Dr. M.G.R.
EDUCATIONAL AND RESEARCH INSTITUTE
DEEMED TO BE UNIVERSITY
University with Graded Autonomy Status
(An ISO 21001 : 2018 Certified Institution)
Periyar E.V.R. High Road, Maduravoyal, Chennai-95. Tamilnadu, India.

FACULTY OF ENGINEERING AND TECHNOLOGY

OUTCOME BASED EDUCATION

Curriculum and Syllabus

M.Tech Biotechnology (Full Time)

2022

DEPARTMENT OF BIOTECHNOLOGY

DEPARTMENT VISION

To be a key driver of economic growth by stimulating the regional innovation system becomes a hub for development of key innovative industrial products processes leading to the creation of spin out, spin along and spin in companies.

DEPARTMENT MISSION

Our mission is to advance knowledge of basic biological processes and apply our research discoveries to improve human health, protect our environment and enrich our economy. We strive to fulfill our mission by nurturing an outstanding environment of learning where students and faculty apply the knowledge innovatively to create useful products or processes for the society. We focus on excellence in research and teaching, as well as service to the community

CORE VALUES

- Intellectual curiosity
- Individual opportunity
- Integrity, truth and empathy
- Fun

PROGRAM EDUCATIONAL OBJECTIVES

PEOs reflect the career and professional accomplishments of graduates.

The PEOs of the B. Tech Biotechnology course follows:

PEO 1: Pursue higher studies or be employed in biotechnology or related disciplines.

PEO2: Be a successful entrepreneur in creating jobs related to applied science and technology

PEO 3: Promote ethics, sustainability and environmental responsibility in their Practice

PROGRAM OUTCOMES

PO1	**Engineering Knowledge**: Apply the Knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching, substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental consideration.
PO4	**Conduct investigations of complex problems:** Use research based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
PO5	**Modern tool usage**: Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to access societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
PO7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work**: Function effectively as an individual and as member or leader in diverse teams and in multidisciplinary settings
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large such as being able to comprehend and write effective reports and design documentation, make effective presentations and give and receive clear instructions.
PO11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to once own work as a member and leader in a team to manage projects and multidisciplinary environments
PO12	**Life –long learning:** Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

LIST OF PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO 1: Graduates will be able to apply to understand the major biological concepts, analyse the problem,design/develop,applytheappropriatetechniqueandabilitytoimplementinthevarioussector in the field of biotechnology.

PSO 2: Graduates will be able to apply reasoning informed by the contextual knowledge in societal and environmental contexts and understanding of ethical choices inherent in Biotechnology field

PSO 3: Graduates will be able to put into practice of lifelong learning and apply his/her knowledge in interpersonal and entrepreneurial skills, with strong communication and efficient able to work in team set.

MAPPING PEO WITH MISSION

	M1	M2	M3
PEO1	**3**	**2**	**3**
PEO2	**3**	**2**	**3**
PEO3	**3**	**3**	**3**

MAPPING PEO WITH PO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
PEO 1	3	3	3	3	3	2	2	2	2	2	2	2
PEO 2	2	2	2	2	2	3	3	3	2	2	2	2
PEO 3	2	2	2	2	2	2	2	3	3	3	3	3

MAPPING PEO WITH PSO

	PSO 1	PSO 2	PSO 3
PEO 1	3	3	3
PEO 2	3	3	3
PEO 3	3	3	3

M. Tech – Biotechnology (Full Time)
Curriculum and Syllabus
2022 Regulation

SEMESTER : 1

S.No	Course Code	Course Title	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C	CATEGORY
1	EMBT22001	RECOMBINANT DNA TECHNOLOGY	Ty	3	1/0	0/0	4	PC
2	EMBT22002	ADVANCED MICROBIOLOGY	Ty	3	1/0	0/0	4	PC
3	EMBT22EXX	PROGRAM ELECTIVE-I	Ty	3	0/0	0/0	3	PE
4	EMBT22EXX	PROGRAM ELECTIVE-II	Ty	3	0/0	0/0	3	PE
5	EMCC22001	RESEARCH METHODOLOGY AND IPR	Ty	3	0/0	0/0	3	ID
6	EMBT22L01	RDNA TECHNOLOGY LAB	Lb	0	0/0	4/0	2	PC
7	EMBT22L02	MICROBIAL TECHNIQUES LAB	Lb	0	0/0	4/0	2	PC
8	EMCC22IXX	AUDIT COURSE-I	IE	2	0/0	0/0	0	ID
TOTAL				17	2	8	21	

CREDITS SUB TOTAL: 21

SEMESTER: 2

S.No	Course Code	Course Title	TY/ LB / ETL /IE	L	T/SLr	P/R	C	CATEGORY
1	EMBT22003	BIOINFORMATICS	Ty	3	1/0	0/0	4	PC
2	EMBT22004	FERMENTATION TECHNOLOGY	Ty	3	0/0	0/0	3	PC
3	EMBT22EXX	PROGRAM ELECTIVE-III	Ty	3	0/0	0/0	3	PE
4	EMBT22EXX	PROGRAM ELECTIVE IV	Ty	3	0/0	0/0	3	PE
5	EMBT22L03	BIOINFORMATICS LAB	Lb	0	0/0	4/0	2	PC
6	EMBT22L04	FERMENTATION TECHNOLOGY LAB	Lb	0	0/0	4/0	2	PC
7	EMCC22IXX	AUDIT COURSE-II	IE	2	0/0	0/0	0	ID
8	EMBT22I01	TERM PAPER	IE	0	0/0	0/4	2	PC
TOTAL				14	1	12	19	

