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., Biotechnology

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 Biotechnology
School of Life Sciences

DEPARTMENT OF BIOTECHNOLOGY

VISION OF THE DEPARTMENT
To develop as a department of eminence, by achieving high standards in both research and teaching, and to become a sought-after destination for highly motivated students and faculty. The Department aspires in delivering distinctive learning skills in biotechnology enabling excellence in professional competence and innovation for further betterment of society and mankind

MISSION OF THE DEPARTMENT	
M1	To maintain high standards of teaching by innovating pedagogy, instilling in students the ability to be lifelong learners, and continually upgrading the program curriculum with international standards of life sciences education and to meet the requirement of industry and research community.
M2	To adopt effective teaching methods to improve the learning process and impart knowledge of biology and technology.
M3	To provide a flexible curriculum that allows the students to study courses of his/her choice (through Elective courses) that will fulfill their aptitude and professional aspirations.
M4	To provide hands-on training and technical skills to transform students into technocrats and facilitate research and higher education in the fields of biotechnology.
M5	To create opportunities and a supporting infrastructure for students – through laboratory courses, projects, dissertations, and possible entrepreneurial ventures in biotechnology to achieve their aspirations. To pursue and promote cutting-edge research in selected fields of biotechnology

PROGRAMME EDUCATIONAL OUTCOMES (PEO)	
PEO1	The post-graduates of Biotechnology will able to attain the in-depth knowledge of the basic and application-oriented subjects of Biotechnology and allied fields.
PEO2	The post-graduates of Biotechnology will able to gain the ability to use the concept of theories, practical skills and latest technological tools in solving any professional issues independently in a global and societal context.
PEO3	The post-graduates of Biotechnology are equipped to design, analyze, conduct and interpret the experiments and data for the development of process/product within the realistic constraints.
PEO4	The Post graduates of Biotechnology will continue to learn and update knowledge to become an entrepreneur in a current competitive world of science & technology and also contribute to society.

PROGRAMME OUTCOMES (PO)	
PO1	Graduates will able to have knowledge on the basic and applied theories in Biotechnology.
PO2	Making the graduates to demonstrate their communication effectively and scientifically.
PO3	Developing an interdisciplinary approach and a rational thinking.
PO4	Designing of research projects that are cost effective, ecofriendly, potent and beneficial to mankind.
PO5	Providing a broad educational and analytical knowledge to make the students to appear competitive examinations.
PO6	Generating the graduates with an ability to identify, formulate and to deliver process/product with professional, societal and ethical responsibilities.
PO7	Graduates will be able to recognize need for self-learning and lifelong learning.

PO8	Environment sustainability: Successful candidates will get adequate knowledge to use information and implement solutions for environmental protection, safeguards and remediation.
PO9	Lifelong learning: Successful candidates will carry on to learn, adapt and disseminate knowledge in a world of constantly evolving technology.

PROGRAMME SPECIFIC OUTCOMES (PSO)	
PSO1	Apply fundamental knowledge of biological sciences for the human Welfare and to have successful career as professional or a researcher through lifelong learning in the field of biotechnology.
PSO2	Demonstrate the application of Biotechnological processes in industries that are of social and commercial importance.
PSO3	Exhibit skills of handling microbial processes and biochemical analysis by making use of state-of-the-art facilities and environment.
PSO4	The ability to critically analyze the research in Biotechnology and to evaluate experimental design, methodology and interpretation of results and to understand the regulation of immune responses which includes the roles of different immune cells, cytokines and signaling pathways in health and disease.
PSO5	For the effective scientific communication and to relate plants, animals and microbes and their role in ecosystem and public health research with wide opportunities and career prospects.

BOARD OF STUDIES

List of Members

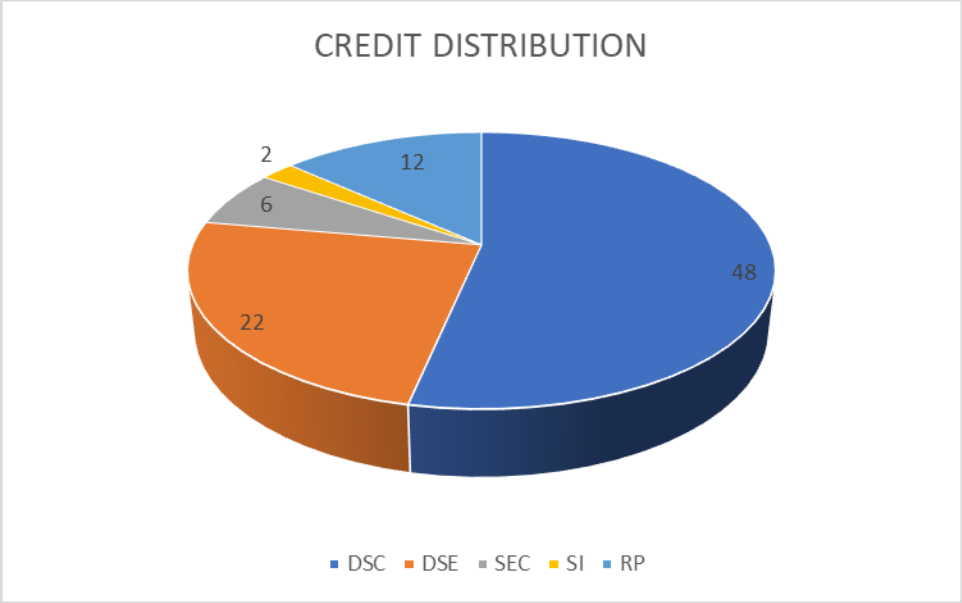
Department of Biotechnology

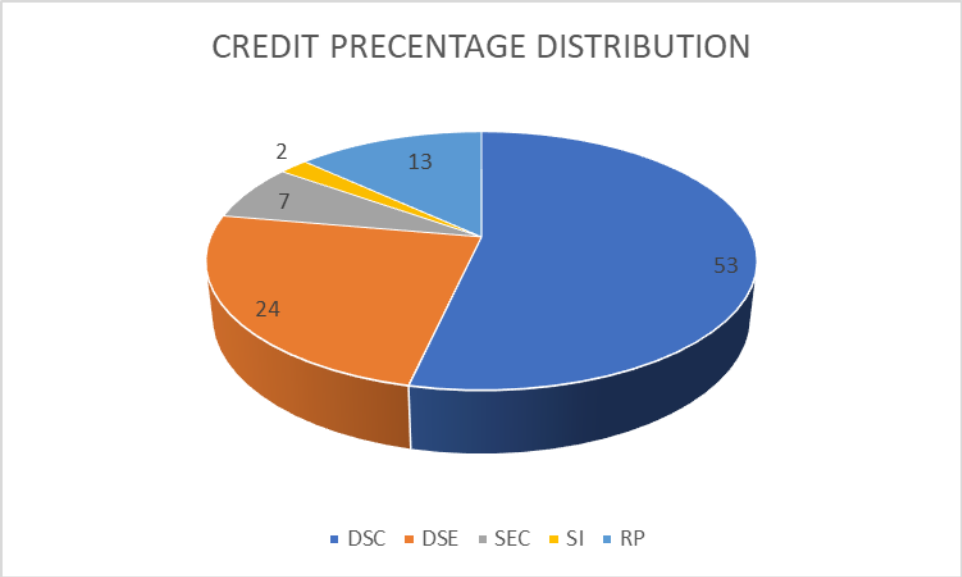
S. No	Name & Designation	Address	Role
1.	**Dr. K. Ashok Kumar** Associate Professor & Head i/c	Department of Biotechnology, Vels Institute of Science, Technology and Advanced Studies, Pallavaram, Chennai – 600117.	Internal Member
2.	**Dr. Rajeswary Hari** Professor and Head	Department of Biotechnology Dr MGR Educational & Research Institute University. Maduravoyal, Chennai – 600117	Academic Expert (External Member)
3.	**Dr. P. Balashanmugam** Director	AviGen Biotech Pvt Ltd. No7, 1st floor, 1st main road, New Colony, Chrompet, Chennai 600 044, Tamil Nadu	Industrial Expert (External Member)
4.	**Dr. N. K. Udaya Prakash** Professor	Department of Biotechnology, Vels Institute of Science, Technology and Advanced Studies, Pallavaram, Chennai-600117.	Internal Member
5.	**Dr. M. Thenmozhi** Associate Professor	Department of Biotechnology, Vels Institute of Science, Technology and Advanced Studies, Pallavaram, Chennai.600117.	Internal Member
6.	**Dr. B. Prakash** Associate Professor	Department of Biotechnology, Vels Institute of Science, Technology and Advanced Studies, Pallavaram, Chennai.600117.	Internal Member
7.	**Dr. G. Abirami** Assistant Professor	Department of Biotechnology, Vels Institute of Science, Technology and Advanced Studies, Pallavaram, Chennai.600117.	Internal Member
8.	**Dr. M. Suganthi** Assistant Professor	Department of Biotechnology, Vels Institute of Science, Technology and Advanced Studies, Pallavaram, Chennai.600117.	Internal Member
9.	**V. Keerthi Vasan**	B.Sc (2018-2021) & M.Sc (2021-2023)	Alumni Member (External Member)

CREDIT DISTRIBUTION

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

Component	I Sem	II Sem	III Sem	IV Sem	2 Yrs 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	DSC courses
DSE	Disciplinary Specific Elective
SEC	Skill Enhancement Courses
SI	Summer Internship
RP	Research Project

