLASMA MEMBRANE **12**

Biochemical composition, Membrane proteins glycophorin, bacteriorhodopsin, membrane bound enzymes-cell surface antigens, Molecular organization, freeze fracture technique and fluid mosaic model, lipid and protein fluidity and molecular mobility of proteins. Isolation and characterization of plasma model membranes, reconstitution of proteins into vesicles, liposomes.

UNIT-II MITOCHONDRIA **12**

Structure of mitochondria, aerobic respiration, respiratory chain carriers, respiratory enzyme complexes and redox potential, inhibitors of respiratory chain, uncouplers. Thermodynamic principles, Energy rich bonds, coupled reactions and oxidative phosphorylations, Bioenergetics. Chemiosmotic hypothesis- loop mechanism, respiratory control, inhibitors of oxidative phosphorylation.

UNIT-III MEMBRANE TRANSPORT **12**

Simple diffusion, Donnan equilibrium, diffusion of charged and uncharged particles, Flick's law, Nernst law. Facilitated transport: carriers and channels. Active transport: Na pump models mechanisms, Ca pump, ATP dependent proton pump. Co-transport: Symport and Antiport; sodium dependent glucose transport amino acids and calcium.

UNIT – IV MICROTUBULES **12**

Structure, function and assembly, Colchicine interaction - formation of centrioles, mitotic spindle and cytokinesis. Golgi apparatus – Structure and functions. Ribosomes - Assembly of ribosomal sub units. Lysosomes - formation and function, phagocytosis. Nucleolus - Structure and composition, Chromosome - Chromatin structure and function. Nucleosome - histone and non-histone proteins.

UNIT– V SECRETORY AND ENDOCYTIC PATHWAY **12**

Vesicular traffic in the secretory and endocytic pathways-Transport from a) the ER through Golgi apparatus b) Trans Golgi Network to Lysosomes. Mannose 6-Phosphate receptor shuttles. Transport in excitable cells - Internalization of macromolecules by phagocytosis, endocytosis and exocytosis. Pinocytosis: Receptor mediated endocytosis- delivery of iron by transferring and infection. The molecular mechanisms of vesicular transport and maintenance of compartmental diversity.

Total: 60 Hours

Course Outcome:

At the end of this course students will be able to,

CO 1: Describe the structure, functions and the mechanism of action of enzymes. Learning kinetics of enzyme catalysed reactions and enzyme inhibitions and regulatory process. Ability to perform immobilization of enzymes. Exposure of wide applications of enzymes and future potential.

CO 2: Demonstrate the fundamental energetics of biochemical processes, chemical logic of metabolic pathways. Knowing in detail about concepts to illustrate how enzymes and redox carriers and the oxidative phosphorylation machinery occur

CO 3: Understand the utilization of proton gradient to drive the formation of high energy bonds and high energy compounds

CO 4: Describe the detailed structures of eukaryotic and prokaryotic cells and methods used to examine them.

CO 5: Acquiring knowledge on cell-cell interactions, Cell cycle cell division and apoptosis

Text Books:

1. Donald Voet and Judith Voet (2004), Biochemistry, third edition, John Wiley & Sons, USA.
2. Geoffrey M. Cooper and Robert E Hausmann (2007), The cell and molecular approach, third edition, ASM Press, Sinauer Associates Inc, Washington, DC.

Reference Books:

1. Lodish Baltimore, Berk, Matsudaira, Kaiser, Krieger, Scott, Zipursky, Darnell (2004), Molecular

cell Biology, fifth edition, WH Freeman and Company, USA.

2. Jeremy M Berg, John L Tymoczko and LubertStryer (2007), Biochemistry, fifth edition, WH Freeman and Company, USA.

Web Sources:

1. https://www.isical.ac.in/~losiana_t/Intro_2_Molbio_Losiana_Nayak.pdf
2. https://biolympiads.com/notes-of-molecular-biology-of-the-cell-by-alberts/

24PMBC11 PRACTICAL BIOCHEMISTRY AND INSTRUMENTATION

L	T	P	O	C
0	0	4	1	2

COURSE OBJECTIVE:

The course aims to develop skills of performing basic biochemical tests important in clinical investigations, to develop familiarity with biochemical laboratory techniques, and to introduce students to various practical aspects of enzymology and their correlation in disease conditions.

LIST OF EXPERIMENTS

Biochemical Studies

1. Estimation of Tryptophan
2. Estimation of Lactate
3. Estimation of pyruvate
4. Estimation of protein by Bradford's method
5. Isolation and estimation of DNA,
6. Isolation and estimation of RNA
7. Isolation and estimation of glycogen from tissues.

Instrumentation Lab

8. Separation of Amino acids/ sugars by paper chromatography and TLC
9. Separation of Plant pigments by column chromatography
10. Separation of Proteins by gel filtration chromatography
11. SDS PAGE-Demonstration

Total: 30 Hours

Course Outcome:

At the end of this course students will be able to,

CO 1: Develop an understanding about the standardization of various biomolecules

CO 2: Examine the various techniques adopted for separation of biomolecules

CO 3: Examine the separation of biomolecules by electrophoresis

CO 4: Compare and discuss the instrumentation and applications of different chromatographic techniques

CO 5: Develop an understanding about the fundamental and applications of the instruments that are routinely used for the characterization of biomolecules

Text Books:

1. J. Jayaraman (2011) (Paperback), Laboratory Manual in Biochemistry, New Age International Pvt Ltd Publishers.
2. S. Sadasivam, A. Manickam (2009) (paperback), Biochemical Methods, New age publishers.

Reference Books:

1. Harold Varley (2006), Practical Clinical Biochemistry, 6 edition, CBS.
2. Hans Bisswanger (2011), Practical Enzymology, 2nd edition, Wiley VCH.

Web Sources:

1. https://www.youtube.com/watch?v=n6tBFjJTTlA
2. https://www.youtube.com/watch?v=keRjfFSWaaY

24DMBC11 BIOTECHNOLOGY AND IPR

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVE:

The content of the syllabus consists of basic biotechnology and its application such as new tools, products developed by biotechnologists such as cell culture, transgenic animals, Genetic engineering are useful in research, agriculture, industry and the clinic. It also helps to understand the Basic principles involved in Intellectual properties rights, scope and importance of marketing and its systems.

UNIT 1 VECTORS 12

Restriction enzymes and joining DNA molecules by DNA ligase, double linkers, adaptors,homopolymer tailing. Plasmids vectors (pBR322, pUC 18), phage vectors (M13), cosmids,expression vectors, yeast vectors –YAC. Selection and screening of recombinants by geneticmethods, immunochemical methods, nucleic acid hybridization methods. Synthesis of probes by radioactive and non–radioactive labeling. Analyzing DNA sequences by Maxam and Gilbert method and Sanger's methods.

UNIT 2 GENE TRANSFER METHODS 12

Introduction of Foreign Genes into Cells using direct gene transfer methods - electroporation, biolistic transfer, transfection, microinjection, lipofection and ultrasonication. Genomic DNA libraries, chromosome walking, cDNA cloning, PCR, RAPD and RFLP.

UNIT 3 CELL CULTURE 12

Cell and organ culture, primary cell culture, cell media and its types, transfer of genes into animal cells in culture. Viral vectors: SV40, retrovirus and adenovirus. In vitro fertilization and embryo transfer. Selectable markers and reporter transgenes. Gene therapy and Antisense therapy.

UNIT 4 TRANSGENIC ANIMALS 12

Production of medically important biomolecules - insulin, growth hormone, interferons, blood proteins, vaccines, lyphokines and monoclonal antibodies. Production of transgenic animals – transgenics and knock-outs. Production of transgenic sheep, cattle, pigs, fish etc. Development and applications of transgenic animals.

UNIT 5 IPR **12**

Intellectual Property Rights (IPR) and Protection, Intellectual Property rights for Plant Breeding, Biosafety in biotechnology and Bioethics. Biotechnology Entrepreneurship.

Total: 60 Hours

Course Outcome:

At the end of this course students will be able to,

CO 1: Explain the general principles of generating transgenic plants, animals and microbes. Identify and debate the ethical, legal, professional, and social issues in the field of biotechnology and design and deliver useful modern biotechnology products to the Society**.**

CO 2: Understand the role of vectors, plasmids in gene technology. Understand the gene transfer methods

CO 3: Understand the DNA sequencing methods. Identify different types of Intellectual Properties (IPs), the right of ownership, scope of protection as well as the ways to create and to extract value from IP. Identify, apply and assess issues relating to each of the relevant areas of intellectual property in various fields of scientific research.

CO 4: Recognize the crucial role of IP in organizations of different industrial sectors for the purposes of product and technology development. Understand the potential role of ownership rights and marketing protection in encouraging, or discouraging, scientific research

CO 5: Be familiar with the processes of Intellectual Property Management (IPM) and various Approaches for IPM and conducting IP and IPM auditing and explain how IP can be managed as a strategic resource and suggest IPM strategy.

Text Books:

1. Sathyanarayana (2006), Biotechnology, 3rd edition, Books and allied Publishers.
2. RC Dubey (2009), Text book of Biotechnology, S. Chand & Co.

Reference Books:

1. Brown TA (1995), “Gene cloning: An introduction” Nelson Thornes, 3rd edition.
2. S Purohit (2007), Biotechnology Fundamentals and applications, 4th edition, Agrobios Publication.

Web Sources:

1. https://www.icsi.edu/media/website/IntellectualPropertyRightLaws&Practice.pdf
2. https://www.easybiologyclass.com/topic-biotechnology/

24DMBC12 **NANOTECHNOLOGY**

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVE:

To make students to understand the basics of Nano, nanoparticles, nanomaterials, various methods of synthesis of nanoparticles, applications of nanoparticles, Synthesis and characterization of new nanoparticles.

UNIT 1 INTRODUCTION **12**

Background to Nanotechnology: Scientific revolution- Atomic structures-Molecular and atomic size-Bohr radius – Emergence of Nanotechnology – Challenges in Nanotechnology - Carbon age–New form of carbon (from Graphene sheet to CNT).

UNIT 2 NANOSTRUCTURES AND NANOMATERIALS **12**

Definition of a Nano system - Types of Nanocrystals-One Dimensional (1D)-Two Dimensional (2D) -Three Dimensional (3D) nanostructured materials. Carbon Nanotubes (CNT) - Metals (Au, Ag) - Metal oxides (TiO2, CeO2, ZnO), Biological system - DNA and RNA - Lipids – Size dependent properties - Mechanical, Physical and Chemical properties.

UNIT 3 SYNTHESIS OF NANOMATERIALS **12**

Synthesis of bulk nanostructured materials - Sol Gel processing- Mechanical alloying and milling-inert gas condensation technique-bulk and nano composite materials - Grinding - high energy ball milling-types of balls-WC and ZrO2-materials –ball ratio-limitations- melt quenching and annealing

UNIT 4 CHARACTERIZATION OF NANOMATERIALS **12**

Characterization: Spectroscopic techniques - Infra red spectroscopy (IR)- UV-visible-Absorption, Imaging techniques - Diffraction analysis – XRD, Imaging techniques – Scanning Electron Microscope, Transmission Electron Microscope.

UNIT 5 NANOMEDICINE **12**

Nanotechnology for drug discovery - protein and peptide based compounds for cancer and diabetes - drug delivery - nanoparticle based drug delivery - lipid nanoparticles - vaccination - cell therapy -Gene therapy.

Total: 60 Hours

Course Outcome:

At the end of this course students will be able to,

CO 1: Acquire knowledge about basics of nano scale, nano particles and nanomaterials

CO 2: Gain expertise in designing experiments and research hypothesis.

CO 3: Understand the principle and industrial application of nanoparticle

CO 4: Understand the mechanism for synthesis of nanoparticles.

CO 5: Know the principle and operating systems of bio analytical instruments

Text Books:

1. S.Shanmugam, Nanotechnology, MJP Publishers, 2010
2. Jurgen Schulte, Nanotechnology, John Wiley & Sons Ltd., 2010

Reference Books:

1. Charles.P.Poole.Jr., Frank.J.Owens (2009), Introduction to Nanotechnology, John Wiley & Sons, Inc.
2. Richard.E.Smalley (2011), Nanotechnology, Jaico publishing house.

Web Sources:

1.https://ec.europa.eu/health/scientific_committees/opinions_layman/en/nanotechnologies/l-2/1-introduction.html

2. https://www.agricorn.in/2023/03/nanotechnology.html

24DMBC13 **HUMAN PHYSIOLOGY**

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVE:

The objective is to impart knowledge and understanding of the human body. To enable the students to learn or to know the biological, physiological activities along with the mechanism of action of various organs.

UNIT 1 CIRCULATORY SYSTEM AND MUSCLES 12

Definition and scope of anatomy, physiology. Anatomical terms in relation to parts of the body, system and organs. **Blood:** Composition and function. Types and function of blood cells. Haematopoiesis. Blood grouping- ABO, Rhesus system and Bombay blood group system. Blood coagulation. Structure and function – Spleen and lymphatic System. Circulatory system and Heart - Structure and functions of heart and associated blood vessels, Cardiac cycle. Blood Clotting. Hormones involved in the regulation of circulatory system. **Tissues:** Types of tissues and their functions. Muscles -Types of muscle cells and their functions. Mechanism of muscle contraction. Hormones involved in the regulation of respiratory system

UNIT 2 DIGESTIVE AND RESPIRATORY SYSTEM 12

Digestive System: Structure and functions of alimentary canal - mouth, oesophagus, stomach, small intestine, large intestine – Digestion and absorption of food in the mouth, stomach and intestines. Various movements of digestive system. Salivary gland, Pancreas and Liver – structure and function. Defecation. Hormones involved in the regulation of digestive system. **Respiratory System:** Outline of various components of respiratory system. Mechanism and chemistry of respiration - considerations, transport of gases, exchange of gases. Bohr effect and role of 2,4 DPG.