CREDITS SUB TOTAL: 19

Note:Ty/Lb/ETL/IE: Theory/Lab/Embedded Theory and lab/Internal evaluation

L/T/SLr/P/R/C: Lecture/Tutorials/Supervised Learning/Practical/Research/Credit
HS:Humanities and Social Science, ES:Engg.Science. BS:Basic Science, PC:Program core, PE:Program Elective, OE:Open Elective, P:Project

SEMESTER: 3

S.No	Course Code	Course Title	TY/ LB / ETL /IE	L	T/SLr	P/R	C	CATEGORY
1.	EMBT22005	PHARMACEUTICAL TECHNOLOGY	Ty	3	0/0	0/0	3	PC
2.	EMBT22EXX	PROGRAM ELECTIVE-V	Ty	3	0/0	0/0	3	PE
3.	EMOL22I01	OPEN ELECTIVE (NPTEL/SWAYAM/Any MOOC approved by AICTE/ UGC)	IE	3	0/0	0/0	3	ID
4.	EMBT22L05	DISSERTATION PHASE-I	Lb	0	0/0	0/10	5	P
5.	EMBT22I02	SUMMER INTERNSHIP	IE	0	0/0	4/0	2	SC
TOTAL				9	0	14	16	

CREDITS SUB TOTAL: 16

SEMESTER: 4

S.No	Course Code	Course Title	TY/ LB / ETL	L	T/SLr	P/R	C	CATEGORY
1.	EMBT22L06	DISSERTATION PHASE-II	Lb	0	0/0	10/10	10	P
2.	EMBT22I03	RESEARCH PUBLICATION	IE	0	0/0	2/2	2	PC
TOTAL				0	0	24	12	

CREDITS SUB TOTAL: 12

Note:Ty/Lb/ETL/IE: Theory/Lab/Embedded Theory and lab/Internal evaluation

L/T/SLr/P/R/C: Lecture/Tutorials/Supervised Learning/Practical/Research/Credit
HS:Humanities and Social Science, ES:Engg.Science. BS:Basic Science, PC:Program core, PE:Program Elective, OE:Open Elective, P:Project

	ELECTIVES (THEORY)							
S.No	**Course Code**	**Course Title**	**TY/ LB / ETL /IE**	**L**	**T/SLr**	**P/R**	**C**	**CATAGORY**
		PROGRAM ELECTIVE -I						
1.	EMBT22E01	Food Biotechnology	Ty	3	0/0	0/0	3	PE
2.	EMBT22E02	Developmental biology	Ty	3	0/0	0/0	3	PE
3.	EMBT22E03	Protein Science	Ty	3	0/0	0/0	3	PE
		PROGRAM ELECTIVE -II						
4.	EMBT22E04	Genomics & Proteomics	Ty	3	0/0	0/0	3	PE
5.	EMBT22E05	Biology of the Immune system	Ty	3	0/0	0/0	3	PE
6.	EMBT22E06	Instrumentation and Analysis	Ty	3	0/0	0/0	3	PE
		PROGRAM ELECTIVE -III						
7.	EMBT22E07	Cancer Biology	Ty	3	0/0	0/0	3	PE
8.	EMBT22E08	Herbal Drug Technology	Ty	3	0/0	0/0	3	PE
9.	EMBT22E09	Animal and plant Tissue culture	Ty	3	0/0	0/0	3	PE
		PROGRAM ELECTIVE -IV						
10.	EMBT22E10	Separation techniques	Ty	3	0/0	0/0	3	PE
11.	EMBT22E11	Stem cell Biology	Ty	3	0/0	0/0	3	PE
12.	EMBT22E12	Biosensors and Biomedical devices in Diagnostics	Ty	3	0/0	0/0	3	PE
		PROGRAM ELECTIVE -V						
13.	EMBT22E13	Applied Environmental Microbiology	Ty	3	0/0	0/0	3	PE
14.	EMBT22E14	Medical Biomaterials	Ty	3	0/0	0/0	3	PE
15.	EMBT22E15	Nutritional and clinical Biochemistry	Ty	3	0/0	0/0	3	PE

AUDIT COURSE-I&II							
S.NO	**Course Code**	**Course Title**	**TY/ LB / ETL /IE**	**L**	**T/SLr**	**P/R**	**C**
1.	EMCC22I01	English for Research paper writing	IE	2	0/0	0/0	0
2.	EMCC22I02	Disaster Management	IE	2	0/0	0/0	0
3.	EMCC22I03	Sanskrit For technical Knowledge	IE	2	0/0	0/0	0
4.	EMCC22I04	Value addition	IE	2	0/0	0/0	0
5.	EMCC22I05	Constitution of India	IE	2	0/0	0/0	0
6.	EMCC22I06	Pedagogy studies	IE	2	0/0	0/0	0
7	EMCC22I07	Stress management by Yoga	IE	2	0/0	0/0	0
8	EMCC22I08	Personality development through life enlightment skills	IE	2	0/0	0/0	0
9	EMCC22I09	Research and Publication Ethics	IE	2	0/0	0/0	0