CURRICULUM STURCTURE

M.Sc., Biotechnology

Total number of Credits: 90

	M.Sc Biotechnology Minimum Credits to be earned :90									
	Hours/Week						Maximum Marks			
SEMESTER 1										
Category	**Code**	**Course**	**L**	**T**	**P**	**O**	**C**	**CIA**	**SEE**	**Total**
DSC 1	24CMBT11	Cell and Molecular Genetics	4	0	0	2	4	40	60	100
DSC 2	24CMBT12	Microbiology	4	0	0	2	4	40	60	100
DSC 3	24CMBT13	Biochemistry	4	0	0	2	4	40	60	100
DSC 4 (Lab)	24PMBT11	Cell, Microbiology and Biochemistry Practical	0	0	4	1	2	40	60	100
DSE 1	24DMBT1-	DSE I	4	0	0	2	4	40	60	100
DSE 2	24DMBT1-	DSE II	4	0	0	2	4	40	60	100
SEC 1	24SSKP11	Soft Skill 1/ 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 2										
Category	**Code**	**Course**	**L**	**T**	**P**	**O**	**C**	**CIA**	**SEE**	**Total**
DSC 5	24CMBT21	Genetic Engineering, IPR and Bioethics	4	0	0	2	4	40	60	100
DSC 6	24CMBT22	Immunotechnology	4	0	0	2	4	40	60	100
DSC 7	24CMBT23	Bioprocess Technology	4	0	0	2	4	40	60	100
DSC 8 (Lab)	24PMBT21	Genetic Engineering & Immunotechnology Practical	0	0	4	1	2	40	60	100
DSC 9 (Lab)	24PMBT22	Bioprocess technology Practical	0	0	4	1	2	40	60	100
DSE 3	24DMBT2-	DSE 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 2/ 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 3										
Category	**Code**	**Course**	**L**	**T**	**P**	**O**	**C**	**CIA**	**SEE**	**Total**
DSC 10	24CMBT31	Plant Biotechnology	4	0	0	2	4	40	60	100
DSC 11	24CMBT32	Animal Biotechnology	4	0	0	2	4	40	60	100
DSC 12	24CMBT33	Pharmaceutical Biotechnology	4	0	0	2	4	40	60	100
DSC 13	24PMBT31	Plant, Animal, Pharmaceutical Biotechnology Practical	0	0	4	1	2	40	60	100
DSE 4	24DMBT3-	DSE IV	3	0	0	2	3	40	60	100
DSE 5	24DMBT3-	DSE V	3	0	0	2	3	40	60	100
SEC 3	24SSKP31	Soft Skill 3 / Sector Skill Course	2	0	0	1	2	40	60	100
			20	-	**4**	-	**22**	-	-	-

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

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

SEMESTER 4										
Category	**Code**	**Course**	**L**	**T**	**P**	**O**	**C**	**CIA**	**SEE**	**Total**
DSC 14	24CMBT41	Research Methodology	4	0	0	2	4	40	60	100
DSE 6	24DMBT4-	DSE VI	4	0	0	2	4	40	60	100
RP 1	24RMBT41	Research Project I	0	0	12	10	12	40	60	100
			8	-	**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**

DSC COURSES

Category	Code	Course	L	T	P	O	C
DSC 1	24CMBT11	Cell and Molecular Genetics	4	0	0	2	4
DSC 2	24CMBT12	Microbiology	4	0	0	2	4
DSC 3	24CMBT13	Biochemistry	4	0	0	2	4
DSC 4	24PMBT11	Cell, Microbiology and Biochemistry Practical	0	0	4	1	2
DSC 5	24CMBT21	Genetic Engineering, IPR and Bioethics	4	0	0	2	4
DSC 6	24CMBT22	Immunotechnology	4	0	0	2	4
DSC 7	24CMBT23	Bioprocess Technology	4	0	0	2	4
DSC 8	24PMBT21	Genetic Engineering & Immunotechnology Practical	0	0	4	1	2
DSC 9	24PMBT22	Bioprocess technology Practical	0	0	4	1	2
DSC 10	24CMBT31	Plant Biotechnology	4	0	0	2	4
DSC 11	24CMBT32	Animal Biotechnology	4	0	0	2	4
DSC 12	24CMBT33	Pharmaceutical Biotechnology	4	0	0	2	4
DSC 13	24PMBT31	Plant, Animal, Pharmaceutical Biotechnology Practical	0	0	4	1	2
DSC 14	24CMBT41	Research Methodology	4	0	0	2	4

DISCIPLINE SPECIFIC ELECTIVE COURSES

Category	Code	Course	L	T	P	O	C
DSE 1	24DMBT11	Bioinstrumentation	4	0	0	2	4
	24DMBT12	Nano Biotechnology	4	0	0	2	4
DSE 2	24DMBT13	Bioinformatics	4	0	0	2	4
	24DMBT14	Entrepreneurship and Management in Biotechnology	4	0	0	2	4
DSE 3	24DMBT21	Environmental Biotechnology	4	0	0	2	4
	24DMBT22	Herbal Drug Technology	4	0	0	2	4
DSE 4	24DMBT31	Genomics & Proteomics	3	0	0	2	3
	24DMBT32	Stem Cell Biology and Tissue Engineering	3	0	0	2	3
DSE 5	24DMBT33	Clinical Research	3	0	0	2	3
	24DMBT34	Agricultural Biotechnology	3	0	0	2	3
DSE 6	24DMBT41	Biotechnology and Human Welfare	4	0	0	2	4
	24DMBT42	Drug Designing	4	0	0	2	4

SKILL ENHANCEMENT COURSE

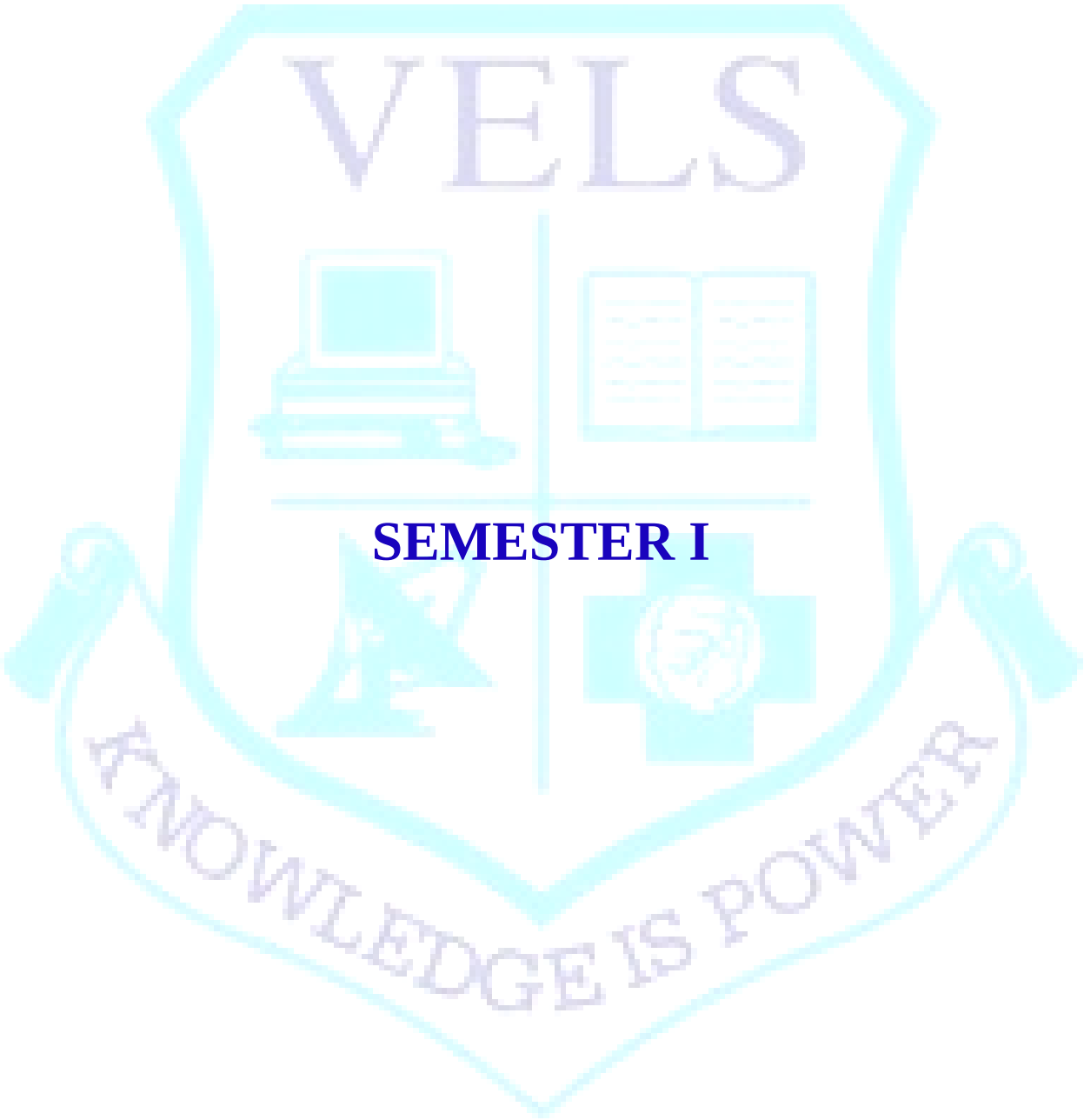
Category	Code	Course	L	T	P	O	C
SEC 1	24SSKP11	Soft Skills 1	2	0	0	1	2
SEC 2	24SSKP21	Soft Skills 2	2	0	0	1	2
SEC 3	24SSKP31	Soft Skills 3	2	0	0	1	2

SUMMER INTERNSHIP

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

RESEARCH PROJECTS

Category	Code	Course	L	T	P	O	C
RP 1	24RMBT41	Research Project I	0	0	12	10	12



SEMESTER I

24CMBT11 **CELL AND MOLECULAR GENETICS**

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVE:

Understand the basics of cell biology and to know the cellular role in depth and make the students understand the basics of genetics

UNIT I INTRODUCTION **12**

Biogenesis theory of origin of life. Cell as a Basic unit; Cell size and shape; Prokaryotic & eukaryotic cell organization. Structural comparison of microbial, plant and animal cells. Cell wall and membrane: Plasma Membrane-Model of plasma membrane; Transport across the membrane, Cell adhesion; Cell junctions; Composition of bacterial cell wall.