UNIT 3 EXCRETORY SYSTEM 12

Structure and role of kidney, nephrons, ureter, urinary bladder and urethra. Mechanism of urine formation- Glomerular filtration, GFR, tubular secretion and reabsorption. Regulation of water balance, electrolyte balance, acid-base balance. Hormones involved in the regulation of excretory system.

UNIT 4 NERVOUS SYSTEM **12**

Brief outline of nervous system- types of nerve cells and nerve fibers, brain, spinal cord. Communication: Electrical and chemical communications - Transmission of nerve impulse, action potential, neurotransmitters and synapses, Membrane channels/carriers. Sleeping: Circadian rhythm, SEM and REM. Reward circuit of brain. Sense organs – Vision, hearing and tactile response. Hormones involved in the regulation of Nervous system.

UNIT 5 REPRODUCTIVE SYSTEM **12**

Structure and functions of male and female reproductive system: Ovulation, menstrual cycle. Spermatogenesis and factors influencing sperm count and viability. Biochemistry of fertilization. Physiological changes during pregnancy, parturition and lactation.

Total: 60 Hours

Course Outcome:

At the end of this course students will be able to,

CO 1: Discus in-depth the structure and physiology of major human organs and explain their role in the maintenance of healthy individuals**.**

CO 2: Discuss in detail how the activities of organs are regulated for maximum efficiency.

CO 3: Explain in depth the interplay between different organ systems and how organs and cells interact to maintain biological equilibrium in the face of a variable changing environment.

CO 4: Identify how changes in normal physiology lead to disease.

CO 5: Implement the knowledge of human physiology in clinical biochemistry to predict and understand the disease.

Text Books:

1. Guyton AC (1991), Text book of Medical Physiology, 8th Edition, TATA McGraw-hill publishing Company, Prism books (pvt), Bangalore, India.

2. C.C. Chatterjee (1985), Human Physiology (Vol. I & Vol. II), 11th Edition, Medical Allied Agency, Calcutta.

Reference Books:

1. Ganong (Williams) (2015), Review of medical physiology, 25th edition, McGraw-Hill.

2. Ross and Wilson (2014), Anatomy and physiology In health and illness, 12th edition, Elsevier.

Web Sources:

1. https://microbenotes.com/category/human-physiology/
2. https://www.embibe.com/study/human-physiology-unit

24DMBC14 **STEM CELL TECHNOLOGY**

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVE:

This paper aims to provide thorough information on the basic properties of stem cells and the regulation at molecular level. It also describes the application of stem cell technology in the therapy of different diseases.

UNIT 1 STEM CELLS **12**

Definition, characterization, pluripotency, niche specification – Drosophila germ line stem cells, self-renewal and differentiation. Adult versus embryonic stem cells, post genomic adult stem cells, stemness, characteristics, hierarchy, stem cell niche. Adult stem cell from amniotic fluid, cord blood. Isolation and maintenance of murine stem cells, primate embryonic stem cells, and human embryonic stem cells.

UNIT 2 EMBRYONIC STEM CELLS **12**

Principle of cell passage, colony formation, techniques for derivation of embryonic stem cells, differentiation and transdiffrentiation. Derivation and maintenance of human embryonic stem cells, derivation and differentiation of human embryonic germ cells, isolation and maintenance of avian embryonic stem cells, Xenopus embryonic stem cells, zebrafish embryonic stem cells.

UNIT 3 CULTURE **12**

Trophoblast stem cells – Identification and lineage specificity, isolation and maintenance of neural precursors, primitive hematopoietic cells. GF and serum free culture of stem cells, feeder free culture, genetic manipulation of human embryonic stem cells, gene silencing, RNAi, vector modified transformation on lentivirus. Recombination, homologous recombination.

UNIT 4 PROPERTIES **12**

Surface antigen markers, lineage markers, microarray, and chemical mutagenesis. Hitchhiker effect, gene silencing, epigenetic mechanism, nuclear transfer cloning, parthenogenetic stem cells.

UNIT 5 APPLICATIONS **12**

Pluripotency of neural and cloned mouse embryo, genomic reprogramming, immunogenicity of stem cells, tolerance in transplantation. Therapeutic application- neurodegenerative disorders, spinal cord injury, heart diseases, diabetes, tissue engineering.

Total: 60 Hours

Course Outcome:

At the end of this course students will be able to,

CO 1: Know about various stem cells, their characteristics and their niches

CO 2: Understand the importance of growth factors

CO 3: Understand the basis of media composition for growth of stem cells

CO 4: Discern the molecular concepts of stem cell self-renewal and tissue and organ development.

CO 5: Demonstrate the routine methods used in stem cell biology.

Text Books:

1. Kiessling, A.A (2006), Human Embryonic Stem cells, 2nd edition, Jones & Barlett Publishers.

2. Lanza, R (2005), Essentials of Stem Cell Biology, 1st edition, Academic Press.

Reference Books:

1. Turksen, K (2004), Adult Stem Cells, 1st edition, Humana Press, Inc.

2. Thomson, J et al. (2004), Handbook of Stem Cells: Embryonic/ Adult and Fetal Stem cells (Vol. 1 & 2), 1st edition, Academic Press.

Web Sources:

1.https://microbenotes.com/stem-cells/

2. https://www.medicalnewstoday.com/articles/323343

24SSKP11 **SOFT SKILL 1**

L	T	P	O	C
2	0	0	1	2

COURSE OBJECTIVE:

- To enable participants Business Communication Skills
- To enhance participants E-mail writing skills
- To impart Leadership and Team Bonding skills

Credit Hours

UNIT- I READING COMPREHENSION AND VOCABULARY **06**

Filling the blanks – Cloze Exercise – Vocabulary building – Reading and answering Questions.

UNIT- II LISTENING AND ANSWERING QUESTIONS **06**

Listening and writing – Listening and sequencing sentences – Filling in the blanks Listening and answering questions.

UNIT- III GROUP DISCUSSIONS **06**

Why GD part of a selection process – Structure of a GD – strategies in GD- Team Work – Body Language

UNIT- IV CONVERSATION. **06**

Face to face Conversation and Telephone conversation

UNIT- V SELF- INTRODUCTION AND ROLE PLAY **06**

Total: 30 Hours

COURSE OUTCOMES:

At the end of this course the students will be able to,

At the end of this course the students will be able to,

CO 1 Prioritize power of understanding and aids assimilation of vocables. Vocabulary to charge communication with educated words

CO 2 Develop comprehensive knowledge through listening leading to answering questions

CO 3 Build observation power and infuse self-confidence through group discussions

CO 4 Identify methodology for befitting constructional ability

CO 5 Experiments with inward looking and visualization of the ‘otherness’ of situations

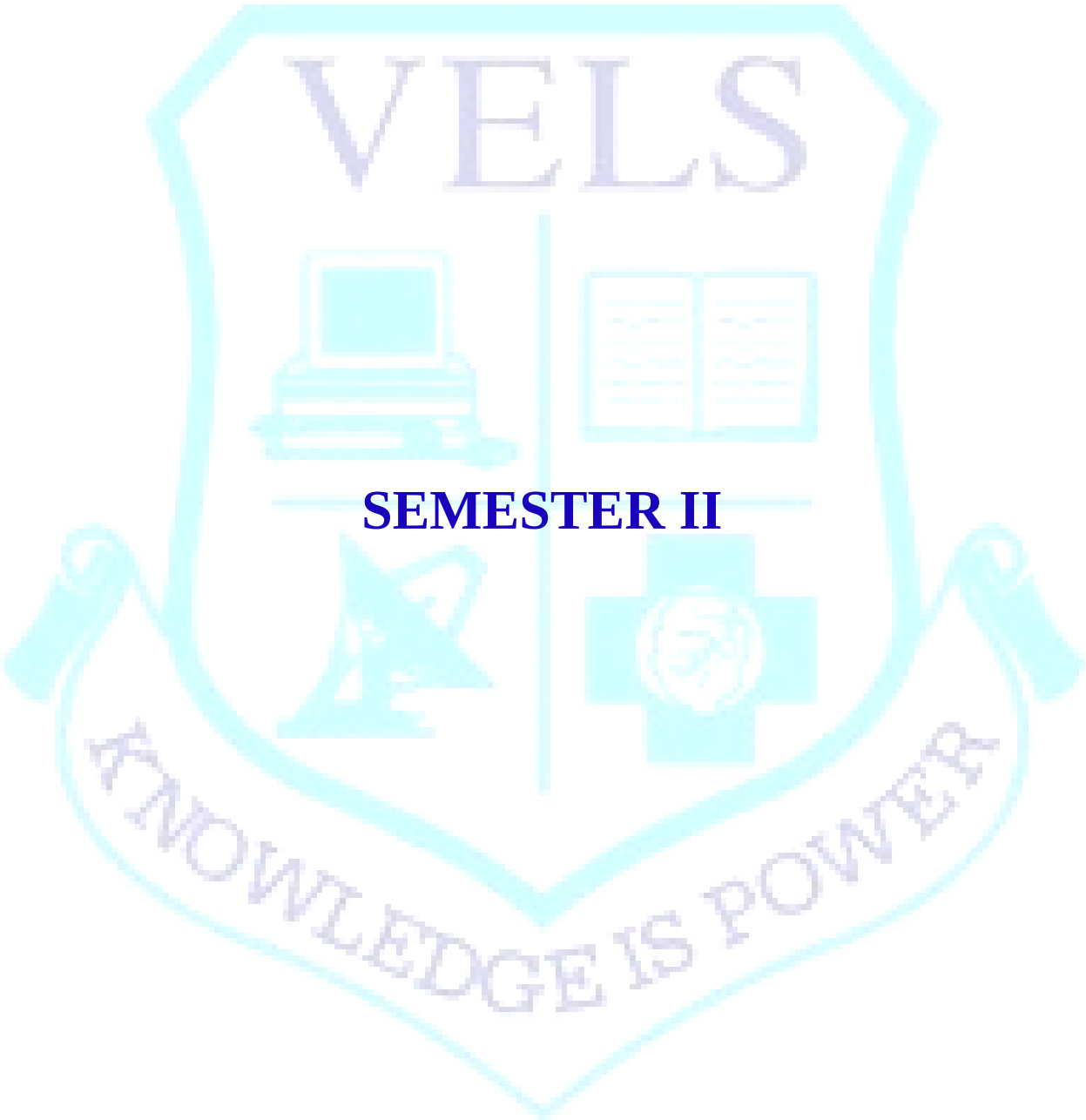
Books Recommended

- Barun K. Mitra. Personality Development and Soft Skills. Oxford University Press. New Delhi.2011.
- S.P. Sharma. Personality Development. Pustaq Mahal. New Delhi. 2010.Meenakshi Raman and Sangeetha Sharma. Technical Communication. Oxford University Press. New Delhi. 2009.

- Tiko, Champa & Jaya Sasikumar. Writing with a Purpose.OUP. New Delhi. 1979

Web Sources:

- https://www.skillsyouneed.com/ips/communication-skills.html
- https://blog.smarp.com/top-5-communication-skills-and-how-to-improve-them
- https://blog.hubspot.com/service/phone-etiquette



SEMESTER II

24CMBC21 **ENZYME AND ENZYME TECHNOLOGY**

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVE:

This course aims to provide a basic understanding of fundamental knowledge on enzymes and their importance in biological reactions and Mechanism of action of enzymes. This course also provides the understanding the enzyme kinetics and role of coenzymes/co-factors and an overview of industrial application of enzymes.

UNIT- I INTRODUCTION **12**

Enzymes- Introduction, Nomenclature and classification of enzymes. Isolation and purification of enzymes. Enzyme units - Katal, IU. Measurement of enzyme activity. Active site - determination of active site. Amino acids - chemical probe, affinity label, and site directed mutagenesis. Investigation of 3-D structure of active site. Abzymes and Isoenzymes.

UNIT-II ENZYME KINETICS **12**

Kinetics of single substrate enzyme - catalysed reactions - Michaelis – Menten equation, importance of Vmax, Km, MM equation, and turnover number. Lineweaver - Burk plot, Eadie - Hofstee plot, Hanes - Woolf plot. Kinetics of Allosteric enzymes - MWC and KNF models. Hill' equation coefficient. Kinetics of multi – substrate enzyme - catalysed reactions - Ping-pong bi-bi, random order and compulsory order mechanism.

UNIT-III ENZYME CATALYSIS AND INHIBITION **12**

Mechanism of enzyme action - general acid-base catalysis, covalent catalysis, role of metal ion in enzyme catalysis, mechanism of serine proteases - chymotrypsin, lvsozyme, carboxy peptidase A and ribonuclease. Reversible Inhibition- competitive, non-competitive, uncompetitive, allosteric inhibition, feedback inhibition and Irreversible inhibition.

UNIT – IV COENYZMES **12**

Coenzymes - prosthetic group and cofactors with examples. Structure, functions and mode of action of TPP (oxidative decarboxylation), FMN, FAD, NAD, NADP (redox reactions), PALP and PAMP – (transamination), Coenzyme A (Acylation/acetylation reactions), biotin – (carboxylation), tetrahydro folate (one carbon transfer). Coenzymic functions of vitamin C, lipoic acid and coenzyme Q in metabolic reactions.

UNIT– V INDUSTRIAL AND CLINICAL USES OF ENZYMES **12**

Industrial uses of enzymes - sources of industrial enzymes, thermophilic enzymes, amylases, glucose isomerases, cellulose degrading enzymes, lipases, proteolytic enzymes in meat and leather industry, detergents and cheese production. Immobilization of enzymes, methods and their applications. A brief account of non-protein enzymes - Ribozymes and DNA enzymes. Use of isoenzymes in diagnosis – LDH and CK. To Visit an industry associated with enzyme production.

Total: 60 Hours

Course Outcome:

At the end of this course students will be able to,

CO 1: Describe different classes of enzymes and their functions

CO 2: Demonstrate basics of enzyme catalyzed reactions and their mechanisms

CO 3: Develop the specificity of enzymes and the chemistry involved in enzyme action

CO 4: Elaborate the enzyme kinetics, various factors regulating catalysis, different models for analyzing the enzyme kinetics.