Credit distribution

SEMESTER	CREDITS
I	21
II	19
III	16
IV	12
TOTAL	**68**

Table 1:Credit Distribution Format

S. No	CATEGORY	Description	No.of Courses	Credits	Total	Credit Weightage	Contact hours
1	CORE COURSES	Core Theory	4	12	28	41.17	180
		Core Lab	4	16			390
2	ELECTIVE COURSES	Department Core Electives/ Skill enhancement electives	5	15	15	22.05	225
3	OPEN ELECTIVES	Open Elective theory	1	3	3	4.4117	45
		Open Elective Lab					
4	INTERDISCIPLINARY/ ALLIED COURSES	Allied Theory			4	5.88	
		Allied Lab	2	4			90
5	HUMANITIES & SOCIAL SCIENCES , LIFE SKILLS &SOFT SKILLS	Language 1 & 2					
		English 1 & 2					
		Soft Skills					
		Foreign Language					
		Environmental Studies					
		Management Papers					
		Entrepreneurship Development					
6	PROJECTS/ INTERNSHIP/ CORE SKILL	Project	1	15	15	22.05	480
		Core Skills					
		Internship / NSS / NCC					
7	ANY OTHER	Audit course and research methodology	2	0	0	0	105
8	RESEARCH COMPONENT	Research methodology, Publication, IPR and patents etc.	1	3	3	4.4117	-
Total			**20**	**68**	**68**	**100**	**1515**

Table 2:**Revision/modification done in syllabus content:**

S.No	Course(Subject) Code	Course (Subject) Name	Concept/ topic if any,removed in current curriculum	Concept/topic added in the new curriculum	% of Revision/ Modification done
No Modification done for 2022 regulation					

Table3:

List of New courses/value added courses//life skills/Electives/interdisciplinary /courses focusing on employability/entrepreneurship/skill development.

S.No	New courses (Subjects)	Value added courses	Life skill	Electives	Inter Disciplinary	Focus on employability/ entrepreneurship/ skill development.
1				Nanotechnology		Research methodology and IPR
2				Biofuels		Mini project
3				Human Genomics		Dissertation-I
4				Biomaterials and tissue Engineering		Dissertation-II

SEMESTER-I

Subject Code: EMBT22001	Subject Name :Recombinant DNA Technology	TY/ LB / ETL /IE	L	T / S.Lr	P/ R	C
	Prerequisite: Biochemistry & Microbial Technology	Ty	3	1/0	0/0	4

T/L/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE: To gain knowledge on gene manipulation using genetic engineering methods and its importance in plant, animal and environmental biotechnology. To understand the principle behind of different enzyme es and vectors used in recombinant DNA technology.

COURSE OUTCOMES (COs) : The students will be able to

CO1	To understand the basic concept steps in the cloning such as Restriction enzymes, Vectors and screening techniques.
CO2	Utilize the knowledge on creation of a genomic library
CO3	To detect the desire gene and analysis of gene function
CO4	To understand the PCR technique
CO5	To learn about sequencing

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	3	3	2	2	1	3
CO2	3	3	3	3	3	3	3	3	2	2	1	3
CO3	3	3	3	3	3	3	3	3	2	2	1	3
CO4	3	3	3	3	3	3	3	3	2	2	1	3
CO5	3	3	3	3	3	3	3	3	2	2	1	3

COs / PSOs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

Subject Code: EMBT22001	Subject Name :Recombinant DNA Technology	TY/ LB / ETL /IE	L	T / S.Lr	P/ R	C
	Prerequisite: Biochemistry & Microbial Technology	Ty	3	1/0	0/0	4

UNIT I: BASIC CONCEPTS IN RECOMBINANTDNATECHNOLOGY **12Hrs**

Overview of nucleic acid extraction and purification methods, detection and quantitation, gel electrophoresis; Restriction Endonucleases, DNA modifying enzymes, Klenow enzyme, Cohesive and blunt end ligation, linkers and adaptors, homopolymer tailing, double digestion, TA cloning, labeling of DNA probes: Nick translation, Random priming, Radioactive and non-radioactive probes. Hybridization techniques: Northern, Southern and Colony Hybridization.

UNIT II: PROPERTIES OF CLONING VECTORS **12 Hrs**

Plasmid Vectors PBR 322, PUC19 vectors, Methods for introducing DNA into cells, Transformation, Selection of recombinants, alpha complementation, replica plating. Bacteriophage vectors : Insertion and replacement vectors, Cosmids, M13 Vectors, yeast vectors, shuttle vectors, Artificial chromosome vectors: YAC and BAC, Constitutive and Inducible Promoters, Expression vectors, GST vector, Animal Virus derived vectors-SV-40; vaccinia/baculo& retroviral vectors.