UNIT II CELL ORGANELLES **11**

Structure and function of cell organelle; Mitochondria, Chloroplast, Endoplasmic reticulum, Golgi complex, lysosomes, Ribosomes, Peroxisomes, Vacuoles, Centrioles and Cytosols. Nucleus and molecular organization of chromatin. Specialized cells: Motile cells, Nerve cells and nerve impulse conduction

UNIT III CELL CYCLE AND CELL SIGNALING **12**

Cell Cycle, Cell division: Mitosis, Meiosis. Cell signaling- types- G Protein receptors, Cancer and molecular basis of cancer cell behavior. Cellular Senescence and Apoptosis, Oncogenes and tumor suppressor genes.

UNIT IV INTRODUCTION TO GENETICS **12**

Mendelian laws of inheritance; non-Mendelian inheritance; Chromosomal theory of inheritance. Back cross and Test cross. Structural and numerical alterations of chromosome- Deletion, Inversion, Duplication, Translocation. Ploidy and their genetic implications. Linkage, crossing over

UNIT V GENETIC MATERIAL **13**

Structure, types, forms and functions of DNA and RNA. Replication, Transcription, Post transcriptional modification, translation, co-and post-translational modifications, Recombination, DNA damage and repair.

Total: 60 Hours

COURSE OUTCOMES:

CO-1: Summarize the features of prokaryote and eukaryote cells,

CO-2; Understand the composition and spatial organization of the cell.

CO-3: Illustrate the structure and function of different subcellular organs in the cell.

CO-4: Assess the molecular mechanisms regulating and controlling cell division and the cell cycle and exemplify how extracellular signals affect cell division.

CO-5: Elaborate on the Apoptosis, Oncogenes and tumor suppressor genes and their significance in Cancer biology

CO-6: Recall on principles in genetics and genome organization in cells

CO-7: Identify the molecular mechanisms behind DNA damage and repair.

TEXT &REFERENCE BOOKS

1. G. Karp (2010), Cell and Molecular Biology: Concepts and Experiments, 6th edition, John Wiley & Sons, Inc.
2. E. D. P. De Robertis and E. M. F. De Robertis (2006), Cell and Molecular Biology, 8th edition, Lippincott Williams and Wilkins, Philadelphia.
3. G. M. Cooper and R. E. Hausman (2009), The Cell: A Molecular Approach, 5th edition, ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
4. W. M. Becker, L. J. Kleinsmith, J. Hardin, and G. P. Bertoni (2009), The World of the Cell, 7th edition, Pearson Benjamin Cummings Publishing, San Francisco.
5. Berk, C. A. Kaiser, H. Lodish, A. Amon, H. Ploegh, A. Bretscher, M. Krieger, and K. C. Martin (2016), Molecular Cell Biology, 8th edition, W.H. Freeman, USA.
6. J. F. Griffiths, S. R. Wessler, S. B. Carroll, and J. Doebley (2010), Introduction to Genetic Analysis, 10th edition, Pearson Benjamin Cummings Publishing, San Francisco.
7. E. J. Gardner, M. J. Simmons, and D. P. Snustad (2003), Principles of Genetics, 8th edition, John Wiley & Sons, Inc.
8. M. W. Strickberger (2008), Genetics, 3rd edition, Phi Learning.
9. P. S. Verma and K. Agarwal (2004), Cell Biology, Genetics, Molecular Biology, Evolution & Ecology, S. Chand Publication.

24CMBT12 **MICROBIOLOGY**

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVE:

Demonstrate the expertise in handling and controlling of microorganisms in labs as well as in various industries and illustrate the microbial knowledge in day-to-day life

UNIT I INTRODUCTION **12**

Historical development of Microbiology, Microbial Taxonomy, systematics, identification: Taxonomical hierarchy species-type strains: culture collections; binomial nomenclature; system of classification - phonetic, numerical taxonomy. General characteristics used in classification- five kingdoms, six kingdoms and eight kingdom systems.

UNIT II MICROBIAL GROWTH **12**

Nutritional requirements and types of microorganisms, Uptake of nutrients by microorganisms. Photosynthetic microorganisms. Definition, cell division in microbes, factors affecting growth, Batch culture, continuous culture and synchronous growth; growth phases and growth curves - Chemostat, Turbidostatic.

UNIT III MUTATION AND MUTAGENESIS: **12**

UV and chemical mutagens; Types of mutation; Ames test for mutagenesis. Plasmids and Transposons. Bacterial Reproduction: Transformation, Transduction and Conjugation. Endospores and sporulation in bacteria.

UNIT IV MEDICAL MICROBIOLOGY: **12**

Pathogenesis, lab diagnosis, prevention and control of important microbial diseases. Pathogenic bacterial diseases, Fungal diseases, Viral Diseases and Protozoan diseases. Antimicrobial agents and their mode of action – antibacterial, antiviral, antifungal, antiparasitic agents

UNIT V ENVIRONMENTAL MICROBIOLOGY: **12**

Nitrate and sulfur oxidizing bacteria, Nitrate and sulfate reducing bacteria. nitrogen fixation, biofertilizers. hydrocarbon transformation. Sewage treatment methods - Role of microorganism in agriculture, food and dairy industry.

Total: 60 Hours

COURSE OUTCOME:

CO-1: Recall about microscopy and Prokaryotic and eukaryotic cells and classification

CO-2: Demonstrate about the nutritional requirement for microbial growth and

CO-3: Elaborate on the role of microbes in various fields.

CO-3: Explain about mutation and various plasmids and gene transfer mechanism

CO-5: Illustrate on pathogenesis and Lab diagnosis of important microbial diseases.

CO-6: List about various microbial diseases and antimicrobial chemicals and its actions.

CO-7: Importance of microorganisms in environmental, food industry and various applications of microbes.

TEXT & REFERENCE BOOKS

1. M. J. Pelczar, E. C. S. Chan, and N. R. Krieg (2006), Microbiology, 5th edition, Tata McGraw Hill Publishing Company.
2. L. M. Prescott, J. P. Harley, and D. A. Klein (2005), Microbiology, 6th edition, McGraw Hill.
3. K. P. Talero and A. Talero (2002), Foundations in Microbiology, 4th edition, McGraw Hill.
4. H. J. Benson (1999), Microbiological Applications: A Laboratory Manual in General Microbiology, 7th edition, McGraw Hill.
5. A. J. Salle (1986), Principles of Bacteriology, 7th edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi.
6. H. A. Modi (1995), Elementary Microbiology (Volume-1 Fundamentals of Microbiology), Akta Prakashan Nadiad, Publication.
7. D. Freifelder (1995), Microbial Genetics, Narosa Publishing House.
8. S. R. Maloy, J. E. Cronan, and D. Freifelder (1994), Microbial Genetics, 2nd edition, Jones Barlett Publishers.
9. J. G. Cappuccino and N. Sherman (no year provided), Microbiology - A Laboratory Manual, 5th edition, Editors: A. E. Wirth and L. Olsen, Wiley VCH publishers.

24CMBT13 **BIOCHEMISTRY**

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVES:

To develop understanding and provide scientific basics of the life processes at the molecular level and explain the structure, function and inter-relationships of biomolecules and their deviation from normal and their consequences for interpreting and solving clinical problems.

UNIT I BIOCHEMICAL ORGANIZATION AND BIOENERGETICS 12

Bioenergetics - and biological oxidation – general concept of oxidation and reduction, electron transport chain, oxidative phosphorylation, uncouplers and theories of biological oxidation and oxidative phosphorylation. High energy compounds, ATP cycle, Calculation of ATP during oxidation of glucose and fatty acids.

UNIT II BIOMOLECULES – CARBOHYDRATES 12

Carbohydrates – classification, properties. Starch, glycogen, dextrin, inulin, cellulose, metabolism of carbohydrates – gluconeogenesis, glycogenolysis, glycolysis. citric acid cycle, pentose phosphate pathway.

UNIT III BIOMOLECULES – LIPIDS 12

Classification, properties, Sterols, essential fatty acids, eicosanoids, phospholipids, sphingolipids, metabolism of lipids, oxidation of fatty acids, α, β - oxidation and biosynthesis of ketone bodies, cholesterol, porphyrin biosynthesis, metabolism of bile pigments.