CO 5: Summarize the fundamental knowledge on enzymes, kinetics and their importance in biological reactions.

Text Books:

1. David Nelson and Michael Cox (2005), Lehninger Principles of Biochemistry, 4th edition.

2. Trevor Palmer (2001), Enzymes: Biochemistry, Biotechnology and Clinical Chemistry, Horwood Chemical Science Series, Horwood Publishers.

Reference Books:

1. Donald Voet, JudithVoet G (2006), Fundamentals of Biochemistry, John Wiley and Sons, Inc., Asia.

2. Trevor Palmer (1995), Understanding Enzymes, 4th edition.

Web Sources:

1. https://microbenotes.com/enzymes/

2. https://www.uou.ac.in/lecturenotes/science/MSCZO- 17/pdf % 20 zoology % 20enzymes %20by% 20 Dr.Shyam %20S.Kunjwal.pdf

24CMBC22 **INTERMEDIARY METABOLISM**

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVE:

The paper intends to provide a basic understanding of the biochemical reactions of molecules, role of enzymes as key elements that govern the biochemical transformations, break-down and synthesis of various biomolecules and the turnover of carbohydrates, proteins, lipids and nucleic acids. To study the concepts of regulation of metabolic pathways. To elaborate the relation between biochemical defects and metabolic disorders

UNIT- I CARBOHYDRATE METABOLISM 12

Fate of dietary carbohydrates. Glycolysis and Gluconeogenesis pathway and significance with energetic & regulation, Cori cycle, Metabolism of Glycogen, TCA cycle - Energetics and its regulation. Pentose phosphate pathway. Uronic acid pathway. Gloxylate cycle. Malate/glycerol phosphate shuttle. Importance of Rate limiting enzymes. Futile cycles in carbohydrate metabolism. Interrelationship of metabolic pathways

UNIT-II LIPID METABOLISM 12

Fate of dietary carbohydrates. Oxidation of fatty acids - Beta oxidation, alpha oxidation and omega oxidation. Metabolism of Ketone bodies - Formation, Utilization, Excretion and significance. Metabolism of Triglyceride, Phospholipids, sphingolipids and cholesterol. Biosynthesis of saturated and unsaturated fatty acids. Importance of Rate limiting enzymes.

UNIT-III PROTEIN METAOLISM 12

Introduction, fate of dietary proteins, catabolism of amino acids - transamination, oxidative and non-oxidative deamination, decarboxylation- urea cycle and its regulation.

UNIT – IV NUCLEIC ACID METABOLISM 12

Introduction, fate of dietary nucleic acids, catabolism of purine and biosynthesis of purine nucleotides- denovo synthesis and salvage pathways. Regulation of purine biosynthesis. Catabolism of pyrimidines and biosynthesis of pyrimidine nucleotides - denovo synthesis and salvage pathways. Regulation of pyrimidine synthesis.

UNIT– V BIOLOGICAL OXIDATION 12

Introduction - Laws of thermodynamics, free energy, free energy of hydrolysis of ATP and other organophosphates. Role of High energy compounds - Electron transport chain- Components and reactions of ETC. Role of ETC - Oxidative Phosphorylation - Chemiosmotic hypothesis. P/O ratio,

ATP/ADP exchange, uncouplers of oxidative phosphorylation. Role of uncouplers in regulation of obesity.

Total: 60 Hours

Course Outcome:

At the end of this course students will be able to,

CO 1: Understand the organization of signaling pathways that regulates the metabolism.

CO 2: Understand the organization of signaling pathways that regulates the metabolism.

CO 3: Explain the integration of biomolecules that takes place in human system.

CO 4: Apply the knowledge of intermediary metabolism in clinical biochemistry

CO 5: Identify how changes in normal metabolism lead to disease

Text Books:

1. David Nelson and Michael Cox (2005), Lehninger Principles of Biochemistry, 4th edition.
2. JL Jain, Sanjay Jain and Nitin Jain (2005), Fundamentals of Biochemistry, 6th edition.

Reference Books:

1. Lubert Stryer, Jeremy M Berg and John L Tymoczko (2005), Biochemistry, 5th edition.
2. Murray, R.K., Granner, D. K., Mayes and P.A., Rodwell, V.W (2012), Harper's Biochemistry, 29th edition, Lange Medical Books/McGraw Hill.

Web Sources:

1. https://www.ncbi.nlm.nih.gov/books/NBK116085/
2. https://www.bbau.ac.in/dept/dz/TM/BVOCLPM%20304%20Animal%20Biochemistry.pdf

24CMBC23 **CLINICAL BIOCHEMISTRY**

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVE:

The course aims to provide an advanced understanding of the biochemical mechanisms and pathophysiological processes responsible for common biochemical disorders. The course provides an overview of normal and abnormal metabolic functions, the impact of disorders on metabolic processes, mechanisms of causation of diseases of liver, kidney and pancreas. Students will get acquainted with the role of enzymes in diagnosis of various diseases.

UNIT- I SPECIMEN COLLECTION **12**

Scope of clinical biochemistry. Concepts of accuracy, precision, sensitivity and reproducibility. Quality control and determination of normal range. Specimens−Collection and processing of Blood, Urine, Feces, Throat swab, Amniotic fluid and CSF. Role of preservatives in blood and urine analysis. Anticoagulants and their specific function. Transport of biological samples. To visit a hospital or Diagnostic center to have hands on training for sample collection.

UNIT 2 CLINICAL ENZYMOLOGY **12**

Principles of diagnostic enzymology - Factors affecting enzyme levels in blood. Principle, assay, and clinical significance of transaminases, creatine kinase, lactate Dehydrogenase, phosphatases, 5'nuclotidase, gamma –glutamyl transferase, amylase, lipase, trypsin, chymotrypsin, glucose -6-phosphate dehydrogenase and ceruloplasmin.

UNIT 3 METABOLIC DISORDERS **12**

Carbohydrate metabolism: Diabetes mellitus – classification, metabolic abnormalities, diagnosis and management. Glycogen storage diseases, galactosemia and fructosuria. Lipid metabolism: Lipo proteins – Hyper lipoproteinemia and Hypolipoproteinemia. Lipid storage Diseases, Atherosclerosis and risk factors. Disorders of amino acid metabolism– amino aciduria, Phenylketonuria, Hartnup disease, alkaptonuria, albinism, cystinuria and maple syrup urine disease. Disorders of nucleic acid metabolism: Hyperuricemia, Hypouricemia, xanthinuria and gout.

UNIT4 ORGAN FUNCTION TESTS **12**

Liver function test – Based on Detoxification and excretory function. Fatty liver and gall

stones. Bilirubin metabolism Differentiation of three types of jaundice. Renal function test: Urine analysis, Clearance test- urea, creatinine and inulin. PAH test, proteinuria and hematuria. Gastric function tests: Collection of gastric contents, Tests of gastric function – Examination of gastric residuum, Fractional Test Meal (FTM), Stimulation tests and Tubeless gastric analysis. Clinical significance of SGOT, SGPT, ALP, ACP, CPK and LDH.

UNIT 5 DIAGNOSTIC TOOLS AND IMAGING TECHNIQUES **12**

Diagnostic tools: Principles and applications. Clinical chemistry analyser- semi and fully automated. Electrolyte analyser. Blood gas analyser– ECG. Glucometer - HbA1C analyser and other point care devices. Medical imaging techniques – CT, MRI, PET and SPECT.

Total: 60 Hours

Course Outcome:

At the end of this course students will be able to,

CO 1: Elaborate on the role of health and its affliction by various diseases/disorders.

CO 2: Elaborate the Basic concepts and principles of Clinical Biochemistry.

CO 3: Recall the metabolism of carbohydrates, lipids and proteins.

CO 4: Apply the knowledge of intermediary metabolism in clinical biochemistry

CO 5: Create awareness of different lifestyle diseases increasingly found in present day.

Text Books:

1. M.N. Chatterjee & Ranashinde (2006), Text Book of Medical Biochemistry, 6th edition, Jaypee Publisher.

2. Burtis et al., (1999), Teitz Textbook of Clinical Biochemistry, 3rd edition, William Heinmann Medical Books Ltd.

Reference Books:

1. Carl A. Burtis, Edward R. Ashwood and David E. Bruns (eds) (2012), Tietz Textbook of Clinical Chemistry and Molecular Diagnosis, 5th edition.

2. Thomas M. Devlin (2010), Biochemistry with clinical correlation, 7th edition, John Wiley & Sons.

Web Sources:

1. https://dspace.cuni.cz/bitstream/handle/20.500.11956/111493/Clinical_biochemistry-pdf.pdf?sequence=1&isAllowed=y

2. https://www.nios.ac.in/media/documents/dmlt/Biochemistry/Lesson-13.pdf

24PMBC21 **PRACTICAL ENZYMOLOGY**

L	T	P	O	C
0	0	4	1	2

COURSE OBJECTIVE:

The course introduces students to various practical aspects of enzymology and stimulates the student's interest in learning the structure, function and kinetics of enzyme and their correlation in disease conditions. This course also makes the students to learn determination pH optimum, Km and Vmax of enzymes and to analyze enzyme kinetics and the effect of factors on enzyme activity.

LIST OF EXPERIMENTS

1. Determination of Optimum pH of Salivary Amylase.
2. Determination of specific activity of Salivary Amylase
3. Determination of Optimum pH of Acid Phospatase
4. Determination of Optimum temperature of Acid Phospatase.
5. Determination of specific activity of Acid Phospatase.
6. Determination of enzyme activity of Creatine kinase.
7. Determination of enzyme activity of Lactate Dehydrogenase
8. Isolation of β -Amylase from Sweet Potato
9. Assay of Urease from Horse – gram
10. Determination of enzyme activity of Adenosine Tri Phosphatase
11. Determination of enzyme activity of Serum Glutamate Oxaloacetate Transaminase
12. Determination of enzyme activity of Serum Glutamate Pyruvate Transaminase

Total: 30 Hours

Course Outcome:

At the end of this course students will be able to,

CO 1: Isolate different enzymes from biological sources and learn the optimal of enzyme activity.

CO 2: Determine the Optimum pH and temperature of Acid Phosphatase. Assay the specific activity of Acid Phosphatase.

CO 3: Determine the Optimum pH and specific activity of Alkaline Phosphatase. Determine the Optimum pH of Salivary Amylase. Assay the specific activity of Salivary Amylase.

CO 4: Analyze and Estimate the enzyme activity of Creatine kinase. Assay the enzyme activity of Lactate Dehydrogenase

CO 5: Analyze and Estimate the enzyme activity of Adenosine Tri Phosphatase. Assay the enzyme activity of Serum Glutamate Oxaloacetate Transaminase. Determine the enzyme activity of Serum Glutamate Pyruvate Transaminase.

Text Books:

1. J. Jayaraman (2011), Laboratory Manual in Biochemistry, New Age International Pvt Ltd Publishers.

2. S. Sadasivam, A. Manickam (2009) (paperback), Biochemical Methods, New age publishers.

Reference Books:

1. Harold Varley (2006), Practical Clinical Biochemistry, 6th edition, CBS.

2. Robert Eisenthal (2002), Enzyme Assays: A Practical Approach (Practical Approach Series), 2nd edition, Oxford University Press, U.S.A.

Web Sources:

1. https://www.youtube.com/watch?v=nFOEZMtNMls
2. https://www.youtube.com/watch?v=7lMlLVsE4os

24PMBC22 **PRACTICAL CLINICAL BIOCHEMISTRY**

L	T	P	O	C
0	0	4	1	2

COURSE OBJECTIVE:

The course introduces students to apply various techniques for the analysis of body fluids, cells and tissues and interpretation of the results in relation to health and disease. This course also develop the students to analyze the biochemical parameters in urine and blood samples and indicate their clinical significance. The discipline encompasses fundamental and applied research into the biochemical and physiological processes of human life and application of the resulting knowledge and understanding to the diagnosis, treatment and prevention of disease.

LIST OF EXPERIMENTS

Analysis of Biological Samples

1. Hematological analysis-RBC, WBC-TC/DC, Hemoglobin content and ESR
2. Analysis of normal and abnormal urine constituents
3. Estimation of Calcium

Enzyme assays

4. Assay of Enzymic antioxidants-SOD, Catalase and GPx
5. Assay of Creatine kinase, LDH and Na K ATPase
6. Assay of SGOT/ SGPT

Biochemical Studies

7. Estimation of renal indices-Urea, Uric acid and Creatinine.
8. Estimation of Blood Glucose
9. Estimation of Serum Bilirubin
10. Estimation of A:G ratio in serum
11. Estimation of serum Cholesterol.
12. Estimation of Vitamins-A & E

Total: 30 Hours

Course Outcome:

At the end of this course students will be able to,

CO 1: Understand the different biological samples and their collection procedures. Perform biochemical laboratory analysis in blood samples

CO 2: Analyze biochemical in urine samples. Distinguish serum, plasma and whole blood emphasizing the role of anticoagulants

CO 3: Assess presence and absence of normal and abnormal constituents in urine by performing qualitative urine analysis.

CO 4: Analyze glucose, urea protein, total protein and A/G ratio in blood

CO 5: Determine analytes such as creatinine, uric acid, cholesterol and triglycerides in serum. Evaluate and interpret the generated results after analysis in order to determine the likely diagnosis

Text Books:

1. J. Jayaraman (2011) (Paperback), Laboratory Manual in Biochemistry, New Age International Pvt Ltd Publishers.

2. S. Sadasivam, A. Manickam (2009), Biochemical Methods, New age publishers.

Reference Books:

1. Harold Varley (2006), Practical Clinical Biochemistry, 6th edition, CBS.

2. Hans Bisswanger (2011), Practical Enzymology, 2nd Edition, Wiley VCH.

Web Sources:

1.https://www.youtube.com/watch?v=0f9p9JX4qJk

2. https://www.youtube.com/watch?v=dbDMgKyTeNM

24DMBC21 **PLANT BIOCHEMISTRY**

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVE:

This paper provides insights into the primary metabolic pathways occurring in plants, the types of plant metabolites and the industrial potential of those metabolites and the role of hormones in plant growth.