UNIT III:GENOMICLIBRARIES **12Hrs**

Construction and Evaluation of Genomic libraries, growing and storing libraries, cDNA libraries, screening libraries with gene probes, screening expression libraries with antibodies, characterization of plasmid clones. Primer design; Fidelity of thermostable enzymes; DNA polymerases; Types of PCR – multiplex, nested, reverse transcriptase, real time PCR, touchdown PCR, hot start PCR, colony PCR, cloning of PCR products, rapid amplification of cDNA ends (RACE), applications of PCR.

UNIT IV: PCRANDSEQUENCING **12Hrs**

Principles of DNA Sequencing: Sanger's method, Maxam and Gilbert method, Automated DNA sequencing, pyrosequencing, next generation sequencing, Analysis of Sequence Data: ORF identification, exon/intron boundaries, expression signals.

UNIT V: ANALYSIS OFGENEFUNCTION **12Hrs**

Analysis of Gene Function –methods for studying the promoter, transposon mutagenesis, allelic replacement and gene knockouts, complementation, protein interaction through two hybrid screening and phage display. Factors affecting expression of cloned genes, expression of cloned genes in bacteria, yeast systems, expression in insect cells baculo virus systems, mammalian systems, adding tags and signals, in vitro mutagenesis.

Total Number of Hours: 60

TEXT BOOKS:

- Jeremy Dale, MalcomeSchantz, and Nick Plant (2011) From Genes to Genomes Concepts and Applications of DNA technology (3rd Ed), Wiley Blackwell Press.
- T.A. Brown (2010) Gene Cloning and DNA analysis (6th Ed)Wiley.

REFERENCE BOOKS:

- S.B. Primrose, R.M. Twyman and R.W.Old (2001) Principles of Gene Manipulation (6th Ed) S.B.University Press.
- Joseph Sambrook, David W. Russell (2001) Molecular cloning: A laboratory Manual (3rd Ed) CSHLPress.
- Watson, Caudy, Myers, Witowski (2007) Recombinant DNA: Genes to Genomes (3rd Ed)Cold Spring Harbor Laboratory Press

Subject Code: EMBT22002	Subject Name : ADVANCED MICROBIOLOGY	TY/ LB / ETL /IE	L	T /SLr	P/ R	C
	Prerequisite: Microbiology	Ty	3	1/0	0/0	4

Ty/Lb Theory/Lab L: Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE :

- To understand the advanced metabolic pathways as well as their taxonomical classification based ontheir biochemical reactions

COURSE OUTCOMES (COs) : End of course students will able

CO1	To know the significance of Bacterial taxonomy
CO2	To memorize metabolic diversity of aerobic heterotrophs
CO3	To understand the fermentation process involved in various bacterial genus
CO4	To gain knowledge of microbial conversion
CO5	To familiarize the deterioration process

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	3	3	2	3	3	1	1	1	3
CO2	2	3	3	3	3	2	3	3	1	1	1	3
CO3	2	3	3	3	3	2	3	3	1	1	1	3
CO4	2	3	3	3	3	2	3	3	1	1	1	3
CO5	2	3	3	3	3	2	3	3	1	1	1	3

COs / PSOs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

1/**2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low**

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

Subject Code: EMBT22002	Subject Name : ADVANCED MICROBIOLOGY	TY/ LB / ETL /IE	L	T /SLr	P/ R	C
	Prerequisite: Microbiology	Ty	3	1/0	0/0	4

UNIT I:BACTERIAL TAXONOMY **12Hrs**

New approaches to Bacterial taxonomy, determination and significance of DNA Base composition, nucleic acid hybridization, RNA fingerprinting, bacterial phylogeny.

UNITII: METABOLIC DIVERSITY OFAEROBICHETEROTROPHS **12Hrs**

Diversity in energy Metabolism Entner- Mayerhalf pathway, sugar degradation via Pentose Phosphate cycle, methyl glyoxal bypass, diversity in energy metabolism.

UNITII:BACTERIALFERMENTATION **12Hrs**

Alcohol fermentation, lactate fermentation, butyrate &butanol–acetone fermentation, anaerobic food chains; Chemolithotrophic and phototropic metabolism.

UNITIV: DEGRADATION OFNATURALSUBSTANCES **12Hrs**

Cellulose degradation, microbial conversion in the rumen, xylan degradation, degradation of starch, fructans, mannan, pectin, agar, chitin, lignin; formation of humus.

UNITV: BIODETERIORATION **12Hrs**

Bio deterioration control and soil, waste and water management – Indicator microorganisms, fouling biofilms, treatment of solid waste, landfills, composting, treatment of liquid waste, biological oxygen demand.

Total Number of Hours: 60

REFERENCES

- General Microbiology, Fifth edition, (2006), Stanier RY, Ingraham JL, Wheels ML and RP Painter, Macmillan Press.
- Bacterial Metabolism, 2nd Edition (1986) Gerhard Gottschalk, SpringerVerlag.
- Microbial Ecology – Fundamentals and Applications, 4th Edition, (2005), Atlas RM and RBartha.
- General Microbiology, 7th Edition (1992), Hans G. Schlegel, Cambridge UniversityPress.