UNIT IV BIOMOLECULES – PROTEINS & NUCLEIC ACID 12

Proteins and amino acids – Classification, properties, biosynthesis of amino acids and proteins, essential amino acids, metabolism of amino acids and proteins, Transamination & Deamination – Urea cycle. Nucleic acids – nucleoprotein, genetic code, nucleic acids, and structure of DNA and RNA, purine biosynthesis and pyrimidine biosynthesis.

UNIT V ENZYMES AND HORMONES 12

Classification, Properties, Nomenclature, enzyme kinetics, mechanism of action, Factors affecting enzyme activity, enzyme induction and inhibition, Vitamins as coenzymes, Allosteric enzymes, enzymes of clinical importance – Enzyme Markers, Hormones – classification, chemical nature and properties,

Total: 60 Hours

COURSE OUTCOMES

CO-1: Understand the importance of Bioenergetics in living system

CO-2: Explain the Structure and significance of ATP and other high-energy compounds.

CO-3: Illustrate the structure and Metabolism of carbohydrates.

CO-4: Summarise the structure and Metabolism of Lipids.

CO-5: Attain Knowledge of Protein structure and functions

CO-6: Understand on the Nucleic acid structure and functions

CO-7: Elaborate on Enzyme Classification, Mechanism and kinetics

TEXT & REFERENCE BOOKS:

1. L. Lehninger, D. L. Nelson, and M. M. Cox (2016), Principles of Biochemistry, 7th edition, CBS Publishers and Distributors.
2. R. K. Murray, D. K. Granner, P. A. Mayes, and V. W. Rodwell (1996), Harpers Biochemistry, 24th edition, Appleton and Lange, Stanford.
3. T. M. Devlin (2010), Textbook of Biochemistry with Clinical Correlations, 7th edition, Wiley Liss Publishers.
4. W. B. Burtis and E. R. Ashwood (1993), Tietz Textbook of Clinical Chemistry, 2nd edition, Saunders Company.
5. L. Stryer (2006), Biochemistry, 6th edition, W. H. Freeman and Company, New York.
6. D. Voet and J. G. Voet (2010), Biochemistry, 4th edition, John Wiley and Sons, Inc.
7. Rama Rao (2006), Textbook of Biochemistry, 9th edition, UBS Publishers' Distributors Pvt. Limited.
8. C. Deb (2001), Textbook of Biochemistry, 9th edition, New Central Book Agency (P) Ltd.

24PMBT11 CELL, MICROBIOLOGY AND BIOCHEMISTRY PRACTICAL

L	T	P	O	C
0	0	4	1	2

COURSE OBJECTIVES:

To get hands on experience on basic microscopy and its principles and functioning. To impart knowledge about various cell organelles and cell division, the students to learn and understand the principles behind the qualitative and quantitative estimation of biomolecules and to learn about the microbial techniques Like culture techniques, Staining techniques and Biochemical analysis.

LIST OF EXPERIMENTS:

CELL BIOLOGY

1. Microscopy: Bright field, phase contrast & Fluorescence Microscopy.
2. Cell Counting – Hemocytometer
3. Identification of mitotic phases from onion root tip.
4. Identification of meiotic phases from grass hopper testis / flower buds
5. Mounting epithelium and observing animal and plant cells using vital staining.

BIOCHEMISTRY

1. Qualitative tests for carbohydrates.
2. Qualitative analysis of amino acids & proteins.
3. Quantitative estimation of protein using Lowry's Reagent.
4. Quantitative analysis of urea in serum.
5. Chromatography: Separation of amino acid by Thin Layer Chromatography.

MICROBIOLOGY

1. Isolation and Culture Techniques: Pour plates, streak plates, spread plates, serial dilution
2. Preservation of culture: slants and cryopreservation
3. Isolation of microbes from water, air, soil and plant surface
4. Microscopic Methods in the Study of Microorganisms; Staining Techniques- Simple, Differential- Gram's Staining Capsule staining, Spore staining and biochemical test
5. Growth curve, Optimization of microbial growth.

Total: 30 Hours

COURSE OUTCOMES:

Upon completion of the laboratory sessions, the students will be able to

CO-1: Comparison of various stages in mitosis and meiosis

CO-2: Understand the parts and working principles of different microscopes.

CO-3: Analyze various biomolecules both quantitatively and qualitatively.

CO-4: Illustrate the principle and procedure of thin-layer chromatography for biomolecule separation.

CO-5: Explain the various methods of enzyme assays needed for clinical research.

CO-6: Examine microbes from water, air, soil and plant surface.

CO-7: Elaboration microbial techniques like culture techniques, Staining techniques and Biochemical analysis.

TEXT & REFERENCE BOOKS

1. J. Jayaraman (2011), Laboratory Manual in Biochemistry, 2nd edition, New Age International Private Limited.
2. S. K. Sawhney and R. Singh (2014), Introductory Practical Biochemistry, 5th or later edition, Narosa Publishing House, New Delhi.
3. R. C. Gupta and S. Bhargavan (2018), Practical Biochemistry, 5th edition, CBS.
4. D. T. Plummer (2006), An Introduction to Practical Biochemistry, 3rd edition, Tata McGraw Hill Publishing Company Ltd., New Delhi.
5. J. G. Cappuccino and N. Sherman (1999), Microbiology: A Laboratory Manual, 4th edition, Addison-Wesley.
6. J. G. Collee, R. S. Miles, and B. Watt (1996), Tests for the Identification of Bacteria, in J. G. Collee, B. P. Marmion, A. G. Fraser, and A. Simmons (Eds.), Mackie & McCartney Practical Medical Microbiology. 14th edition, Churchill Livingstone, New York.

L	T	P	O	C
2	0	0	1	2

24SSKP11 **SOFT SKILL 1**

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

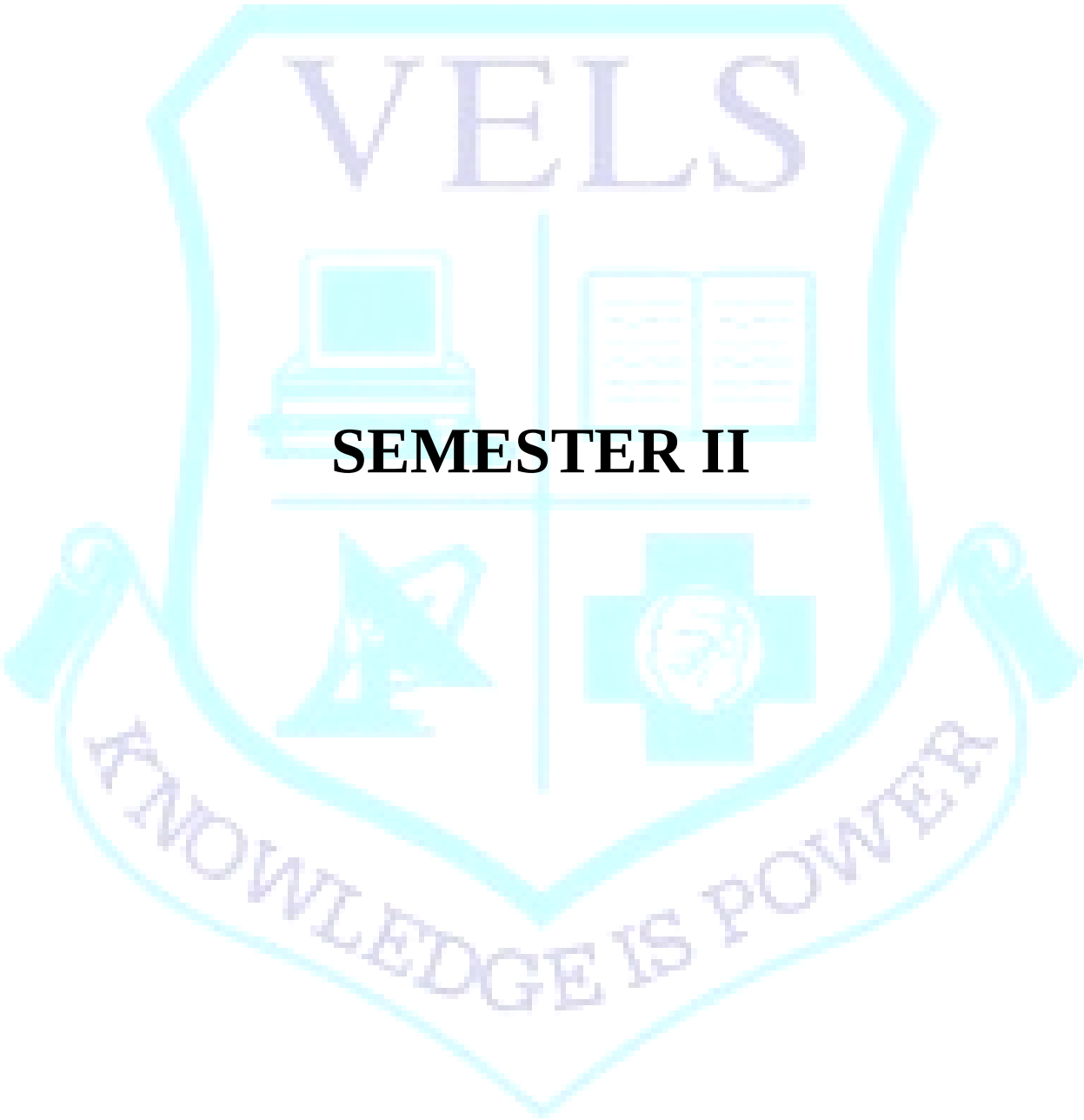
- Barun K. Mitra. Personality Development and Soft Skills. Oxford University Press. New Delhi.2011.
- S.P. Sharma. Personality Development. Pustaq Mahal. New Delhi. 2010.Meenakshi Raman

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

24CMBT21 GENETIC ENGINEERING, IPR AND BIOETHICS

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVE:

To provide fundamental theoretical knowledge about Genetic Engineering, Cloning Vector, molecular techniques.