UNIT 1 PHOTOSYNTHESIS **12**

Photosynthetic apparatus, pigments of photosynthesis, Calvin cycle (C3 plants), Hatch slack (C4 plants) & CAM pathways of carbon reduction and its regulation, Structure, function and regulation of RUBISCO, Crassulacean acid metabolism in plants. Photorespiration: Photorespiration pathway and significance, cyanide resistance, relationship between photosynthesis, photorespiration.

UNIT 2 PHYTOHORMONES **12**

Biosynthesis, transport, physiological effects, mode of action and signal transduction of auxins, gibberellic acid, abscisic acid, ethylene and cytokinin in germination, embryogenesis, growth and development of plant. Biochemistry of seed development and germination, Biochemistry of fruit ripening.

UNIT 3 SECONDARY PLANT METABOLITES **12**

Biochemistry and significance of secondary metabolites – cyanogenic glycosides, glucosinolates, phenolic compounds, steroids, terpenoids, and alkaloids. Biochemistry of plant toxins, phytohemagglutinins, lathy Rogens, nitriles, protease inhibitors, protein toxins, role of secondary metabolites in chemical defence.

UNIT 4 PLANT STRESS PHYSIOLOGY **12**

Plant stress, plant responses to abiotic and biotic stresses, salinity, water, heat, chilling, anaerobiosis, heavy metals, radiations and their impact on plant growth and metabolism. Interaction between biotic and abiotic stresses; stress adaptation. Mechanisms of resistance to biotic stress and abiotic stress, antioxidative defense mechanism

UNIT 5 PLANT DEFENSE **12**

Genetic basis of plant-pathogen interactions, antio R-Avr gene interactions and isolation of R genes, hypersensitive response (HR), systemic acquired resistance (SAR) and induced systemic resistance (ISR). Plant defense response, antimicrobial molecules; genes for resistance, hypersensitive

response, and cell death; systemic and acquired resistance.

Total: 60 Hours

Course Outcome:

At the end of this course students will be able to,

CO 1: Develop a basic understanding of biochemical events associated with structural arrangement of plant cell and organization

CO 2: Explain and understand the biochemistry of photosynthetic process and its relation to man and its environment.

CO 3: Understand the mechanism of Nitrogen fixation and its importance in Agricultural production and economics.

CO 4: Know the significance of plant growth regulators in the development of plants.

CO 5: Acquire knowledge about the importance of secondary metabolites and its industrial applications. Growth regulators and secondary metabolites and its potential in crop development

Text Books:

1. H.D Kumar and H.N Singh (1980), Plant Metabolism, 1st edition, Publisher: Macmillan, ISBN-10: 0333256387: ISBN-13:978-0333256381.
2. K.G Ramawat (2000), Biotechnology: Secondary Metabolites, 1st edition, Publisher: Science Publishers, U.S. ISBN-10: 1578080576 ISBN-13: 978-1578080571.

Reference Books:

1. P.M Dey and J.B. Harborne (Editors) (1997), Plant Biochemistry, 1st edition, Publisher: Academic Press ISBN-13:978-0122146749.
2. Prof David T. Dennis, Prof David H. Turpin, Dr Daniel D. Lefebvre and Dr David B. Layzell(Ed) (1997), Plant Metabolism, 1st edition, publisher: Longman ISBN-13:978-582259065.

Web Sources:

1. https://www.slideshare.net/Christa_belle/photosynthesis-43829124
2. https://www.slideshare.net/kayeenvadakkan/overview-of-nitrogen-metabolism

24DMBC22 **CANCER BIOLOGY**

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVE:

This curriculum is designed to provide students a broad understanding of the molecular, genetic, cell biological, and Pathobiological aspects of cancer. Students will also learn about the current state of clinical diagnosis, treatment of human cancers, and hurdles to overcome to realize its potential.

UNIT 1 CELL CYCLE **12**

Regulation of Cell cycle - Cell cycle control and pRb tumor suppressor. Apoptosis and p53 tumor suppressor. Mutations that cause changes in signal molecules - effects on receptor - signal switches. Tumor suppressor genes. Modulation of cell cycle in cancer. Different forms of cancers. Diet and cancer.

UNIT 2 CARCINOGENESIS **12**

Chemical Carcinogenesis, Metabolism of Carcinogens is, Natural History of Carcinogenesis, Targets of Chemical Carcinogenesis, Principles of Physical Carcinogenesis, X-Ray radiation – Mechanism of radiation Carcinogenesis. DNA repair mechanisms.

UNIT 3 ONCOGENES **12**

Oncogenes, Identification of Oncogenes, Retroviruses and Oncogenes, detection of Oncogenes Oncogenes / Proto Oncogenes activity RAS, NFkB, Wnt signaling in cancer. Epigenetics of cancer – DNA methylation, Histone modification, gene silencing by micro RNA.

UNIT 4 METASTASIS **12**

Clinical significances of invasion, Metastatic cascade three step theory of invasion, Proteinases and tumour cell invasion. Multi-step tumorigenesis and the evolution of cancer. Tumor-promoting stimuli. Cancer stem cells.

UNIT 5 TREATMENT **12**

Different forms of therapy - Chemotherapy, Radiation Therapy, Immunotherapy. Detection of Cancers. Prediction of aggressiveness of Cancer. Advances in Cancer detection

Total: 60 Hours

Course Outcome:

At the end of this course students will be able to,

CO 1: Explain the different types of cancer and the treatment strategies involved

CO 2: Explain the mechanism of replication in cancer' and genes involved in it

CO 3: Describe the cell cycle as well as apoptosis processes

CO 4: Differentiate about types of cancer and its development stages.

CO 5: Describe the mechanism of carcinogenesis and the genes involved for cancer formation & Development

Text Books:

1. Vincent.T, Devita (2014), Cancer-Principles & practice of oncology, 3rd edition.
2. Momna Hejmadi, Introduction to Cancer Biology, 2nd edition.

Reference Books:

1. Kinnell Parchment G. Mc. R. E, Perantoni (2006), The Biological Basis of Cancer, 2nd edition, Cambridge University Press.
2. Robert A. Weinberg (2006), The Biology of Cancer, Garland Science.

Web Sources:

1.https://bio.libretexts.org/Bookshelves/IntroductoryandGeneral_Biology/Biology_(Kimball)/12%3A_Cancer

2. https://www.mlsu.ac.in/econtents/1466_Unit%203-Study%20Notes%20on%20Cancer.pdf

24SSKP21 **SOFT SKILL II**

L	T	P	O	C
2	0	0	1	2

COURSE OBJECTIVE:

- To enable students to develop their communication skills effectively
- To enhance students Reading, Writing, Listening and Speaking skills
- To develop their self-confidence through communication

UNIT- I PRESENTATION SKILLS 06

Elements of an effective presentation – structure of presentation – voice modulation –Audience analysis – Body language

UNIT- II SOFT SKILLS 06

Time Management – Articulateness – Assertiveness – Stress management

UNIT- III RESUME / REPORT PREPARATION / LETTER WRITING 06

Structuring the resume / Report – Business letters – E-Mail Communication

UNIT- IV INTERVIEW SKILLS 06

Kinds of Interviews – Required by Skills – Corporate Culture – Mock Interviews

UNIT- V 30 FREQUENTLY ASKED QUESTIONS 06

Total: 30 Hours

COURSE OUTCOMES:

At the end of this course the students will be able to,

At the end of this course, the students will be able to,

CO1 Illustrate the essentials of presentation skills, thoughts, structure, voice modulation, audience analysis, and body language

CO2 Utilize the psychological skills pertaining to time management, articulation, assertion, and stress management

CO3 Construct methodology for the preparation of resumes, reports, business letters, and email communication

CO4 Appraise learners with varied skills needed for exposure to interviews

CO5 Categorize the nature of questions asked usually in interviews

Books Recommended

- Barun K.Mitra. Personality Development and soft skills. Oxford University Press. New Delhi. 2011.
- S P Sharma. Personality Development. Pustaq Mahal. New Delhi. 2010.
- Meenakshi Raman and Sangeetha Sharma. Technical Communication. Oxford University Press. New Delhi. 2009.

Web Sources:

- https://www.skillsyouneed.com/ips/communication-skills.html
- https://www.businessnewsdaily.com/5836-top-interviewing-skills.html
- https://gdpi.hitbullseye.com/Group-Discussion.php

VELS
INSTITUTE OF SCIENCE, TECHNOLOGY & ADVANCED STUDIES (VISTAS)
(Deemed to be University Estd. u/s 3 of the UGC Act, 1956)
PALLAVARAM, THALAMBUR, PERIYAPALAYAM-CHENNAI
ACCREDITED BY NAAC WITH 'A++' GRADE

POSTGRADUATE DEGREE PROGRAMME

M.Sc., BIOCHEMISTRY

Two Years

CURRICULUM & SYLLABUS

REGULATION 2024

Choice Based Credit System (CBCS)

&

Learning Outcomes Based Curriculum Framework (LOCF)

Effective from the Academic Year

2024 -2025

Department of Biochemistry

School of Life Sciences

VELS

INSTITUTE OF SCIENCE, TECHNOLOGY & ADVANCED STUDIES (VISTAS)
(Deemed to be University Estd. u/s 3 of the UGC Act, 1956)
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DEPARTMENT OF BIOCHEMISTRY

VISION OF THE DEPARTMENT
➢ To be recognized in the global scientific arena, with a marked specialization and excellence in Biochemistry. ➢ To provide an atmosphere for critical thinking to differentiate and interlink the various branches; cell biology, intermediary metabolism, clinical biochemistry, immunology, enzymology and endocrinology.

MISSION OF THE DEPARTMENT	
M1	To excel in the basic concepts and principles of Biochemistry
M2	To identify the problem in protocols in the thrust areas of research where the intervention of biochemist is essential
M3	To expose the students to the grooming areas of research with advanced instrumentation technique
M4	To correlate the anthropogenic inputs in the environment with the biochemical changes in the biological species and its impact on human life
M5	To understand the concepts in scientific learning for the process of experimentation and hypothesis testing.

PROGRAMME EDUCATIONAL OUTCOMES (PEO)	
PEO1	Compare and contrast the scope and profundity of scientific knowledge in the broad range of fields, including Cell biology, Intermediary metabolism, Clinical Biochemistry, Hormonal Biochemistry, Genetics, Nutritional Biochemistry, Immunology and Enzymology.
PEO2	An ability to gain knowledge and know-how for successful career in academia, industry and research.
PEO3	Describe the biochemical basis of human diseases, protein structure and conformation, non invasive diagnostics, biochemical pathway regulation and drug development and apply the same for a multitude of laboratory applications.
PEO4	Promoting lifelong learning to meet the ever-evolving professional demands by developing ethical, inter personal and team skills.

PROGRAMME OUTCOMES (PO)	
PO1	Life Sciences knowledge: Successful candidates will acquire current/recent specific knowledge in the respective discipline with proficiency in practical skills and leadership skills for a successful career.
PO2	Problem analysis: Successful candidates will be able to analyses, design standards, resolve and troubleshoot problems in implementation or standardization of Life sciences protocols.
PO3	Design/development of solutions: Successful candidates will develop creative and cognitive thinking and cooperate with each other to solve problems in the field of Life sciences.

PROGRAMME SPECIFIC OUTCOMES (PSO)	
PSO1	Demonstrate an understanding of structure and metabolism of macromolecules and understand the regulation and disorders of metabolic pathways.
PSO2	Gain proficiency in laboratory techniques in both biochemistry and molecular biology, and be able to apply the scientific method to the processes of experimentation and Hypothesis testing.