Subject Code: EMCC22001	Subject Name : Research Methodology and IPR	TY/ LB / ETL /IE	L	T / S.Lr	P/ R	C
	Prerequisite: core subjects	Ty	3	0/0	0/0	3

Ty/Lb/ : Theory/Lab L : Lecture T : TutorialP : Practical/Project R : Research C: Credits Ty/Lb Theory/Lab

OBJECTIVE: The goal is to emphasize the importance of innovation and creativity by understanding the research concepts and ethics which will aid to build the nation IPR status.

COURSE OUTCOMES (COs) : By doing this course students will

CO1	Understand research problem formulation by Analyzing research related information and its execution by following research ethics
CO2	Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
CO3	Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasise the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
CO4	Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	3	3	2	3	3	2	2	2	3
CO2	2	3	3	3	3	2	3	3	2	2	2	3
CO3	2	3	3	3	3	2	3	3	2	2	2	3
CO4	2	3	3	3	3	2	3	3	2	2	2	3

COs / PSOs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

Subject Code: EMCC22001	Subject Name : Research Methodology and IPR	TY/ LB / ETL /IE	L	T / S.Lr	P/ R	C
	Prerequisite: core subjects	Ty	3	0/0	0/0	3

UNIT 1: SELECTION, ANALYSIS AND STATEMENT OF THERESEARCHPROBLEM; 9hrs

Literature Review and Formulation of Objectives – using the following Critical thinking Skills – Drawing a Concept map, Oral Communication, Debating, Questioning, Collaborating, Evaluation and Reasoning.

UNIT 2:RESEARCH DESIGN 9hrs

Types of Study, Types of Data, Measures of Variability, Setting up the Hypotheses, data collection techniques and tools, sampling, Describing data – Charts and graphs ; Data processing – Categorization, coding, summarization.

UNIT 3: DATA ANALYSIS ANDREPORTWRITING: 9hrs

Statistical measures, Regression and correlation, significance test; Report writing – Purpose, format, content, editing and evaluation. Using Citation tools; Report for specific purposes – Theses, Journals, Grant application. Oralpresentation to an audience; use of project management digital tools and plagiarismchecking.

UNIT 4: INTRODUCTION TOINTELLECTUALPROPERTY 9hrs

Types of intellectual property rights – Patent, Copyright, Trade Mark, Industrial Design, Geographical Indication, Trade Secrets - Traditional Knowledge. Elements of Patentability - Novelty, Non Obviousness (Inventive Steps), Industrial Application – Non patentable inventions – Process of patenting – National and International – Form and Fees for IP India

UNIT 5: PRIOR ART SEARCH,PATENTDRAFTING 9hrs

Drafting patent Claims – Types of claims - Registration Procedure, Rights and Duties of Patentee; Patent infringement; Licensing – Franchising - Joint ventures; Non-Disclosure Agreements (NDAs) - Material Transfer Agreements (MTAs).

Total Number of Hours: 45

References:

- C. Vijayalakshmi and C. Sivapragasam (2011) Research Methods – Tips and Techniques, , MJPPublishers
- Deboraj Rumsey (2010) Statistics Essentials for Dummies, Wiley PublishingIncorporated
- Bouchoux (2013) Intellectual Property, DELMAR CENGAGE Learning,USA
- V K Ahuja (2017) Law Relating to Intellectual Property Rights, LexisNexis ButterworthsIndia

IMPORTANT WEB LINKS

- https://www.wipo.int/portal/en/index.html
- http://ipindia.nic.in/
- https://www.epo.org
- https://www.uspto.gov

Subject Code: EMBT22L01	Subject Name :R DNA Technology Lab	TY/ LB / ETL /IE	L	T /SLr	P/ R	C
	Prerequisite: Biochemistry Lab & Microbiology Lab	Lb	0	0/0	4/0	2

T/L Theory/Lab L : Lecture T : Tutorial P : Practical/Project R : Research C: Credits

OBJECTIVE:

- To apply the knowledge gained in Recombinant DNA technology regarding DNA, RNA and genemanipulation

COURSE OUTCOMES (COs) : Students would be able to perform

CO1	Plasmid isolation techniques
CO2	Gene expression techniques
CO3	Transformation techniques
CO4	PCR technique
CO5	Blotting technique

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	3	3	3	2	3	3
CO2	3	3	3	3	3	3	3	3	3	2	3	3
CO3	3	3	3	3	3	3	3	3	3	2	3	3
CO4	3	3	3	3	3	3	3	3	3	2	3	3
CO5	3	3	3	3	3	3	3	3	3	2	3	3

COs / PSOs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

ubject Code: EMBT22L01	Subject Name :R DNA Technology Lab	TY/ LB / ETL /IE	L	T /SLr	P/ R	C
	Prerequisite: Biochemistry Lab & Microbiology Lab	Lb	0	0/0	4/0	2

1. Preparation of Competent cells,transformation
2. Plasmid mini preps, large scalepreparation
3. Restriction analysis
4. PCR and TAcloning
5. Mutagenesis by chemical agents orUV
6. Mapping of bacterialgenes
7. Probe preparation and Southern blotting
8. RNA extraction, RNA gel, Northernblotting
9. Agrobacterium mediated Planttransformation
10. Purification of Recombinantproteins

TEXT BOOKS:

- Molecular Cloning by Sambrook etal.,

Subject Code: EMBT22L02	Subject Name :MICROBIAL TECHNIQUES LAB	TY/ LB / ETL /IE	L	T/SLr	P/ R	C
	Prerequisite: Microbiology Lab	Lb	0	0/0	4/0	2

L : Lecture T:Tutorial P : Project R : Research C: Credits Ty/Lb: Theory/Lab

OBJECTIVE:

- To understand the basic microbial systems and to know how does it help in the biodegradation andbiotransformation process.