UNIT-I INTRODUCTION TO GENETIC ENGINEERING 12

Introduction to genetic engineering: Importance and outline of genetic engineering, organization of gene and genome, gene expression- Enzymes in genetic engineering- Endo and exonucleases - Restriction endonucleases- types, and mechanism of action, Ligases - types and mechanism of action, linker, adaptor, homopolymer tailing - Polymerases types and mechanism of action- other enzymes

UNIT-II CLONING VECTORS AND THEIR APPLICATIONS 12

E. coli Vectors - Plasmids (Properties, types, In vitro construction-pBR322, pUC), Bacteriophage-lambda and M13 (Biology, Classes, in vitro construction of cloning vectors), Cosmids and phagemids and its properties- -Plant viral vectors (CAMV, Gemini) animal viral vectors (SV40, Retro viral)- Cloning in Yeast- Expression vectors.

UNIT-III ISOLATION AND TRANSFER 12

Plasmid isolation and purification method- nucleic acid and protein electrophoresis -nucleic acid staining and labelling - types of gene transfer- molecular probes - Selection and screening of recombinants – Blotting techniques - hybridization techniques – Autoradiography, PCR technology – concept, types, primer design.

UNIT-IV MODERN TECHNIQUES 12

DNA sequencing methods - DNA microarray technology - Molecular markers and types- Chromosome walking and jumping - DNA finger printing - DNA Foot printing- Site directed mutagenesis- Protein engineering - Gene therapy – types, Application of genetic engineering in medicine, Industrial and agriculture- antisense technology- recombinant vaccine

UNIT V BIOETHICS AND IPR 12

Genetically modified organism- Ethical, legal and social issues, Biosafety and its types, environmental fallout. Principles and practices – containment facilities, ethical concerns of

biotechnology research and innovation, Disposal of biowaste, Bioethics committees. Intellectual property rights - patent, copyright, trade mark, TRIPS- GATT and PBR, WTO.

Total: 60 Hours

COURSE OUTCOMES:

CO-1: Understand the basics of gene cloning and various modern techniques used in rDNA technology.

CO-2: Summarize bout genetic engineering techniques, molecular probes and blotting techniques.

CO–3: Make use of various molecular techniques and their application such as DNA sequencing and fingerprinting.

CO–4: Discuss on Gene transfer technologies and their application the Agriculture

CO-5: Explain on the gene transfer technologies in Forensic science

CO–6: Explain the international and national controls regarding biosafety and biosecurity

CO-7: Illustrate on bioethics applicable to facilities and associated scientists handling pathogens.

TEXT & REFERENCE BOOKS:

1. R. W. Old and S. B. Primrose (1998), Principles of Gene Manipulation: An Introduction to Genetic Engineering, Blackwell Sciences, U.K.
2. T. A. Brown (2010), Gene Cloning and DNA Analysis, 6th edition, Wiley Blackwell Science.
3. J. D. Watson (2004), Molecular Biology of the Gene, 5th edition, Pearson Education, Singapore.
4. H. J. Kreuzer and A. Massey (2001), Recombinant DNA and Biotechnology, ASM Press.
5. I. E. Alcamo (2001), DNA Technology, Academic Press.
6. J. M. Walker and R. Rapley (2006), Molecular Biology and Biotechnology, 4th edition.
7. B. R. Glick and J. J. Pasternak (2002), Molecular Biotechnology, Panima Publishing House, New Delhi, India.
8. S. B. Primrose (2001), Molecular Biotechnology, Panima Publishing House, New Delhi, India.
9. E. L. Winnacker (2003), From Genes to Clones, Panima Publishing House, New Delhi, India.
10. B. D. Singh (2005), Molecular Biology and Genetic Engineering, Kalyani Publishers.

24CMBT22 **IMMUNOTECHNOLOGY**

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVES

To provide a wider and global perspective of techniques involved as well as the genetic basis of the immunological diseases and their cure, with an ability to discriminate, evaluate, analyse and synthesis existing and new knowledge, and integration of the same for enhancement of knowledge

UNIT I INTRODUCTION TO IMMUNOTECHNOLOGY 12

Brief history and Introduction to Immunotechnology, immune system, components of the immune system, Antigen and Antibody, Innate and adaptive immune system, external and internal barriers, phagocytosis.

UNIT II ANTIBODIES & IMMUNODIAGNOSIS 12

Monoclonal and polyclonal antibodies – their production and characterization – Western blot analysis – Immunoelectrophoresis, SDS-PAGE – Purification and synthesis of antigens – ELISA principle and applications – Radio immuno assay (RIA) principles and applications – non-isotopic methods of detection of antigens – Enhanced chemiluminescence assay, Widal test, VDRL test.

UNIT III: CELLULAR IMMUNOLOGY 12

PBMC separation from the blood; identification of lymphocytes based on CD markers; FACS; Lympho -proliferation assay; Mixed lymphocyte reaction; macrophage cultures; cytokine bioassays-IL2, gamma IFN, TNF alpha; HLA typing.

UNIT IV: IMMUNOPATHOLOGY 12

Preparation and storage of tissues, identification of various cell types and antigens in tissues – Isolation and characterization of cell types from inflammatory sites and infected tissues, functional studies on isolated cells – Immunocytochemistry – Immuno fluorescence, Immuno- enzymatic and Immuno-ferritin techniques, immuno-electron microscopy.

UNIT V: MOLECULAR IMMUNOLOGY 12

Vaccines: Vaccine technology including DNA vaccines, identification of B and T epitopes for vaccine development. Immunodiagnosis of infectious diseases, Transplantation Immunology.

Total: 60 Hours

COURSE OUTCOME

CO-1 Understand the historical development and evolution of the immune system

CO-2: Demonstrate on the structure and function of Antigen and antibody.

CO-3: Summarize the Immunotechniques for diagnosis of various diseases and infections

CO-4: Explain the Cellular & molecular events involved in immunological processes and their regulation

CO-5: Analyze about antigen-antibody interactions and the techniques involved..

CO-6 Develop approaches in Vaccine technology and Transplantation

CO-7: Illustrate on the preparation of tissues for the anti-inflammatory studies.

TEXT & REFERENCE BOOKS

1. Roitt (1997), Immunology, 9th edition, Blackwell Scientific.
2. R. A. Goldsby, T. J. Kindt, B. A. Osborne, and J. Kerby (2003), Immunology, 5th edition, W. H. Freeman.
3. J. Punt, S. Stanford, P. Jones, and J. A. Owen (2018), Kuby Immunology, 8th edition, W. H. Freeman & Co.
4. K. Chakravarthy (2006), Immunology and Immunotechnology, Tata McGraw-Hill.
5. D. M. Weir and J. Stewart (1997), Immunology, 8th edition, Churchill Livingstone.
6. T. J. Kindt, B. A. Osborne, and R. A. Goldsby (2006), Kuby Immunology, 6th edition, W. H. Freeman and Company.

24CMBT23 **BIOPROCESS TECHNOLOGY**

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVE (EMPLOYABILITY)

To provide the students with the basics of bioprocess principles and bioreactor engineering. To develop bioengineering skills for the production of biochemical products using integrated biochemical processes.

UNIT I INTRODUCTION TO BIOPROCESS TECHNOLOGY 12

Scaling up of a Bioprocess, Upstream Processing, Downstream Processing, Fermentation- Types of Fermentation, Its significance in Industry, Submerged Fermentation and Solid-state fermentation, batch fermentation and continuous fermentation, Chemostat Fermentation

UNIT II DESIGN OF FERMENTATION PROCESS 12

Kinetics of substrate utilization, biomass growth and product formation, inhibition on cell growth and product formation. Design and operation of continuous cultures, chemostat in series, batch and fed batch cultures; Sterilization of liquid media and air, Design of batch and continuous sterilization.

UNIT III BIOREACTOR DESIGN & CONSTRUCTION 12

Basic configuration of Fermentor, Batch, continuous and fed batch cultivation; Types of Bioreactors - packed bed reactor, airlift reactor, fluidized bed reactor and bubble column reactor; Biomass estimation - direct and indirect methods.

UNIT IV DOWNSTREAM PROCESSING 12

Filtration, centrifugation, cell disruption, liquid/liquid extraction, dialysis, Purification, Drying, Packing and labelling. Chromatographic technique – HPLC.

UNIT V FERMENTATION DERIVED PRODUCTS 12

Industrial production of primary metabolites and secondary metabolites – shikimic acid, flavonoids; Fermentative production of alcohol, citric acid; Amino acid – Phenylalanine; Vitamins – Riboflavin; Antibiotics – Penicillin; Microbial production of enzymes – amylase, protease, cellulase; SCP production. Industrial Visit to production units of Biotechnology Industries.

Total Hours: 60

COURSE OUTCOMES

CO-1: Understand operation modes and select appropriate bioreactor configurations based on

the nature of bioproducts and cell lines and other process criteria.

CO-2: Illustrate on upstream and Downstream processes in Bioprocess

CO-3: Explain the type of Bioprocess and standard Lab practices.

CO-4: Design bioreactor and control process of bioreactor.