BOARD OF STUDIES

List of Members

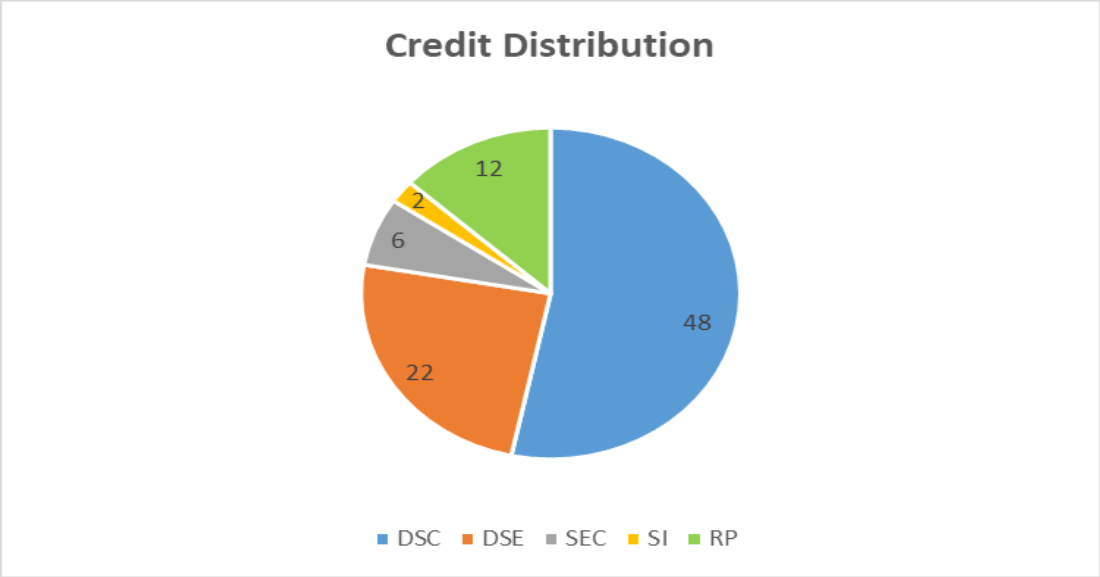
Department of Biochemistry

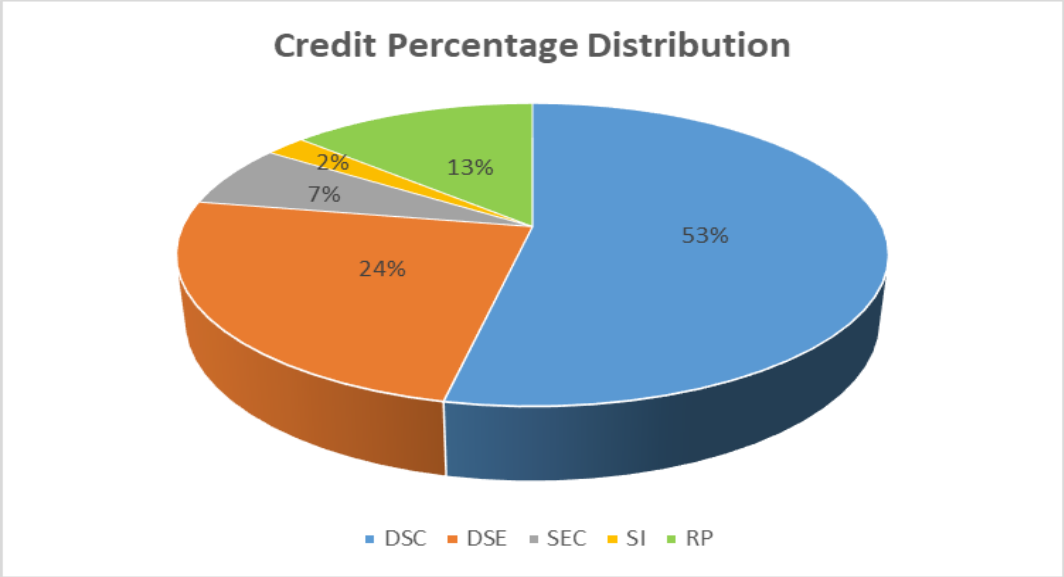
S. No	Name & Designation	Address	Role
1.	Dr. R. B.Usharani	Associate Professor & Head i/c, Department of Biochemistry, School of Life Sciences, VISTAS	Chair Person
2.	Dr. P. Kalaiselvi	Department of Medical Biochemistry, University of Madras	External Expert
3.	Dr.M.Ganesan	Managing Director, Microtherapeutics Research Labs No 6, Kamarajar St, East Tambaram, Selaiyur, Chennai 600059	External Expert
4.	Dr.R.Padmini	Associate Professor, Department of Biochemistry, School of Life Sciences, VISTAS	Member
5.	Dr.C.Shobana	Associate Professor, Department of Biochemistry, School of Life Sciences, VISTAS	Member
6.	Dr.R.Vidya	Assistant Professor, Department of Biochemistry, School of Life Sciences, VISTAS	Member
7.	Dr.P.Amudha	Assistant Professor, Department of Biochemistry, School of Life Sciences, VISTAS	Member
8.	Ms. Sathya	Medical coder, Omega Health Care, Chennai	Alumni member 2014-2016 batch

CREDIT DISTRIBUTION

M.Sc., Biochemistry
Minimum credits to be earned: 90

Component	I Sem	II Sem	III Sem	IV Sem	Total credits
DSC	14	16	14	4	48
DSE	8	4	6	4	22
SEC	2	2	2	-	6
SI	-	2	-	-	2
RP	-	-	-	12	12
Total Credits	**24**	**24**	**22**	**20**	**90**





ABBREVIATIONS

DSC	Disciplinary Specific Core
DSE	Disciplinary Specific Elective
SEC	Skill Enhancement Courses
SI	Summer Internship
RP	Research Project

CURRICULUM STURCTURE

M.Sc., Biochemistry Two Years

Total number of Credits: 90

	M.Sc., Biochemistry Minimum Credits to be earned : 90									
	Hours/Week						Maximum Marks			
SEMESTER I										
Category	**Code**	**Course**	**L**	**T**	**P**	**O**	**C**	**CIA**	**SEE**	**Total**
DSC1	24CMBC11	CHEMISTRY OF BIOMOLECULES	4	0	0	2	4	40	60	100
DSC 2	24CMBC12	ADVANCED INSTRUMENTAL TECHNIQUES	4	0	0	2	4	40	60	100
DSC 3	24CMBC13	CELLULAR BIOCHEMISTRY	4	0	0	2	4	40	60	100
DSC 4 (Lab)	24PMBC11	PRACTICALS I - BIOCHEMISTRY & INSTRUMENTATION	0	0	4	1	2	40	60	100
DSE 1	24DMBC1-	DISCIPLINE SPECIFIC ELECTIVE-I	4	0	0	2	4	40	60	100
DSE 2	24DMBC1-	DISCIPLINE SPECIFIC ELECTIVE-II	4	0	0	2	4	40	60	100
SEC 1	24SSKP11	SOFT SKILL I/ SECTOR SKILL COURSE	2	0	0	1	2	40	60	100
			22	**-**	**4**	**-**	**24**			

CIA - Continuous Internal Assessment SEE - Semester End Examination

***L – Lecture, *T- Tutorial, *P- Practical, *O - Outside the class effort / self-study, , *C- Credits**

SEMESTER II										
Category	**Code**	**Course**	**L**	**T**	**P**	**O**	**C**	**CIA**	**SEE**	**Total**
DSC 5	24CMBC21	ENZYME & ENZYME TECHNOLOGY	4	0	0	2	4	40	60	100
DSC 6	24CMBC22	INTERMEDIARY METABOLISM	4	0	0	2	4	40	60	100
DSC 7	24CMBC23	CLINICAL BIOCHEMISTRY	4	0	0	2	4	40	60	100
DSC 8 (Lab)	24PMBC21	PRACTICAL ENZYMOLOGY	0	0	4	1	2	40	60	100
DSC 9 (Lab)	24PMBC22	PRACTICAL CLINICAL BIOCHEMISTRY	0	0	4	1	2	40	60	100
DSE 3	24DMBC2-	DISCIPLINE SPECIFIC ELECTIVE-III	4	0	0	2	4	40	60	100
SI	24INPG21	INTERNSHIP	0	0	2	1	2	40	60	100
SEC 2	24SSKP21	SOFT SKILL II/ SECTOR SKILL COURSE	2	0	0	1	2	40	60	100
			18	-	**10**	-	**24**			

CIA - Continuous Internal Assessment **SEE - Semester End Examination**

***L – Lecture, *T- Tutorial, *P- Practical, *O - Outside the class effort / self-study, , *C- Credits**

SEMESTER III										
Category	**Code**	**Course**	**L**	**T**	**P**	**O**	**C**	**CIA**	**SEE**	**Total**
DSC 10	24CMBC31	GENETICS & MOLECULAR BIOLOGY	4	0	0	2	4	40	60	100
DSC 11	24CMBC32	PHARMACEUTICAL BIOCHEMISTRY	4	0	0	2	4	40	60	100
DSC 12	24CMBC33	PLANT & ANIMAL TISSUE CULTURE	4	0	0	2	4	40	60	100
DSC 13 (Lab)	24PMBC31	PRACTICAL GENETICS & MOLECULAR BIOLOGY	0	0	4	1	2	40	60	100
DSE 4	24DMBC3-	Discipline Specific Elective-IV	3	0	0	2	3	40	60	100
DSE 5	24DMBC3-	Discipline Specific Elective-V	3	0	0	2	3	40	60	100
SEC 3	24SSKP31	SOFT SKILL III/ SECTOR SKILL COURSE	2	0	0	1	2	40	60	100
			20	**-**	4	-	**22**	40	60	100

CIA - Continuous Internal Assessment **SEE - Semester End Examination**

***L – Lecture, *T- Tutorial, *P- Practical, *O - Outside the class effort / self-study, , *C- Credits**

KNOWLEDGE IS POWER

SEMESTER IV										
Category	**Code**	**Course**	**L**	**T**	**P**	**O**	**C**	**CIA**	**SEE**	**Total**
DSC 14	24CMBC41	TOXICOLOGY & FORENSIC BIOCHEMISTRY	4	0	0	2	4	40	60	100
DSE 6	24DMBC4-	Discipline Specific Elective-VI	4	0	0	2	4	40	60	100
RP1	24RMBC41	RESEARCH PROJECT I	0	0	12	10	12	40	60	100
			8	**0**	**12**	-	**20**			

CIA - Continuous Internal Assessment **SEE - Semester End Examination**

***L – Lecture, *T- Tutorial, *P- Practical, *O - Outside the class effort / self-study, *C- Credits**

DISCIPLINE SPECIFIC CORE COURSES

Category	Code	Course	L	T	P	O	C
DSC 1	24CMBC11	CHEMISTRY OF BIOMOLECULES	4	0	0	2	4
DSC 2	24CMBC12	ADVANCED INSTRUMENTAL TECHNIQUES	4	0	0	2	4
DSC 3	24CMBC13	CELLULAR BIOCHEMISTRY	4	0	0	2	4
DSC 4 (Lab)	24PMBC11	PRACTICALS I - BIOCHEMISTRY & INSTRUMENTATION	0	0	4	1	2
DSC 5	24CMBC21	ENZYME & ENZYME TECHNOLOGY	4	0	0	2	4
DSC 6	24CMBC22	INTERMEDIARY METABOLISM	4	0	0	2	4
DSC 7	24CMBC23	CLINICAL BIOCHEMISTRY	4	0	0	2	4
DSC 8 (Lab)	24PMBC21	PRACTICAL ENZYMOLOGY	0	0	4	1	2
DSC 9 (Lab)	24PMBC22	PRACTICAL CLINICAL BIOCHEMISTRY	0	0	4	1	2
DSC 10	24CMBC31	GENETICS & MOLECULAR BIOLOGY	4	0	0	2	4
DSC 11	24CMBC32	PHARMACEUTICAL BIOCHEMISTRY	4	0	0	2	4
DSC 12	24CMBC33	PLANT & ANIMAL TISSUE CULTURE	4	0	0	2	4
DSC 13 (Lab)	24PMBC31	PRACTICAL GENETICS & MOLECULAR BIOLOGY	0	0	4	1	2
DSC 14	24CMBC41	TOXICOLOGY & FORENSIC BIOCHEMISTRY	4	0	0	2	4

DISCIPLINE SPECIFIC ELECTIVE COURSES

Category	Code	Course	L	T	P	O	C
DSE 1	24DMBC11	BIOTECHNOLOGY AND IPR	4	0	0	2	4
	24DMBC12	NANOTECHNOLOGY	4	0	0	2	4
DSE 2	24DMBC13	HUMAN PHYSIOLOGY	4	0	0	2	4
	24DMBC14	STEM CELL TECHNOLOGY	4	0	0	2	4
DSE 3	24DMBC21	PLANT BIOCHEMISTRY	4	0	0	2	4
	24DMBC22	CANCER BIOLOGY	4	0	0	2	4
DSE 4	24DMBC31	ENDOCRINOLOGY	3	0	0	2	3
	24DMBC32	ENVIRONMENTAL SCIENCES	3	0	0	2	3
DSE 5	24DMBC33	IMMUNOLOGY AND MICROBIOLOGY	3	0	0	2	3
	24DMBC34	PHYTOCHEMISTRY, PHARMACOGNOSY AND QUALITY CONTROL	3	0	0	2	3
DSE 6	24DMBC41	MODERN LIFESTYLE ASSOCIATED DISEASE	4	0	0	2	4
	24DMBC42	NEUROBIOLOGY	4	0	0	2	4

SUMMER INTERNSHIP

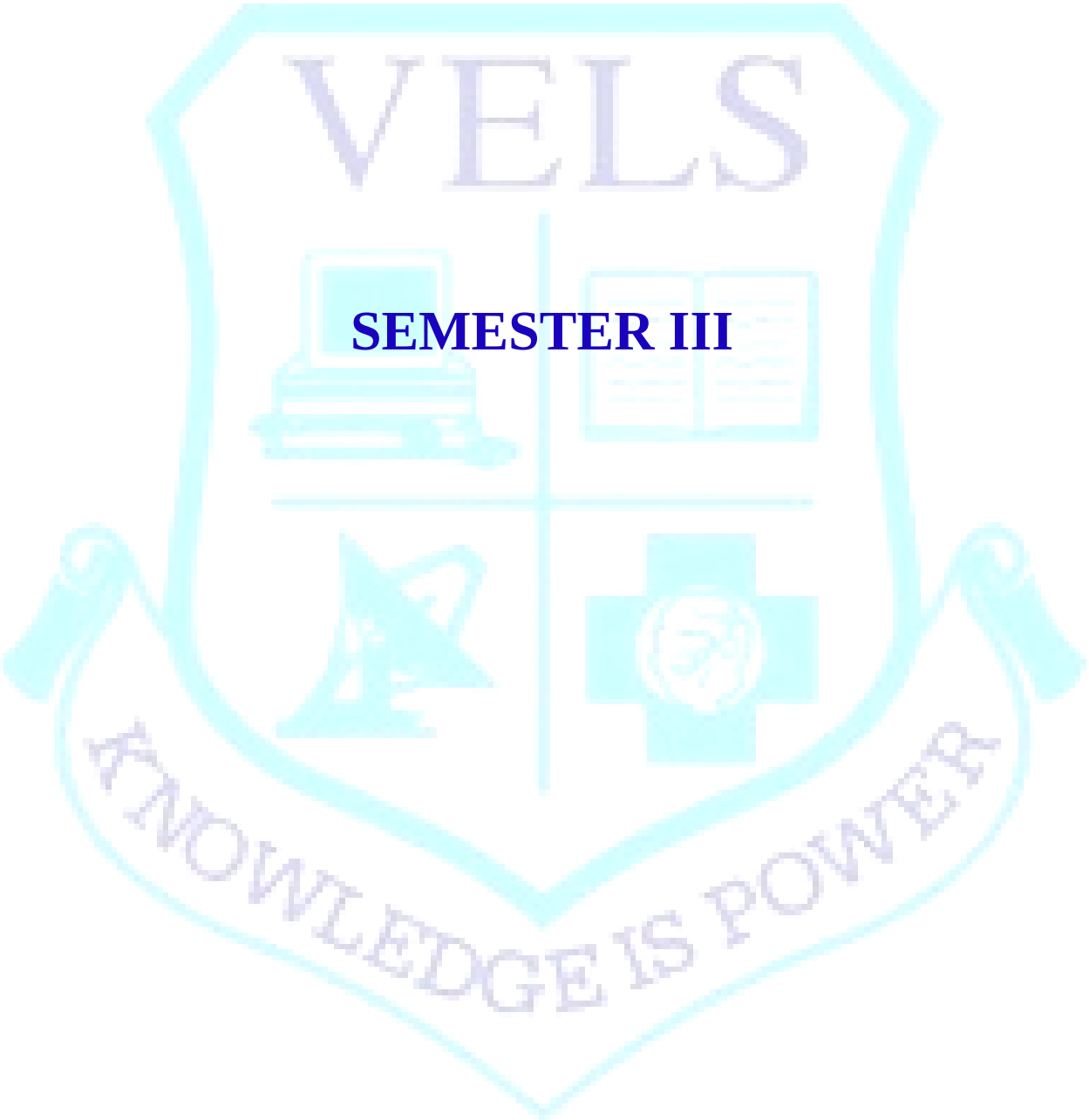
Category	Code	Course	L	T	P	O	C
SI	24INPG21	INTERNSHIP	0	0	2	1	2