COURSE OUTCOMES (COs) : The students will have an idea

CO1	To teach the basic concept involved in the sterilization, of a microbiology lab for conducting microbe related experiment
CO2	To understand isolation and cultivation of microbes with good laboratory practice which will help them to handle the microorganisms
CO3	Tobefamiliarwithculturalandmorphologicalcharacteristicsofmicroorganismsgrowninpureculture
CO4	To familiarize them in conducting antibiotic resistance tests
CO5	To understand the practical knowledge of various biochemical phenomena by demonstrate the experiment, their applications and interpret the results.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO12
CO1	3	3	3	3	3	3	3	3	3	2	2	3
CO2	3	3	3	3	3	3	3	3	3	2	2	3
CO3	3	3	3	3	3	3	3	3	3	2	2	3
CO4	3	3	3	3	3	3	3	3	3	2	2	3
CO5	3	3	3	3	3	3	3	3	3	2	2	3

COs / PSOs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

Subject Code: EMBT22L02	Subject Name :MICROBIAL TECHNIQUES LAB	TY/ LB / ETL /IE	L	T /	P/ R	C
	Prerequisite: Microbiology Lab	Lb	0	0/0	4/0	2

1. Sterilization techniques; Cultivation of microorganisms, use of differential and selective media, bacterial growth curve
2. Bacterial stainingtechniques
3. Biochemicalcharacterization
4. Cultivation and enumeration of bacteriophages
5. Isolation of Antibiotic resistantbacteria
6. BacterialConjugation
7. Isolation of a streptomycin resistantmutant
8. Microbial flora of mouth,skin
9. Microbiological analysis of urine and bloodspecimens
10. Species identification of unknown bacterial cultures

TEXT BOOK

- Microbiology, Laboratory Manual by Cappuccino and Sherman 6thEdition, Pearson Education,(2006)

SEMESTER-II

Subject Code: EMBT22003	Subject Name :Bioinformatics	TY/ LB / ETL /IE	L	T /SLr	P/ R	C
	Prerequisite: Protein Science /Molecular Biology	Ty	3	1/0	0/0	4

L : Lecture T:Tutorial P : Project R : Research C: Credits T/L :Theory/Lab

OBJECTIVE:

- To learn nucleotide, protein and genome databases and know about the file formats. To understand pair wise and multiple sequence alignment and the principle and to gain knowledge on approaches for gene prediction methodsin prokaryotes andeukaryotes

COURSE OUTCOMES (COs) : Upon completion of this course, students will be able to

CO1	Develop bioinformatics tools with programming skills.
CO2	Apply computational based solutions for biological perspectives.
CO3	Pursue higher education in this field.
CO4	To know different protein identification techniques
CO5	To know different gene prediction techniques

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	3	3	2	3	3	2	2	2	3
CO2	2	3	3	3	3	2	3	3	2	2	2	3
CO3	2	3	3	3	3	2	3	3	2	2	2	3
CO4	2	3	3	3	3	2	3	3	2	2	2	3
CO5	2	3	3	3	3	2	3	3	2	2	2	3

COs / PSOs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

Subject Code: EMBT22003	Subject Name :Bioinformatics	TY/ LB / ETL /IE	L	T /SLr	P/ R	C
	Prerequisite: Protein Science /Molecular Biology	Ty	3	1/0	0/0	4

UNIT I: SEQUENCE DATABASES ANDINFORMATIONRETRIEVAL **12Hrs**

NucleotideSequenceDatabases;GenBank,EMBL,DDBJ,allaspartofINSDC;accessionnumbers&annotations,Medical Databases

UNIT II: PAIRWISESEQUENCECOMPARISONS **12Hrs**

Biology of homology, PAM & BLOSSUM scoring matrices, global& local alignment algorithms, statistical significance of pairwise alignments.

UNIT III: BLAST, FASTA ANDADVANCED BLAST **12Hrs**

Database searching, FASTA algorithm, BLAST ALGORITHM, PSI BLAST, statistical significance of database searches

UNIT IV: PROTEIN SEQUENCE ANDSTRUCTURE ANALYSES **12Hrs**

Fouressentialperspectivesonproteins:(1)domainsandmotifs,(2)physicalproperties,(3)proteinlocalization,(4)protein function.GeneOntologyforthesеperspectivesinaction;proteomics-methods,practices,databasesintroductiontoprotein structure and structural genomics; principles of protein structure & protein folding - X-ray crystallography and NMR - the PDB, RCSB, SCOP, CATH, DALI, FSSP &others.