CO-5: List the different techniques involved in downstream processing.

CO-6: Demonstrate the skills and techniques to design a process for product purification.

CO-7: Explain the bioprocess application in different biotechnology industries for product production.

TEXT & REFERENCE BOOKS

1. P. F. Stanbury,., Whitaker, A., & Hall, S. J. (2008). Principles of fermentation technology. Elsevier.
2. P. T.Kalichelvan, , & Arul Pandi, I. (2009). Bioprocess technology. MJP Publishers.
3. M.Shuler, , & Kargi, F. (2002). Bioprocess engineering. Prentice Hall.
4. E. M. T. Mansi., Bryce, C. F. A., Dmain, A. L., & Alliman, A. R. (2009). Fermentation microbiology and biotechnology. Taylor and Francis.
5. L. E. Cassida, (1968). Industrial microbiology. John Wiley and Sons.
6. W. Crueger, & Crueger, A. (2000). Biotechnology: A textbook of industrial microbiology. 2nd edition. Panima Publishing Corporation.
7. M. J. Waites, , Morgan, N. L., & Rockey, J. S. (2002). Industrial microbiology. 2nd edition. Blackwell Science.

24PMBT21 GENETIC ENGINEERING AND IMMUNOTECHNOLOGY PRACTICALS

L	T	P	O	C
0	0	4	1	2

COURSE OBJECTIVE:

To educate and train the students for lab techniques of genetic engineering and gene cloning. To teach advanced techniques and skills required in diagnosis, treatment and research in Immunotechnology. To acquire knowledge concerning the principles and applications of immunoassay procedure.

LIST OF EXPERIMENTS:

GENETIC ENGINEERING

1. Isolation of genomic DNA and Plasmid DNA
2. Estimation of nucleic acids
3. identification of nucleic acids and protein (AGE, SDS).
4. Restriction and Ligation
5. Blotting Techniques – Southern, Northern
6. Transformation, selection of transformed colonies
7. PCR and Manual DNA sequencing (Demo)

IMMUNOTECHNOLOGY

1. Collection of Blood, Serum and Plasma
2. Methods of bleeding (Eg. Tail bleeding, Intravenous, intraorbital)
3. Blood smear identification of leucocytes by Giemsa stain
4. Agglutination reactions: Determination of hemagglutination titer of IgM antibodies using human RBC
5. Radial and Double immunodiffusion (Ouchterlony Double Diffusion)
6. Immunoelectrophoresis
7. Antigen-antibody reaction-Haemagglutination, precipitation-Widal and VDRL

Total Hours: 30

COURSE OUTCOME

CO-1: Demonstration of training in isolation of DNA Bacterial Culture.

CO-2: Illustrate on genomic and plasmid DNA isolation

CO-3: Understand on procedure of Agarose gel electrophoresis and SDS-PAGE

CO-4: Students will be given practical training in Purification and Quantization of nucleic acids and about selection of transformed colonies and preservation.

CO-5: Understand on immunological and clinical tests.

CO-6: Explain on Immunodiffusion techniques

CO-7: Elaborate on the principle of Immunoelectrophoresis.

TEXT & REFERENCE BOOKS:

1. J. Sambrook, Fritsch, E. F., & Maniatis, T. (2000). Molecular cloning: A laboratory manual. Cold Spring Harbor Laboratory Press.
2. D. M. Glover, & Hames, B. D. (2000). DNA cloning: A practical approach. IRL Press.
3. J. G. James, & Rao, V. B. (2001). Recombinant DNA: Principles and methodologies. Marcel Dekker Publications.
4. P.Maliga, (2000). Methods in plant molecular biology: A laboratory course manual. Cold Spring Harbor Laboratory Press.
5. E. A. Greenfield, (2014). Antibodies: A laboratory manual (2nd ed.). Cold Spring Harbor Laboratory Press.
6. F. C. Hay & Westwood, O. M. R. (2008). Practical immunology (4th ed.). Blackwell Science Ltd.

24PMBT22 BIOPROCESS TECHNOLOGY PRACTICALS

L	T	P	O	C
0	0	4	1	2

COURSE OBJECTIVE:

To learn - microbial process fundamentals, enzyme catalysis. Bioreactor design and analysis.

BIOPROCESS TECHNOLOGY

1. Growth optimization of Bacteria – Biomass estimation
2. Growth optimization of Algae - Biomass estimation
3. Fermenter design and structure
4. Inoculum preparation and sterilization
5. Isolation of amylase producing microorganisms
6. Isolation of antibiotic producing microorganisms from soil
7. Optimization of culture conditions for citric acid production
8. Effect of pH, temperature on enzyme activity
9. Immobilization of enzymes – Entrapment Method
10. Wine Production
11. Cell Disruption using chemical and enzymatic method
12. Downstream processing by Solvent extraction
13. Downstream processing by Ammonium sulphate precipitation
14. Downstream processing by Dialysis

Total: 30 Hours

COURSE OUTCOMES

CO-1: Learning of industrial important microorganism isolation

CO-2: Formulate fermentation process and fermentor design

CO-3: Evaluate the growth kinetics of microorganism and become adept with medium optimization technique

CO-4: Determine the knowledge about downstream processing

CO-5: Explain about biological and kinetic concepts underlying bioprocesses engineering

CO-6: Illustrate the importance of the Immobilization of enzymes by entrapment method.

CO-7: Elaborate the effect of temperature and pH on the activity of enzymes.

TEXT & REFERENCE BOOKS:

1. T. Palvannan, Shanmugam, S., & Sathishkumar, T. (2005). Laboratory manual on biochemistry, bioprocess and microbiology. SciTech Publications India Pvt. Ltd.
2. J. E. Bailey., & Ollis, D. F. (1986). Biochemical engineering fundamentals, 2nd edition. McGraw Hill.
3. M. L. Shuler., & Kargi, F. (1992). Bioprocess engineering. Prentice Hall.
4. P. Doran, (1995). Bioprocess engineering calculation. Blackwell Scientific Publications.
5. P. F. Stanbury., Hall, S. J., & Whitaker, A. (2016). Principles of fermentation technology. 3rd edition. Butterworth-Heinemann.
6. A. L. Demain., & Davies, J. . (2004). Manual of industrial microbiology and biotechnology. 2nd edition. ASM Press.
7. E. M. T.Mansi, , Bryce, C. F. A., & Demain, A. L. (2006). Fermentation microbiology and biotechnology. 2nd edition. CRC Press.

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

24IMPG21 **INTERNSHIP**

L	T	P	O	C
0	0	2	1	2

Course objective: Students should go for training in any biotechnological industry or laboratories and learn their laboratory techniques by hands on training. After the training, students should submit detailed reports about the training in an assignment.

- For the benefit of the students, it has been mandatory to attend a minimum of one internship/ Mini project during semester vacation
- Students should go for Internship/ Mini projects in any biotechnological industry or laboratories and learn their laboratory techniques by hands-on training.
- After the Internship/ Mini project, students should submit detailed reports about the Internship/ Mini project in printed format.
- Evaluation is based on work done, quality of report, performance in viva-voce, presentation etc.
- The report will be evaluated by a duly appointed teaching faculty from the head of department.

Total: 30hrs

Discipline Specific Elective Courses

24DMBT11 **BIOINSTRUMENTATION**

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVE:

To provide fundamental theoretical knowledge to the students about bio instruments and bio methods, its principle and operation methods.

UNIT-I: MICROSCOPIC TECHNIQUES 12

Visualization of cell and subcellular components by light microscopy, resolving powers of different microscopes, microscopy of living cells, scanning and transmission electron microscope, different fixation and staining techniques for EM, freeze-etch and freeze-fracture methods for EM, image processing method in microscopy, pH meter.

UNIT-II: BIOPHYSICAL METHOD 12

Analysis of biomolecules, Principles, instrumentation, sample preparation and applications of IR, fluorescence, circular dichroism, NMR and ESR spectroscopy, Absorption Spectroscopy, X- ray Spectroscopy. FTIR, Raman spectroscopy.

UNIT- III CENTRIFUGATION 12

Principle and Applications of various types of centrifuges, Chromatography Techniques: Principle and Application of Paper, TLC, Gel Filtration, Ion Exchange, Affinity, GC & HPLC. Cell Sorting, FACS.

UNIT-IV: ELECTROPHORESIS 12

Theory of electrophoresis and types of electrophoresis zonal, moving boundary and pulse field – their principles and applications. Capillary electrophoresis, 2D Gel Electrophoresis, Optical densitometry, Isoelectric Focusing

UNIT-V RADIO-ISOTOPIC TECHNIQUES 12

Introduction to Radioisotopes, Uses and their Biological Applications, Radioactive Decay – Types and Measurement, Principles and Applications of GM Counter, Solid and Liquid Scintillation Counter, Autoradiography, RIA, Radiation Dosimetry, Health effects of radiations.

Total Hours: 60

COURSE OUTCOME:

CO-1: Understand on Basics of Microscopy, its operation and maintenance and

CO-2: Illustrate on the advanced microscopes like SEM, TEM etc and image processing for microscopical studies.