SKILL ENHANCEMENT COURSES

Category	Code	Course	L	T	P	O	C
SEC 1	24SSKP11	SOFT SKILL I/ SECTOR SKILL COURSE	2	0	0	1	2
SEC 2	24SSKP21	SOFT SKILL II/ SECTOR SKILL COURSE	2	0	0	1	2
SEC 3	24SSKP31	SOFT SKILL III/ SECTOR SKILL COURSE	2	0	0	1	2

RESEARCH PROJECT

Category	Code	Course	L	T	P	O	C
RP1	24RMBC41	RESEARCH PROJECT I	0	0	12	10	12



SEMESTER III

24CMBC31 GENETICS AND MOLECULAR BIOLOGY

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVE:

Molecular biology deals with nucleic acids and proteins and how these molecules interact within the cell to promote proper growth, division, and development. It is a large and ever-changing discipline. This course will emphasize the molecular mechanisms of DNA replication, repair, transcription, protein synthesis, and gene regulation in different organisms.

UNIT 1 GENETICS 12

Gene concept and interaction of genes. Molecular structure of genes and chromosomes. Mendel's work on heredity, Mendel's mono and dihybrid experiments. Mendel's Laws, Linkage and crossing over, coupling and repulsion hypothesis, sex linked inheritance. Non-chromosomal inheritance. Gene expression, Genetic change.

UNIT 2 REPLICATION 12

Evidences for DNA as the genetic material. DNA structure, Structural organization and functional elements of eukaryotic chromosomes. Prokaryotic and Eukaryotic replication, Regulation of replication, Mutation and its types, Recombination, DNA Repair, Replication fork, DNA replicating proteins.

UNIT 3 PROKARYOTIC TRANSCRIPTION 12

Prokaryotic transcription. RNA polymerase, Inhibitiors of transcription. Post transcriptional processing of rRNA and tRNA. Regulation of transcription in prokaryotes– the lac operon, negative and positive regulation and tryptophan operon.

UNIT 4 EUKARYOTIC TRANSCRIPTION 12

Eukaryotic transcription and regulation. RNA polymerase I,II and III, promoters, transcription factors, Transcription factor motifs, Activators, repressors and enhancers, transcription complex assembly and mechanism of transcription. Post transcriptional processing of mRNA, rRNA and tRNA. Splicing, Alternative splicing, catalytic RNA (ribozymes), RNA editing, Antisense RNA.

UNIT 5 TRANSLATION 12

Genetic code and translation. The genetic code – general features, deciphering the code, Wobble Hypothesis. Translation- activation of aminoacids, initiation, elongation, termination in prokaryotes and eukaryotes. Regulation of gene expression in eukaryotes. DNA methylation, chromatin remodelling, DNA response elements, degradation of proteins. Protein sorting, targeting of proteins to mitochondria, chloroplast and nucleus, Receptor mediated endocytosis

Total: 60 Hours

Course Outcome:

At the end of this course students will be able to,

CO 1: Organize and understand the basics of heredity population genetics and master fundamental genetic calculation

CO 2: Understand and construct the synthesis of DNA and Post replication processes and the molecular mechanisms behind DNA damage and repair

CO 3: Understand the differentiate synthesis of RNA and post transcriptional modification and Differentiate the synthesis of protein and its post translational modifications cell division.

CO 4: Describe and compare different molecular mechanisms to bring about cell death and explain how this is linked to DNA damage

CO 5: Explain and compare different principles of how extracellular signals can reach the cell interior, be amplified, transmitted and terminated, and exemplify how signal routes are integrated and how specificity can be achieved

Text Books:

1. De Robertis (2001), Cell and molecular biology, 8th Edition, Dhanpat Rai Publisher.
2. Nalini Chandar, Susan Viselli (2010), Lippincott Illustrated Reviews: Cell and Molecular Biology, LWW: North American Edition.
3. Robert Franklin Weaver (2011), Molecular Biology, 5th edition, Mc-Graw Hill science.

Reference Books:

1. Bruce Alberts, Alexander Johnson, Julian Lewis (2014), Molecular biology of the cell, 6th edition, Garland Science.
2. Benjamin Lewin (2007), Genes IX, 9th edition, Jones & Bartlett Learning.

Web Sources:

1.https://microbenotes.com/category/molecular-biology/

2.https://www.easybiologyclass.com/molecular-biology-online-tutorials-lecture-notes-study-materials/

24CMBC32 PHARMACEUTICAL BIOCHEMISTRY

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVE:

The course was designed in such a way to equip the students with Definition and classification of drugs, Basics of Pharmacokinetics of a drug, Basics of Pharmacodynamics in living system, and Mechanism of action of drugs, Toxicity assessment and Drug abuse.

UNIT I INTRODUCTION TO DRUG BIOCHEMISTRY 12

Classification, routes of administration – factors influencing dosage and drug action, Absorption and distribution of drugs. Pharmacogenetics. origin of a drug from plants and animals.

UNIT II DRUG METABOLISM 12

Drug Biotransformation pathways - phase I – oxidation, reduction and hydroxylation. Phase II-Conjugation, Elimination of drugs from the body system. Storage of drugs in adipose tissue. Mechanism of drug action, the combined effect of drugs. Factors modifying drug action, tolerance and dependence.

UNIT III PHARMACODYNAMICS 12

Pharmacodynamics - receptor concepts, theory, drug receptor interaction (DRI), Factors affecting DRI, Cholinergic and anticholinergic drugs, Adrenergic and adrenergic blockers, General anesthetics, Local anesthetics. Adverse reactions to drugs and common drug receptor interactions. Visit to Pharmaceutical based IT industry / Pharmaceutical industry

UNIT IV THERAPIES 12

Principles of therapeutics: Chemotherapy of microbial diseases, Chemotherapy of fungal infections, Chemotherapy of parasitic infections, rational use of antibiotics. Application for New Drug Discovery (NDD) according to Indian Control Authority and USFDA guidelines. Ethical considerations in utilizing human subjects for drug discovery process. Helsinki‟s declaration.

UNIT V TOXICOLOGY 12

Toxicology: Principles of toxicology and treatment of poisoning. Heavy metals and antagonists. Non-metallic environmental toxicants. Methods involved in the development of new drugs. Preclinical toxicological studies: Calculation of LD50 and ED50.Acute, subacute and chronic toxicity studies; Irwin profile test, pre-clinical pharmacokinetic and dynamic studies. Lipinski’s rule for drug like molecule, High throughput screening (in-vitro and in-vivo) for pre-clinical pharmacokinetic and pharmacodynamics studies.

Total: 60 Hours

Course Outcome:

At the end of this course students will be able to,

CO 1: Identify and recall key biochemical principles and processes relevant to pharmaceutical sciences

CO 2: Explain the biochemical mechanisms underlying drug metabolism and pharmacokinetics.

CO 3: Apply biochemical knowledge to analyze drug interactions and predict potential side effects.

CO 4: Analyze biochemical data to evaluate the effects of pharmaceutical compounds on cellular processes.

CO 5: Assess the quality and reliability of biochemical research related to drug development.

Text Books:

1. Satoskar, R.S and Bhandarkar, S.D. (2000) Pharmacology and Pharmacotherapeutics, 13th edition, Vol. I and II, Popular Prakeshan PVT Ltd, Mumbai.
2. Tripathi, K.D. (2013) Essentials of Medical Pharmacology, 7th edition, Jaypee brother's medical publishers, New Delhi.

Reference Books:

1. Rang, H.P., Dale, M.M., Ritter, J. and Flower, R.J. (2007) Pharmacology, 6th edition, Churchill Living Stone Elsevier.
2. Barar, F.S.K. (2013) Text Book of Pharmacology, 1st edition, S.Chand and Company Pvt. Ltd.

Web Sources:

1. https://www.carewellpharma.in/bpharmacy/notes/2nd-sem/biochemistry
2. https://www.scribd.com/document/352974635/Pharmaceutical-Biochemistry-

24CMBC33 PLANT AND ANIMAL TISSUE CULTURE

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVE:

The objectives of this course is to educate students about the fundamental concepts of plant, animal and microbial cell system, their differences, related applications, thus preparing them to meet the challenges of the new and emerging areas of biotechnology industry.

UNIT I INTRODUCTION 12

Introduction of plant tissue culture and cell suspension culture, physico-chemical conditions for propagation of plant cells and tissues, composition of media, nutrient and hormone requirement; Types of culture – callus, embryo, protoplast culture.

UNIT II TECHNIQUES 12

Invitro pollination and fertilization; somatic embryogenesis and somoclonal variation. Immobilised plant cells. Conservation of germplasts. To visit a tissue culture laboratory to have hand on training for the techniques.

UNIT III PLANT TISSUE CULTURE 12

Plant tissue culture – genetic engineering: Transfer of nucleic acid to plant cells: - Direct transformation by electroporation and particle gun bombardment; - Agrobacterium, Ti plasmid vector. Theory and techniques for the development of new genetic traits, conferring resistance to herbicide, pesticide, plant pathogens. Biosynthesis of secondary metabolites of biotechnological importance

UNIT IV ANIMAL TISSUE CULTURE 12

History of animal cell culture and development, Development of primary culture, Development of cell line by enzymatic disaggregation, Culture media and growth conditions. Cell type and characterization, Origin of animal cell line, maintenance and characterization of different cell lines, Marker gene characterization. Cryopreservation.

UNIT V CELL GROWTH TECHNIQUES 12

Cell growth characteristics and kinetics, Micro-carrier attached growth, Cell culture in continuous, perfusion and hollow fiber reactor, Mass transfer in mammalian cell culture. Hybridoma technology, Organ culture technology.

Total: 60 Hours

Course Outcome:

At the end of this course students will be able to,

CO 1: Develop a fundamental understanding of basic concepts of animal and plant tissue culture

methods and their applications in the field of Biotechnology.

CO 2: Differentiate between the various sources of cells to be used in cell culture techniques

CO 3: Correlate between different biological samples and understand the importance of different media in tissue culture

CO 4: Comprehend the applications of plant, animal and microbial cell culture in industry, healthcare and environment.

CO 5: Evaluate applications of various concepts & techniques of animal and plant tissue culture to facilitate biotechnological advancement and innovations.

Text Books:

1. B.D.Singh (2010), Introduction to Biotechnology, second edition, Kalyani Publishers.
2. H.S.Chawala, Taylor and Francis (2009), Introduction to plant Biotechnology, 3rd Edition.

Reference Books:

1. Plant Biotechnology: Recent Advances, 1st edition (2000), P. C. Trivedi Panima Publishing Corporation.
2. Babiuk L.A and Philips.J.P. Eds (1989), Animal Biotechnology.

Web Sources:

1. https://www.slideshare.net/slideshow/tissue-culture-244818552/244818552
2. https://microbenotes.com/animal-cell-culture/

24PMBC31 PRACTICAL GENETICS AND MOLECULAR BIOLOGY

L	T	P	O	C
0	0	4	1	2

COURSE OBJECTIVE:

To Understand and perform, the most recent and important methods in Molecular Biology and also understand the molecular approach used in research relevant for understanding the development and treatment of human diseases. Hands –on training of the latest molecular biology techniques.

LIST OF EXPERIMENTS

1. Separation of proteins by SDS PAGE.
2. Determination of molecular weight of serum proteins by SDS PAGE
3. Study of enzyme activity on Native PAGE.
4. Isolation of protein and analysis.
5. Amplification techniques
6. Isolation of plasmid DNA genomic DNA from plant source.
7. Separation of DNA by Agarose gel electrophoresis.
8. Determination of size of DNA by agarose gel electrophoresis
9. RFLP.
10. Gene amplification by PCR.
11. RT-PCR (Demonstration)
12. Southern hybridization (Demonstration).
13. Western blotting (Demonstration).

Total: 30 Hours

Course Outcome:

At the end of this course students will be able to

CO 1: Determine and understand the basic principle involved in isolation of biomolecules from various biological sources.

CO 2: Isolate and purify DNA and RNA from various sources – viz plant, microbes and animals

CO 3: Separate Proteins by SDS PAGE, Native PAGE

CO 4: Understanding the mobility differences of macromolecules in electrophoresis and the optimal conditions essential for protein/nucleic acid separation and purification.

CO 5: Understand the application of these techniques.

Text Books:

1. Michael R. Green, Joseph Sambrook, Molecular Cloning: A Laboratory Manual, 4th Edition.
2. S.K.Sawhney and Randhir Singh (2005), Introductory practical biochemistry, 2nd edition.

Reference Books:

1. Michael R. Green, Joseph Sambrook. Molecular Cloning: A Laboratory Manual, 4th Edition
2. S.K.Sawhney and Randhir Singh (2005), Introductory practical biochemistry, 2nd edition.