UNIT V: MSA'S OR MULTIPLESEQUENCEALIGNMENTS **12Hrs**

MSA's or Multiple Sequence Alignments: Hierarchical and non-hierarchical Methods -MSAs by PSI-BLAST , Tools for MSAs, 3D-PSSM Protein Fold Recognition (Threading) Server: Introduction to Molecular Evolution, Tree nomenclature and structure; the 4 stages of Phylogenetic Analysis, tree-building methods, NJ, MP, ML, tree-evaluation methods, the Bootstrap,Phylogenetics:Introductiontothebasics,Models,Assumptions,&Interpretations,HowtoconstructaTreein4 steps; the differences, between Parsimony, Distance, andLikelihood.

Total Number of Hours: 60

TEXTBOOKS

- Bioinformatics and Functional Genomics by Jonathan Pevsner (2003),Wiley-Liss
- Bioinfbook.org - Website dedicated to the text with updatedURLs

REFERENCES

- An Introduction to Bioinformatics Algorithms by N.C. Jones & P.A. Pevzner (2004), MITPress
- Phylogenetic Trees Made Easy: A How-To Manual, Second Edition by Barry G. Hall(2004),
- Sinauer Associates, Inc.
- Bioinformatics and Molecular Evolution by Paul G. Higgs and Teresa K. Attwood (2005),BlackwellPublishers
- Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, edited byBaxevanis&Oulette (2005),Wiley-Interscience
- Fundamental Concepts of Bioinformatics by D.E. Krane& M.L. Raymer (2003), BenjaminCummings

Subject Code: EMBT22004	Subject Name :Fermentation Technology	TY/ LB / ETL /IE	L	T /SLr	P/ R	C
	Prerequisite: Microbial Technology/Chemical Reaction Engineering/Enzyme technology	Ty	3	0	0/0	3

Ty/Lb Theory/Lab L: Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE :

- To develop bioengineering skills by explain the different aspects of bioreactors for the production of biochemicalproduct using integrated biochemicalprocesses.

COURSE OUTCOMES (COs) : At the end of studying this course students would be able to

CO1	To learn the basic growth kinetics, isolation of industrially important microbes
CO2	To gain knowledge of optimization technique and sterilization kinetics
CO3	To learn the preservation and cultivation process of different microbes
CO4	To know the basic functions and properties of fermentors.
CO5	To gain knowledge, in scale up reaction how to increase in powers and magnitude in scale down reaction which mimic same condition in small reactor vs large industrial bioreactor

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	3	3	2	1	2	3
CO2	3	3	3	3	3	3	3	3	2	1	2	3
CO3	3	3	3	3	3	3	3	3	2	1	2	3
CO4	3	3	3	3	3	3	3	3	2	1	2	3
CO5	3	3	3	3	3	3	3	3	2	1	2	3

COs / PSOs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

Subject Code: EMBT22004	Subject Name :Fermentation Technology	TY/ LB / ETL /IE	L	T /SLr	P/ R	C
	Prerequisite: Microbial Technology/Chemical Reaction Engineering/Enzyme technology	Ty	3	0/0	0/0	3

UNIT I: INTRODUCTION TOFERMENTATIONPROCESS **9Hrs**

Component parts of fermentation processes, Microbial growth kinetics-batch & continuous culture, isolation, preservation & cultivation of microbes.

UNIT II: MEDIA OPTIMIZATION &STERILIZATIONKINETICS **9Hrs**

Introduction, medium formulation, sources of media, media optimization-PlackettBurman method, medium sterilization, design of batch & continuous sterilization processes, sterilization of fermentor, sterilization of feeds & liquid waste, filter sterilization

UNIT III: DESIGNOFFERMENTER **9Hrs**

BasicFunctionsofFermenter,BodyconstructionofFermenter,Aeration&agitation,achievement&maintenanceofascetic conditions, types of fermenters, instrumentation & control (temperature, pH & pressure), Measurement & control of dissolved oxygen.

UNIT IV: AERATION&AGITATION **9Hrs**

Oxygenrequirement&supply,determinationofKLavalues(sulphiteoxidation&gassingouttechniques),factorsaffecting KLavalues(diffusivity,ionicstrength&surfaceactiveagent),effectofthedegreeofagitation&effectofmicrobialbiomass on KLa values

UNIT V: SCALE UP ANDSCALEDOWN **9Hrs**

Balance between oxygen supply and demand – controlling biomass concentration and specific oxygen uptake rate, scale – up of aeration/agitation regimes in STR, scale-up of Airlift reactors and scale down methods.

Total Number of Hours: 45

TEXT / REFERENCE BOOKS:

- Principles of Fermentation Technology - Peter F.Stanbury, Allan Whitaker, StephenJ.Hall.
- Biochemical Engineering Fundamentals – James E.Bailey, David F.Ollis : SecondEdition.

Subject Code: EMBT22L03	Subject Name : BIOINFORMATICS LAB	TY/ LB / ETL /IE	L	T /SLr	P/ R	C
	Prerequisite: Molecular Biology & Protein Science	Lb	0	0/0	4/0	2

L : Lecture T:Tutorial SLr : Supervised Learning P : Project R : Research C: Credits T/L :Theory/Lab

OBJECTIVE: To enable the students to understand. To understand basic commands in UNIX OS. To understand different biological databases. To carry out sequence and phylogenetic analysis.