CO-3: Illustrate about the analysis of biomolecules using spectroscopy and Applications of NMR and ESR in determination of biomolecules

CO-4: Design and demonstrate adsorption and chromatography processes for the purification of biomolecules

CO-5: Analyse the separation of Biomolecules using electrophoresis

CO-6: Apply radio-isotopes in detection and measurement of biomolecules and

CO-7: Learn biological imaging of tissues using radio-isotopes

TEXT& REFERENCE BOOKS

1. L. Veerakumari.,Bioinstrumentation, Publishers; 1st edition, 2011.
2. Webster, Bioinstrumentation, Wiley India Private Limited, 2007.
3. John G Webster, Bioinstrumentation. John Wiley & Sons, New York, Physical John, 2004.
4. F. Robyt , Bernard J. White, Biochemical Technique: Theory and Practice, - Waveland PrInc; Reprint edition, 1990.
5. K. Wilson., Walker, J. E. J. Wood, K., Walker, J, Principles and techniques of practical biochemistry Cambridge University Press, Cambridge, 5th Edition, 2000.
6. Michael R. Green, Joseph Sambrook, Molecular Cloning: A Laboratory Manual, Cold Spring Harbor Laboratory Press,U.S, 4th Edition, 2014

24DMBT12 **NANO BIOTECHNOLOGY**

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVE:

To impart knowledge on characterization, structure, function and application of Nanobiotechnology

UNIT I INTRODUCTION TO NANOBIOTECHNOLOGY 12

History and Scope of nanobiotechnology. Nanostructures: Quantum dot, Nanotubes, Nanorods, Nanofibres, Fullerenes, Nanocomposites and other Nanostructures. Characterization techniques: Dynamic Light Scattering (DLS), Scanning and Transmission Electron Microscope (SEM, TEM), X-ray Crystallography (XRD), Fourier Transform Infra-Red Spectrophotomer (FTIR), Brunauer Emmet Teller (BET).

UNIT II NANO BIOMATERIALS 12

Nano Biomaterials: Lipids, Polysaccharides, DNA - Protein nano structures. Biomolecular Design, Self- assembly of nanomolecules. Molecular Modeling and Biomolecular structure determination. Chemical, physical and biological properties of biomaterials and bioresponse.

UNIT III BIOSYNTHESIS AND PROPERTIES OF NANO BIOMATERIALS 12

Biosynthesis, structure-property relationships in polymeric materials (synthetic polymers and structural proteins); biotransformation, biomineralization, Bio-electromagnetism, Bio-mechanics, Neuro transport, Biological Rhythms.

UNIT IV CELLULAR TRANSPORTATION 12

Functions of Bio-nanomachines. Molecular recognition, cellular communication, material transfer into and within cells. Biomolecular sensing. Effects of physical, chemical and electrical stimuli on cell function and gene regulation.

UNIT V APPLICATIONS OF BIO NANOTECHNOLOGY 12

Microfabrication and Nanolithography. Nanoimaging, Application of nanobiotechnology in health science, Nanobiotechnology in Environmental sciences. Nanomedicine, Drug nanoparticles, Bio incompatibility and drug delivery. Gene Therapy, DNA computers, hybrid materials, artificial life and biosensors.

Total: 60 hours

COURSE OUTCOME:

CO-1: Learning the structure and characterization of Bio-Nanomaterials

CO-2: Understanding different nanobiomolecules, their molecular structure and assemblies

CO-3: Explain on the Chemical, physical and biological properties of biomaterials

CO-4: Knowledge on the biosynthesis and Bio properties of Nano Biomolecules

CO-5: Understanding the cellular transport, signal stimuli and communication between cells

CO-6: Learning different application of nanobiotechnology.in Environmental sciences.

CO-7: Illustrate on different application of nanobiotechnology.in Clinical Sciences.

TEXT& REFERENCE BOOKS

1. Claudia Nicolini. Nanobiotechnology Nanobiosciences. Pan Stanford Publishing Pte. Ltd, 2009.
2. Niemeyer, C.M. and Mirkin, C.A. Nanobiotechnology concepts, application and perspectives. WILEY-VCH, Verlag Gmb H & Co. 2004.
3. Manasi Karkare, Nanotechnology: Fundamentals and Applications, I K International Publishing House Pvt. Ltd ,2008.
4. David S. Goodsell, Bionanotechnology: Lessons from Nature, 1stEdition, Wiley-Liss, 2004.
5. Charles Poole, Frank Owens, Introduction to Nanotechnology, Wiley 2007.
6. Gero Decher, Joseph B. Schlenoff, Multilayer Thin Films, Wiley- VCH Verlag, GmbH & Co. KGaA, 2003.
7. Neelina H. Malsch, Biomedical Nanotechnology, 1st Edition, CRC Press, 2005.

24DMBT13 **BIOINFORMATICS**

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVE

This course covers bioinformatics fundamentals, including data analysis, sequence alignment, genome analysis, protein structure prediction, and medical applications like drug discovery, in an interdisciplinary approach merging biology, computer science, and medicine.

UNIT-I INTRODUCTION 12

Bioinformatics data nucleic acid sequence, protein sequence, protein structure, genomic, proteomic and metabolomic information, Bioinformatics databases types, design, file formats, access tools with examples, Bioinformatics tools and Resources free online tools, downloadable free tools, software packages, internet, Bioinformatics books and Journals, Bioinformatics web-portals

UNIT-II BIOINFORMATICS TOOLS 12

Sequence alignment basics, match, mismatch, similarity, scoring an alignment, gap penalty, protein vs DNA alignments, Dot-matrix alignment, pairwise alignment global and local alignment algorithms, Multiple sequence alignment-progressive alignment and Iterative alignment algorithms, consensus sequence, patterns and profiles, Database searching: Pairwise alignment based rigorous algorithm (Smith and Waterman) and Heuristic algorithms (FASTA and Blast). Multiple sequence alignment-based database searching PSI- Blast, PAM and Blosum matrices

UNIT-III STRUCTURE PREDICTION 12

Bioinformatics for genome sequencing, EST Clustering and analyses, finding genes in prokaryotic and eukaryotic genomes, Regulatory sequence analysis, Bioinformatics for Genome maps and markers, Bioinformatics for understanding Genome variation, Protein structure prediction and classification, Bioinformatics in support of Proteomic research

UNIT-IV VISUALIZATION 12

Molecular visualization tools Rasmol, Chime and Spdb viewer Structure analysis tools VAST and DALI, Structural biology - Homology modeling, Bioinformatics for micro array designing and transcriptional profiling, Bioinformatics for metabolic reconstruction, Bioinformatics for phylogenetic analysis.

UNIT-V DRUG DISCOVERY 12

Medical application of Bioinformatics disease genes, Drug Discovery History Steps in drug discovery Target Identification Target Validation QSAR Lead Identification Preclinical pharmacology and toxicology ADME Drug designing Rational drug design Computer aided drug design Ligand based approach Target based approach.

Total Hours: 60

COURSE OUTCOMES

CO-1: Proficiency in handling bioinformatics data and databases.

CO-2: Mastery of sequence alignment techniques and database searching methods.

CO-3: Application of bioinformatics in genome analysis and protein structure prediction.

CO-4: Utilization of molecular visualization tools and bioinformatics in biological analyses.

CO-5: Understanding the role of bioinformatics in medical applications.

CO-6: Illustrate on the role of Bioinformatics in metabolic reconstruction, phylogenetic analysis.

CO-7: Explain about the steps in drug discovery and disease gene identification.

TEXT& REFERENCE BOOKS

1. DassanayakeS.Ranil, Y.I.N. Silva Gunawardene., (2011). Genomic and Proteomic Techniques, Narosa Publishing House Pvt. Ltd, New Delhi.
2. Thiagarajan B, Rajalakshmi.P.A. , (2009). Computational Biology, MJP publishers, Chennai.
3. BosuOrpita, SimminderKaurThukral., (2007). Bioinformatics Databases Tools and Algorithms, Oxford University press, New Delhi.
4. Rastogi.S.C, Mendiratta.N, Rastogi.P., (2004). Bioinformatics methods and applications., Prentice-Hall of India private limited, New Delhi.
5. Lohar s. Prakash., (2009). Bioinformatics, MJP Publishers, Chennai.
6. Stephen misener and Stephen A. Krawetz., (2000). Bioinformatics methods and protocols, Humana press Inc, New Jersey.

7. Durbin.R, S.Eddy, A.Krogh and G.Mitchison, (1998). Biological sequence analysis, Cambridge university press, Cambridge.

Websites:

www.google.co.in - Search for database or tool name and find help file.

24DMBT14 ENTREPRENEURSHIP AND MANAGEMENT IN BIOTECHNOLOGY

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVE

Bio-entrepreneurship, an interdisciplinary course, revolves around the central theme of how to manage and develop life science companies and projects

UNIT I INTRODUCTION TO MANAGEMENT 12

Introduction – Meaning – nature and characteristics of Management, Scope and Functional areas of management. Management V/s Administration – Roles of Management, Levels of Management. Evolution of management thought: early, contemporary and modern.

UNIT II PLANNING AND ORGANIZATION 12

Nature, purpose and importance of planning process. Types of plans. Decision making. Importance of planning – steps in planning & planning premises. Hierarchy of plans. Components of planning. Nature and purpose of organization. Principles of organization, Types of organization. Departmentation Committees. Centralization Vs Decentralization of authority and responsibility. Nature and importance of staffing–Process of Recruitment and Selection.

UNIT III MEANING AND NATURE OF DIRECTING 12

Understanding, Supervision, motivation and leadership. Leadership styles, Motivation Theories (Abraham Maslo, Herzberg and Victor Hvrom's). Communication – Meaning and importance. Meaning and steps in controlling – Essentials of a sound control system – Methods of establishing control (in brief).