Web Sources:

1. https://webstor.srmist.edu.in/web_assets/downloads/2021/20BTC502J-lab-manual.pdf

2.https://www.slideshare.net/slideshow/practical-manual-on-molecular-biology-and-genetic-engineeringrecombinant-dna-technology/109053921

24DMBC3- **ENDOCRINOLOGY**

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVE:

This paper ascertains that the biochemists get an accurate information about various hormones, functions, mechanism of action, and related disorders.

UNIT 1 PITUITARY HORMONES 12

Hormones – Classification, biosynthesis, transport, modification, and degradation. Mechanism of hormone action. Hypothalamic and pituitary hormones, hypothalamic releasing factors, hypothalamic hypophyseal portal system. Anterior pituitary hormones- GH, TSH, ACTH, LH, FSH and PR - biological role, feedback regulation and related disorders. Posterior pituitary hormones-oxytocin and vasopressin – biological actions, regulation, and related disorders.

UNIT 2 THYROID HORMONES 12

Thyroid hormones – synthesis, secretion, regulation, transport, metabolic fate and biological actions. Antithyroid agents. Hyper and hypothyroidism. Hormonal regulation of calcium and phosphate metabolism. Parathyroid hormones - Parathormone and Calcitonin - biological actions, and related disorders - Hypercalcemia and Hypocalcemia, Rickets and Osteomalacia.

UNIT 3 ADRENAL HORMONES 12

Hormones of Adrenal cortex - synthesis, action, biological role, regulation, transport, and metabolism. Adrenal function tests. Disorders of adrenal cortex - Cushing's syndrome, aldosteronism, congenital adrenal hyperplasia, Adrenal cortical insufficiency. Hormones of Adrenal medulla - synthesis, biological role, metabolism, regulation, and related disorder - Phaeochromocytoma.

UNIT 4 PANCREATIC HORMONES 12

Pancreatic hormones – synthesis, regulation, biological effects, mechanism of action and related disorder of glucagon, somatostatin, and insulin. Gastrointestinal Hormones - synthesis, regulation, biological effects, mechanism of action and related disorder of gastrin, secretin, cholecystokinin, glucose-dependent insulinotropic peptide (GIP), and motilin.

UNIT 5 GONADAL HORMONES 12

Gonadal hormones - Biosynthesis, biological actions, transport, regulation and metabolism of androgens, estrogen and progesterone. The menstrual cycle. Pregnancy –Biochemical changes and diagnostic tests. Role of hormones during parturition and lactation. Gonadal disorders – causes, symptoms and treatment of hypogonadism and hypergonodism.

Total: 60 Hours

Course Outcome:

At the end of this course students will be able to,

CO 1: Understand the hormonal regulation of physiological processes in animals with special reference to humans

CO 2: Describe the various endocrine systems, hormones, and their role in nutrition.

CO 3: Analyze the role of the endocrine glands and their neuronal networks

CO 4: Identify the class and functions of various types of second messengers and their action.

CO 5: Discuss the pathophysiology, diagnosis, treatment and management of endocrine disorders

Text Books:

1. Prakash.S.Lohar (2005), Endocrinology, MJP Publishers.
2. R.Radheshyam (2012), Textbook of Endocrinology, Neha Publishers.

Reference Books:

1. **Hadley ME (1996)**, The vertebrate **endocrine** system, in. **Endocrinology**, 4th **Edition** (Prentice Hall, NJ).

C. Guyton, MD and John E. Hall (2006), Textbook of Medical Physiology.

Web Sources:

1.https://endocrinology.co.in/WELCOME+TO+NOTES+IN+ENDOCRINOLOGY

2.https://www.uc.edu/content/dam/uc/ce/docs/OLLI/Page%20Content/The%20Endocrine%20System.pdf

24DMBC3- ENVIRONMENTAL SCIENCES

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVE:

The core Module Syllabus for Environment Studies includes class room teaching and Field Work. The course structure includes the continuing problems of pollution, loss of forget, solid waste disposal, degradation of environment, issues like economic productivity and national security, Global warming, the depletion of ozone layer and loss of biodiversity have made everyone aware of environmental issues.

UNIT 1 PRINCIPLES AND CONCEPTS OF ECOSYSTEM 12

Structure of ecosystem and Homeostasis- Energy transfer in an ecosystem-Food chain. Food web-Ecological efficiencies- Trophic structure and energy pyramids. Biogeochemical cycles (N, C, P cycles). Biodiversity: Types of diversity; Genetic diversity, Species diversity and Ecosystem diversity. Molecular taxonomy –Methods of biodiversity conservation- Gene banks; Cryopreservation. Assessing, analyzing and documenting biodiversity – Vulnerability and extinction of biodiversity.

UNIT 2 PROPERTIES OF WATER 12

Water quality parameters- pH, Dissolved Oxygen (DO), Chemical Oxygen demand (COD); Biological Oxygen demand (BOD); Atmospheric toxicants- CO, NO_2, CO_2, SO_2-; Toxic heavy metals. Radionuclides. Sampling of air, soil and water pollutants - Monitoring techniques and methodology; Pesticide residue – classification, degradation, analysis, pollution due to pesticides; phenols and petrochemicals

UNIT 3 TRADITIONAL BIOLOGICAL TREATMENT 12

Stabilization pond, aerated lagoon, activated sludge process trickling filter anaerobic treatment. Use of microbes (bacteria and fungi) in biodegradation and Biotransformation: Bioremediation. Microbial transformation; Accumulation and concentration of metals; Bio sorption- Oil field microbiology; improved oil recovery; Biotechnology and oil spills.

UNIT 4 ENVIRONMENTAL BIOTECHNOLOGY 12

Biodegradation of agricultural chemicals; GM Crops and their impact on environment; Biofertilizers; Biological control of insect pests; Role of bio pesticides/ insecticides; Biocontrol of plant pathogens; Integrated pest management-practical implementation

UNIT 5 ROLE OF BIOTECHNOLOGY IN MANAGEMENT OF RESOURCES 12

Reclamation of wasteland: Biomass production: Biogas and biofuel production; Development of environment-friendly processes such as integrated waste management. Nature of Environmental Policies; International Agreements and Treaties: Stockholm Conference (1972); Rio Conference

(UNCED) (1992); Jonesburg treaty; GAAT and Environment; CITES; Montreal protocol National Policy on Environment, Constitutional provisions for Environmental Protection.

Total: 60 Hours

Course Outcome:

At the end of this course students will be able to,

CO 1: Understand complex relationships between natural and human system

CO 2: Demonstrate awareness of ecosystem

CO 3: Understand the ecological knowledge and its consequences

CO 4: Easily assess the environmental changes and challenges.

CO 5: Understand natural science, how biology, chemistry and physics interlinked

Text Books:

1. Trivedi R.K. (2006), Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards, Vol I and II, Enviro Media (R).
2. Agarwal, K.C. (2001), Environmental Biology, Nidi Publ. Ltd. Bikaner.

Reference Books:

1. Sharma B.K. (2001), Environmental Chemistry, Geol Publ. House, Meerut.
2. Jadhav, H & Bhosale, V.M.(1995), Environmental Protection and Laws, Himalaya Publication House, Delhi.

Web Sources:

1.https://www.hzu.edu.in/bed/E%20V%20S.pdf

2. https://vemu.org/uploads/lecture_notes/23_12_2022_566610443.pdf

24DMBC3- IMMUNOLOGY AND MICROBIOLOGY

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVE:

The paper should give sound knowledge of essential elements of the immunology with special consideration to the importance of the immune system in medicine and the mechanism of action of immune system.

UNIT 1 INTRODUCTION TO IMMUNITY 12

Types of immunity: non-specific physiological and cellular barriers, Acquired immunity – characteristics. Antigen, Haptens and Adjuvants, Antibody. Structure and types of immunoglobulins. Distribution and function of immunoglobulins

UNIT 2 CELLS AND ORGANS OF IMMUNE SYSTEM 12

Organs of immune system – primary and secondary, Cells of immune system. Humoral and Cell Mediated immune response. Structure and functions of MHC, association of MHC with disease susceptibility. Autoimmunity and Hypersensitivity.

UNIT 3 IMMUNO-TECHNIQUES 12

Introduction to Antigen-antibody interactions. Affinity, avidity, cross reactivity, precipitation, agglutination, complement fixation test, tissue typing, Radial immune diffusion, Ouchterlony double diffusion, ELISA, RIA, immunofluorescence, Immunodiffusion; Immunoblot.

UNIT 4 STERILIZATION 12

Sterilization – High temperature- Tyndallization, Pasteurization, inspissation, incineration, moist heat under pressure; low temperature – preservation; filtration- membrane filters, depth filters; centrifugation; radiation- principle, use and Quality control. Disinfection- Mode of action and Evaluation.

UNIT 5 ANTIBIOTICS 12

Antibiotics – Classification, Mode of Action, mechanism of resistance, Evaluation – Disc Diffusion; MIC-Broth dilution, agar dilution; MBC; E- test with Quality control for each method.

Total: 60 Hours

Course Outcome:

At the end of this course students will be able to,

CO 1: Discuss on how the immune system works building on their previous knowledge from biochemistry, genetics and cell biology

CO 2: Describe the immunological processes at a cellular and molecular level.

CO 3: Develop an understanding about the defense mechanisms against infectious agents and tumors.

CO 4: Differentiate the key mechanisms and cellular players of innate and adaptive immunity and how they relate.

CO 5: Describe the mechanism involved in immune system alterations as well as comprehend the function of vaccines and immunotherapy

Text Books:

1. Prescott (2003), Microbiology, 3rd edition, Magrawhill, Boston.
2. Roitt, Brostoff, Mal (2001), Immunology, 6th edition.

Reference Books:

1. Panicker (2005), Microbiology, 6th edition, orient Longman , Hyderabad.
2. M.J.Pelzar (2005), Microbiology, 5th edition, Tata mac hran, Hill New Delhi.

Web Sources:

1. https://dspmuranchi.ac.in/pdf/Blog/General_MicrobiologyCSP_Proof012417.PDF
2. https://www.jsscacs.edu.in/sites/default/files/Department%20Files/immunology%20notes.pdf

24DMBC3- PHTYOCHEMISTRY, PHARMACOGNOSY AND QUALITY CONTROL

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVE:

This paper deals with the study of the physical, chemical, biochemical and biological properties of drugs, drug substances or potential drugs of natural origin as well as the search for new drugs from natural sources. It enables the students to study procedures undertaken to ensure the identity and purity of a particular pharmaceutical compounds.

UNIT 1 PHYTOCONSTITUENTS OF MEDICINAL IMPORTANCE I 12

Glycosides, Anthraquinones. Flavonoids (definition, natural sources, classification, biogenesis, extraction, isolation, identification and therapeutic applications). Anthocyanins Coumarins, Terpenes, Volatile Oils (definition, classifications, natural sources, medicinal and non medicinal uses, pharmacological and toxicological effects).

UNIT 2 PHYTOCONSTITUENTS OF MEDICINAL IMPORTANCE II 12

Saponins and Alkaloids (definition, natural sources, classification, physical and biological properties, localization, nomenclature, physico-chemical properties, extraction, detection, isolation, purification, biosynthetic origin and pharmacological activities.

UNIT 3 PHARMACOGNOSY 12

Historical development, modern concept and scope of Pharmacognosy. Significance of Pharmacognosy in various systems of medicine *viz*; Ayurveda, Unani, Homeopathic, Siddha and Allopathic systems practiced in India. Common drugs of plant origin. Quantitative microscopy-an overview. Importance of authentication of plants. Preparation of herbal extracts. Natural pesticides and Insecticides-Tobacco, Pyrethrum, Neem. Introduction to herbicides and fungicides. Study of Indian toxic plants.

UNIT 4 PHARMACEUTICAL REGULATIONS 12

Harmonization of regulatory requirements including ICH activity. Regulatory requirements of different regions applicable to pharmaceutical developments, manufacturing, quality control on finished products, extended release products, biopharmaceutical and bioequivalence assessment and good clinical practices and comparison with regulation in India. Filing of INDA, NDA and ANDA for approval and registration.

UNIT 5 STABILITY TESTING 12

Role of stability testing, stability test guidelines. Protocol of stability testing including testing under different climatic zones and conditions. Conduct of stability testing, presentation and

recording of stability data, determination of shelf life. Stability test equipment and recent developments in this area. Documentation: Importance of documentation, statutory requirements and procedure for documentation, critical examination of documents.

Total: 60 Hours

Course Outcome:

At the end of this course students will be able to,

CO 1: Understand the basic terminologies: pharmacognosy, medicinal plant, crude drug, folk medicine and flora.

CO 2: Classify herbal drugs according to botanical origin, chemical constituents, and medicinal activity.

CO 3: Explain different methods of cultivation, collection, curing, drying, adulteration and storage of medicinal plants

CO 4: Discuss different types of plant cells, secretory structures, different classes of secondary metabolites and their chemical identification

CO 5: Describe methods for detection and identification of natural drugs, especially leaves, fruits, seeds, herbs, barks and wood macro- and micro-morphologically and chemically

Text Books:

1. C.K. Kokate, A.P. Purohit and S.B. Gokhle (2008), Pharmacognosy, Nirali prakasham, 42nd edition.
2. Gupta, Vijay Kumar and Singh (2014), Medicinal plants: Phytochemistry, Pharmacology and Therapeutics –Vol 3, 1st edition, Daya publishing house.

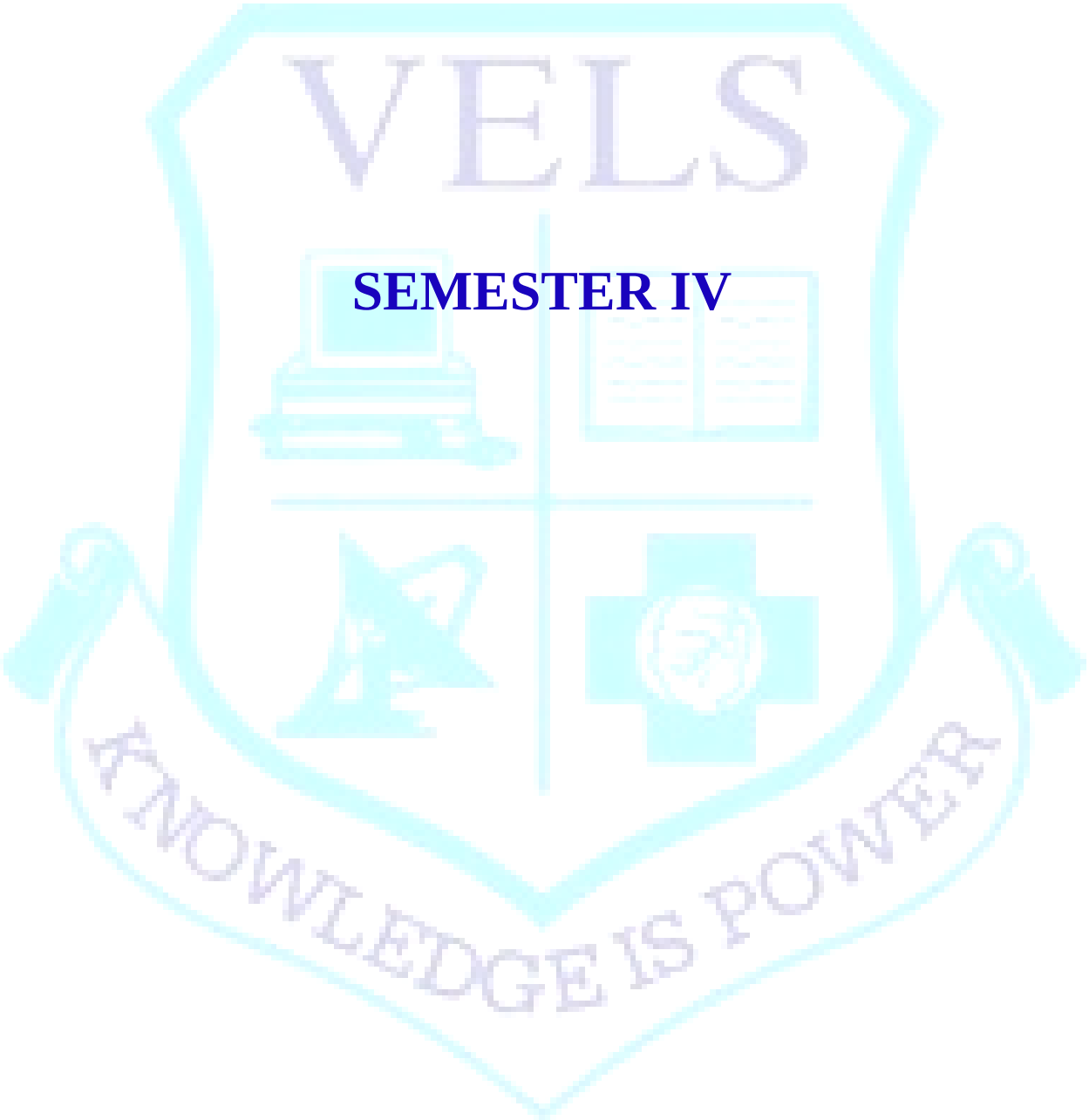
Reference Books:

1. Carol A. Newal, Linda A. Anderson and J. David Phillipson (1997), Herbal Medicines, A Guide for Health Care Professionals.
2. Biren Shah, Avinash seth (2012), Text books of Pharmacognosy and Phytochemistry, 1st edition, Elsevier India publishers.

Web Sources:

1. https://www.annamalaiuniversity.ac.in/studport/download/engg/pharm/resources/BPHARM_ 2Y_4S _ 405T_Pharmacognosy%20&%20Phytochemistry-I.pdf

2. https://www.slideshare.net/Poonamchougule/unit-5-basics-of- Phytochemistrypptx



SEMESTER IV

24CMBC41 TOXICOLOGY AND FORENSIC BIOCHEMISTRY

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVE:

This paper provides a complete understanding of the responses of the human body to toxic agents and the therapeutic approaches to toxicity. The paper also deals with the forensic aspects like legal procedures and types of trauma.

UNIT 1 BASICS OF TOXICOLOGY 12

Definition and scope of toxicology. Common toxicological Terminology. Classification of toxic agents. Dose-response relationship: Synergism and Antagonism, Determination of ED 50 & LD 50. Acute and chronic exposures. Factors influencing toxicity. Toxication vs. Detoxication. Biochemical basis of toxicity: Mechanism of toxicity. Genotoxicity and tissue specific toxicity.

UNIT 2 CLINICAL TOXICOLOGY 12

Classification of poisons: plant poisons, animal poisons, metallic Poisons, cardiac poisons, corrosive poisons and neural poisons. Accidental, suicidal and homicidal poisonings. Physico-chemical characteristics and mode of action of poisons. Signs and symptoms of common poisoning and their antidotes. Metabolism and excretion of poisons.

UNIT 3 INTRODUCTION TO FORENSICS 12

Definition, Concepts and Scope of forensic science. Tools and Techniques in Forensic Science. Organizational set up of Forensic Science Laboratories in India - Central and State Forensic Science Laboratories, Fingerprint Bureaus, National Crime Records Bureau, Police & Detective Training Schools. Services of crime laboratories.

UNIT 4 IDENTIFICATION PROCEDURES 12

Identification of the living and the dead. Forensic thanatology; causes of death, mechanism and manner of death, changes after death, artifacts. Medico-legal death investigation, exhumation. Locard's exchange principle, lie detector and narco analysis. Superimposition; DNA finger printing and HLA typing.

UNIT 5 MEDICO LEGAL ASPECTS OF INJURIES 12

Injuries - mechanical injuries; injuries due to electricity, lightning and radiation; train and road traffic accidents; firearm and explosion injuries. Classification of mechanical asphyxia: hanging, strangulation, drowning, smothering, choking, garroting, burking and yoking. Medico legal aspects of wounds. Medical and medico Legal documents; evidences; witnesses; laws related to medical profession. Medical negligence and duties of medical practitioners to victims of torture.

Total: 60 Hours

Course Outcome:

At the end of this course students will be able to,

CO 1: Describe the basic concepts of toxicology, toxins, the biochemical basis of toxicity and injuries.

CO 2: Implement the knowledge of medico-legal procedures in India and the proceedings involved in criminal cases and also the basic understanding of identification procedures employed under the Forensic toxicology lab.

CO 3: Examine predict and give solution to the problems when handling or exposed to various toxic materials and also make assessments in forensic lab.

CO 4: Implement the knowledge gained from this subject to protect and aware the people about toxins and medico-legal aspects in India

CO 5: Describe the various identification procedures employed under the Forensic toxicology

Text Books:

1. Narayanareddy K. S (2007), The Essentials of Forensic Medicine & Toxicology, 26th Edition, Published by K. Sugana Devi, Hyderabad.
2. Basu, R (2009), Fundamentals of forensic medicine and toxicology, 2nd Edition, Books and Allied (P) Ltd. Kolkata.

Reference Books:

1. Parikh C.K (1999), Parikh's Textbook of Medical Jurisprudence and Toxicology, 6th Edition Reprint 2007 Publishers Bangalore.
2. Pillay V.V (2009), Text book of Forensic Medicine, Paras Publication. Hyderabad.

Web Sources:

1. https://mrssmithsblog.net/fs-class-notes/
2. https://msrobbinspnhs.weebly.com/forensic-science-notes.html

24DMBC4- MODERN LIFESTYLE ASSOCIATED DISEASE

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVE:

The objective is to make a connection between knowledge of anatomy and physiology and real-world situations, including healthy lifestyle decisions and homeostatic imbalances.

UNIT 1 MODERN LIFESTYLES AND HABITS **12**

Modern lifestyles - Sedentary habits, Junk food, Polluted environment, Sleeping habits, Smoking, Alcoholism, Drugs, Stress.

UNIT 2 FOOD **12**

Elementary knowledge of balanced food. Obesity, Acidity, Dieting, Anorexia, Food poisoning. Deficiency of nutrients- Vitamins, Minerals, Beverages- hot and cold.

UNIT 3 CARDIOVASCULAR COMPLICATIONS **12**

Elementary knowledge of cardiovascular system: Atherosclerosis, Ischemia, Myocardial infarction (Heart attack), Hypertension.

UNIT 4 DISEASES OF THE DIGESTIVE SYSTEM **12**

Elementary knowledge of digestive system and liver- Hepatitis, Fatty liver, Cirrhosis, Gallstones. Stomach- Gastritis, Acidity, Ulcer, Amoebiasis, Constipation, Piles.

UNIT 5 DISEASES OF THE DIGESTIVE SYSTEM **12**

Elementary knowledge of Respiratory system- Common cold, Asthma, Wheezing, Allergic sinusitis. Elementary knowledge of excretory system, Hypertension, Uncontrolled Diabetes, Kidney Stones.

Total: 60 Hours

Course Outcome:

At the end of this course students will be able to,

CO 1: Understanding the basics about the human anatomy and physiology

CO 2: Describe the effects of current lifestyle as a consequence of industrialization.

CO 3: Understand global scenario on sedentary lifestyle nutrition

CO 4: Understand Basics of nutrition, RDA, balanced diet and BMR.

CO 5: Describe about cardiovascular system, respiratory system, digestive system, excretory system and associated disorders

Text Books:

1. Carl A. Burtis and Edward R. Ashwood (2012), Tietz Textbook of Clinical Chemistry and Molecular Diagnostics, 5edition, Saunders Publication.
2. M N Chatterjee and Rana shinde (2011), Textbook of Medical Biochemistry,8th edition, Jaypee Publishers.

Reference Books:

1. Thomas M. Devlin (2004), Biochemistry with Clinical Correlation, 7th edition, John Wiley & Sons.
2. Dennis L. Kasper, Anthony S. Fauci, Stephen L. Hauser, Dan L. Longo (2015), Harrison Principles of Internal Medicine, 19th edition.

Web Sources:

1.https://www.nios.ac.in/media/documents/SecHmscicour/english/Home%20Science%20(Eng)%20Ch-8.pdf

2.https://medcraveonline.com/JCCR/lifestyle-diseases-consequences-characteristics-causes-and-control.html

24DMBC4- **NEUROBIOLOGY**

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVE:

This paper provides a basic understanding of the nervous system, Structure and function relationship and integration of the nervous tissue networking and insights in to neurotransmission

UNIT 1 INTRODUCTION TO NEUROBIOLOGY **12**

Overview of nervous system. Central nervous system. Peripheral nervous system- somatic and autonomic neural system. Structure, classification and functions of neurons. Glial cells- astrocytes, oligodendrocytes, Schwann cells, and microglia and ependymal cells.

UNIT 2 NEUROANATOMY **12**

Neuroanatomy- Introduction and basic terminology. Anatomy of brain and spinal cord. Microscopic morphology of brain and spinal cord. Different parts and functions of brain- cerebrum, cerebellum, spinal cord and brain stem. Protection of brain and central nervous system.

UNIT 3 NEUROPHYSIOLOGY **12**

Membrane potential- definition, mechanism and importance. Action potential- definition, phases and importance. Synaptic signaling- neurotransmitters, receptors and neural plasticity. Membrane excitability and ion channels. Neurophysiological mechanism- circadian rhythms and sleep disorders.

UNIT 4 NEUROCHEMISTRY AND NEURODEVELOPMENT **12**

Neurotransmitters and neuromodulators- Introduction, classification and functions. Neurotransmitter- synthesis and degradation. Neurochemical basis of behavioral and cognition. Neurotransmitter receptors. Neurodevelopment- cell migration and synaptogenesis. Plasticity in brain. Environmental factors influencing brain development.

UNIT 5 SENSORY AND MOTOR SYSTEMS **12**

Sensory system- Anatomy of the visual system- visual processing and photoreceptors, Anatomy of the auditory system- auditory processing and hair cells. Gustatory and olfactory receptors. Motor system- motor pathways, voluntary movements and spinal reflexes. Basal ganglia and cerebellum- learning and motor coordination. Motor disorders- Huntington's disease, Parkinson's disease and cerebellar ataxia

Total: 60 Hours

Course Outcome:

At the end of this course students will be able to,

CO 1: Demonstrate comprehensive understanding of the anatomy and physiology of the nervous system

CO 2: Interpret the mechanisms of neurotransmission, synaptic transmission, and neuronal signaling pathways

CO 3: Recall the processes of neural development, including neurogenesis, neuronal migration, axon guidance, and synaptogenesis

CO 4: Examine the organization and function of sensory systems

CO 5: Interpret the mechanisms of neurological and psychiatric disorders, including neurodegenerative diseases

Text Books:

1.Deepak Sharma, Sangeeta Singh, Ramesh Singh (2021), Textbook of Neurobiology, Dreamtech press.

2.Liqun Luo (2016), Principles of Neurobiology. CRC Press Inc.

Reference Books:

1.Singh (2020), Text book of Clinical Neuroanatomy, 4th edition, Elsevier.

2.Mark F. Bear, Barry W.Connors, Michael A. Paradiso (2015), Neuroscience: Exploring the brain, Lippincott Williams and Wilkins publisher.

Web Sources:

1.https://www.osmosis.org/notes/Anatomy_and_Physiology_of_the_Nervous_System

2.https://ocw.mit.edu/courses/7-29j-cellular-neurobiology-spring-2012/pages/lecture-notes/

24RMBC41 **RESEARCH PROJECT**

L	T	P	O	C
0	0	12	10	12

COURSE DETAILS

The final requirement for awarding the MSc degree is the completion of a substantial and original research project.

The successful completion of this requirement is demonstrated through the production of a dissertation document, describing the research project and its results, and the defense of the project from challenges offered by the members of the student's faculty Dissertation Committee.

The quality of the dissertation and the defense of its thesis are evaluated by the Dissertation Committee in order to determine if the student has successfully completed this final requirement for the MSc degree in Biochemistry.

Total: 60 Hours