UNIT IV BIO MARKETS 12

Introduction to Bio markets - business strategy and marketing Negotiating the road from lab to the market (strategies and processes of negotiation with financiers, government and regulatory authorities), Pricing strategy, Challenges in marketing in bio business (market conditions & segments; developing distribution channels, the nature, analysis and management of customer needs), Basic contract principles, different types of agreement and contract terms typically found in joint venture and development agreements, Dispute resolution skills

UNIT V STRUCTURE OF A BIOTECHNOLOGY COMPANY 12

Start-up of Biotechnology Company, New Product Development. Entrepreneurship development

programs of public and private agencies (MSME, DBT, BIRAC, Make In India), strategic dimensions of patenting & commercialization strategies. Intellectual Property Principles in Biotechnology. Health Care Overview and Role of Government in Biotechnology. Ethical and Other Legal Issues in Biotechnology

Total: 60 Hours

COURSE OUTCOME:

CO-1: Identifying a winning business opportunity, gathering funding and launching a business. CO-

CO-2: Explain on growing and nurturing the organization and harvesting the rewards.

CO-3: Understand the various operations involved in venture creation, identify scope for entrepreneurship in biosciences.

CO-4: Illustrate the utilization of the schemes promoted through knowledge centres and various agencies.

CO-5: Knowledge on management should also help students to be able to build up a strong network within the industry.

CO-6: Critical analysis of the Indian biotech sector's development.

CO-7: Expertise in industrial management practices for biotech manufacturing.

TEXT & REFERENCE BOOKS

1. Adams, D.J., & Sparrow,J. C. (2008). Enterprise for Life Scientists: Developing Innovation and Entrepreneurship in the Biosciences.Bloxham:Scion.
2. Shimasaki, C. D. (2014). Biotechnology Entrepreneurship: Starting, Managing, and Leading BiotechCompanies.Amsterdam:Elsevier.AcademicPress isanimprint of Elsevier.
3. Jordan, J. F. (2014). Innovation, Commercialization, and Start-Ups in Life Sciences. London: CRC Press.
4. Desai, V. (2009). The Dynamics of Entrepreneurial Development and Management. New Delhi: Himalaya Pub.House.
5. Craig Shimasaki, (2014). Biotechnology Entrepreneurship: Starting, Managing, and Leading Biotech Companies [Kindle Edition] Academic Press; 1 edition,

6. Kumawat, H. S.. (2013).Modern Entrepreneur and Entrepreneurship Theory Process Practice Neha Publishers & Distributors.
7. Erik Larson (Author), Clifford Gray, (2013). Project Management: The Managerial Process with MS Project (The Mcgraw-Hill Series Operations and Decision Sciences) 6th Edition.
8. Narasimhan S.L. McLeavey D.W and Billignton P.J. (1995), Production planning and Inventory control, 2nd Ed. Prentice Hall of India.

24DMBT21 **ENVIRONMENTAL BIOTECHNOLOGY**

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVE: (EMPLOYABILITY)

The course aims to provide students with a comprehensive understanding of environmental microbiology and its applications in environmental biotechnology.

UNIT I SUSTAINABLE ENERGY SOURCES (BIOFUELS) 12

Introduction to sustainable energy sources and their environmental significance. Biofuels: Types, production methods, and environmental impact assessment. Conversion of biomass to biofuels: Ethanol, biodiesel, and biogas.

UNIT II BIOREMEDIATION AND SOIL HEALTH 12

Bioremediation: Principles, techniques, and applications in soil and water remediation. Role of microbial consortia in the degradation of organic pollutants. Soil health assessment: Importance, methods, and applications.

UNIT III PHYTOREMEDIATION AND ENVIRONMENTAL RESTORATION 12

Phytoremediation: Concepts, mechanisms, and applications in soil and water remediation. Plant-microbe interactions in phytoremediation. Environmental restoration: Strategies for ecological rehabilitation and conservation.

UNIT IV WASTEWATER TREATMENT AND SUSTAINABLE AGRICULTURE 12

Wastewater treatment technologies: Principles and applications in municipal and industrial settings. Biofertilizers: Types, production, and role in sustainable agriculture. Symbiotic and asymbiotic nitrogen-fixing bacteria: Applications in soil fertility and crop production.

UNIT V BIOMINERALIZATION AND ENVIRONMENTAL SUSTAINABILITY 12

Biomineralization: Mechanisms and applications in biomining and bioleaching. Microbial biomineralization of metals: Gold, copper, and uranium. Genetically modified microorganisms: Environmental implications and ethical considerations.

Total: 60 hours

COURSE OUTCOME

CO–1: Understand the principles of sustainable energy sources and evaluate their environmental impact.

CO–2: Apply bioremediation techniques to address soil and water pollution, emphasizing the role of microbial consortia in organic pollutant degradation.

CO–3: Explain the concepts and applications of phytoremediation,

CO-4: Analyse the strategies involved in environmental restoration and conservation.

CO–5: Evaluate wastewater treatment technologies and assess the role of biofertilizers in sustainable agriculture, focusing on nitrogen-fixing bacteria.

CO–6: Analyse the mechanisms of biomineralization in biomining and bioleaching

CO- 7: Assess the environmental implications of genetically modified microorganisms.

TEXT& REFERENCE BOOKS

1. Pradipta Kumar Mohapatra (2007) ,"Environmental Biotechnology",I.K. International Publishing House; 1st Edition.
2. Satyanarayana, U, (2013) "A Textbook of Biotechnology", Books and Allied (p) Limited.
3. Purohit S.S. (2010) "Agricultural Biotechnology", Agrobios, 3rd edition, 2010.
4. Alan Scragg, (2007)."Environmental Biotechnology", Oxford; Second edition.
5. Hans-Joachim Jordening and Jesef Winter, (2004) "Environmental Biotechnology – Concepts and Applications",Wiley VCH, 2004.
6. Metcalf and Eddy, (2003). "Waste Water Engineering", Tata McGraw hill, 4th edition,
7. Alicia L. Ragout De Spencer, JohnF.T. Spencer. (2004). "Environmental Microbiology: Methods and Protocols", Humana Press.
8. Milton Wainwright, (1999). "An Introduction to Environmental Biotechnology", Springer,

24DMBT22 **HERBAL DRUG TECHNOLOGY**

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVE (EMPLOYABILITY)

This course teaches students about the basic concept of the herbal medicine industry, the quality of raw materials, recommendation for the quality of herbal pharmaceuticals, herbal cosmetics, natural sweeteners, nutraceuticals, and so on. This subject also focuses on Good Manufacturing Practices (GMP), patenting, and regulatory difficulties for Herbal medications.

UNIT I: INTRODUCTION TO HERBS 11

Definition of herb – Source of herbs – Selection, identification, and authentication of herbal materials – Processing of raw materials – herbal drug preparation – Indian System of Medicines

UNIT II: NUTRACEUTICALS 14

Role of herb as nutraceuticals in diseases – Diabetes, Cancer, Irritable bowel syndrome and Gastro intestinal diseases. Herbs as medicinal food – Ginger, Fenugreek, Garlic, Honey, Amla, Ashwagandha, Spirulina. Herb drug and food interaction – General introduction to interaction and classification.

UNIT III: COSMETICS 10

Sources and description of raw materials of herbal origin via fixed oils, waxes, gums, colours, perfumes, protective agents, bleaching agents, antioxidants in products such as skin care, hair, and oral hygiene products. Herbal Excipients – Natural origin excipients colorants, sweetner, binder, diluents, viscosity builders, disintegrants, flavors & perfumes.

UNIT IV: EVALUATION & REGULATORY OF HERBAL DRUG 15

Evaluation - WHO & ICH guidelines for the assessment of herbal drugs Stability testing of herbal drugs. Patenting - Patenting aspects of Traditional Knowledge and Natural Products. Case study of Curcuma & Neem. Regulatory – Regulation in India, Schedule Z of drug & Cosmetic Act for ASU drugs.

UNIT V: ENTREPRENEURSHIP 10

Plant Based Industries and Institutions involved in medicinal and aromatic plant works in India. GMP in Indian system of medicine – Component of GMP (Schedule – T) and its objectives Infrastructural requirements, Working space, storage area, machinery, and equipment's, standard operating procedures, health and hygiene, documentation and records.

Total: 60 hours

COURSE OUTCOMES

CO-1: Understand the definition and sources of herbs, and the methods for selection, identification, and authentication of herbal materials

CO-2: Identify specific herbs with medicinal food properties and understand their therapeutic effects and mechanism of action.

CO-3: Describe and demonstrate the knowledge on herbal cosmetic preparation.

CO-4: Understand the competence in Evaluation and Regulatory Aspects

CO-5: Elaborate on the IPR about herbal drugs and Natural products

CO-6: Develop entrepreneurial skills for establishing and managing herbal-based businesses.

CO-7: Illustrate on GMP and its Objectives and Components

TEXT/REFERENCE BOOK

1. Textbook of Pharmacognosy by Trease & Evans.
2. Textbook of Pharmacognosy by Tyler, Brady & Robber.
3. Pharmacognosy by Kokate, Purohit and Gokhale.
4. Essential of Pharmacognosy by Dr.S.H.Ansari.
5. Pharmacognosy & Phytochemistry by V.D.Rangari.
6. Pharmacopoeal standards for Ayurvedic Formulation (Council of Research in Indian Medicine & Homeopathy).
7. Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals. Business Horizons Publishers, New Delhi, India, 2002.