COURSE OUTCOMES (COs) : After completing this course students were able

CO1	To demonstrate the protein/DNA sequence search methods.
CO2	To make the student understand sequence alignment databases
CO3	To understand and hands-on-training on the genome sequence analysis and annotation.
CO4	To analyze the comparative genomics
CO5	To use various computational tools for expression analysis to identify open reading frames, mutations, conserved region

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	3	3	2	3	3	2	2	2	3
CO2	2	3	3	3	3	2	3	3	2	2	2	3
CO3	2	3	3	3	3	2	3	3	2	2	2	3
CO4	2	3	3	3	3	2	3	3	2	2	2	3
CO5	2	3	3	3	3	2	3	3	2	2	2	3

COs / PSOs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

1/**2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low**

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

Subject Code: EMBT22L03	Subject Name : BIOINFORMATICS LAB	TY/ LB / ETL /IE	L	T /SLr	P/ R	C
	Prerequisite: Molecular Biology & Protein Science	Lb	0	0/0	4/0	2

1. Demonstration of Entrez andSRS
2. Exploring nucleotide database Gen Bank
3. Exploring Protein Database Uniprot
4. Database Searches with BLASTP and PSI BLAST
5. Protein secondary structureprediction
6. Pairwise Sequence Alignment-EMBOSS
7. Multiple sequence alignment – CLUSTALOMEGA
8. Primer BLAST
9. Phylogeneticanalysis
10. Simple Sequence Formats- Sequin(demo)

REFERENCE BOOK

- Bioinformatics and Functional Genomics by JonathanPevsner
- Bioinformatics Data Skills: Reproducible and Robust Research with Open by VinceBuffalo
- Introduction to Bioinformatics Using Action Labs by Jean-Louis Ryan Rossi, StephenSheel

Subject Code: EMBT22L04	Subject Name :Fermentation Technology Lab	TY/ LB / ETL /IE	L	T	P/ R	C
	Prerequisite: Microbial Technology/Chemical Reaction Engineering/Enzyme technology	Lb	0	0	4/0	2

Ty/Lb Theory/Lab L: Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE :

- To develop bioengineering skills by explain the different aspects of bioreactors for the production of biochemicalproduct using integrated biochemicalprocesses.

COURSE OUTCOMES (COs) : At the end of studying this course students would be able to

CO1	To learn about sterilization techniques
CO2	To learn how to produce product by using different fermentation process
CO3	To produce some important bio products
CO4	To learn using software for media optimization
CO5	To have a wide knowledge of various purification process of product

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	3	3	3	3	3	2	1	2	3
CO2	2	3	3	3	3	3	3	3	2	1	2	3
CO3	2	3	3	3	3	3	3	3	2	1	2	3
CO4	2	3	3	3	3	3	3	3	2	1	2	3
CO5	2	3	3	3	3	3	3	3	2	1	2	3

COs / PSOs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✔								

Subject Code: EMBT22L04	Subject Name :Fermentation Technology Lab	TY/ LB / ETL /IE	L	T	P/ R	C
	Prerequisite: Microbial Technology/Chemical Reaction Engineering/Enzyme technology	Lb	0	0	4/0	2

1. Heating-cooling profile and determination of cooling, heating and holding for optimizing sterilization parameters.
2. Citric acid production by (a) solid state and (b) submerged fermentation.
3. Optimization of media by using design expert software.
4. Amylase production by batchfermentor.
5. Effect of substrate consumption rate vs. product production rate for amylase production.
6. Enzyme purification by ammonium sulphate precipitation, dialysis, lyophilization and chromatography.
7. Kinetic study of enzyme.

REFERENCES:

- "Industrial Microbiology", S.C. Prescott and C.G. Dunn, McGraw-Hill Book Company,Inc. New York.Official methods of analysis ofAOAC.
- "An Introduction to Practical Biochemistry", david T. Plummer, Tata McGraw-HillPublishing Co. Ltd., NewDelhi.

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Subject Code: EMBT22I01	Subject Name : TERM PAPER	TY/ LB / ETL /IE	L	T	P/ R	C
	Prerequisite: All core papers	IE	0	0/0	0/4	2

Ty/Lb Theory/Lab L: Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:

- Students have to choose a research problem in any one of the major domains and should find solutions by doingsystematic research procedure.

COURSE OUTCOMES (COs) : The students are expected

CO1	Formulate a particular research problem
CO2	To know how to collect literature in support of their research problem.
CO3	To understand technical procedure to be followed for solving it
CO4	About the execution of the project in solving the problem
CO5	To know the presentation of the solution he/she has obtained.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	3	3	3	1	2	3
CO2	3	3	3	3	3	3	3	3	3	1	2	3
CO3	3	3	3	3	3	3	3	3	3	1	2	3
CO4	3	3	3	3	3	3	3	3	3	1	2	3
CO5	3	3	3	3	3	3	3	3	3	1	2	3

COs / PSOs	PSO1	PSO2	PSO3
CO1	2	2	2
CO2	2	2	2
CO3	2	2	2
CO4	2	2	2
CO5	2	2	2

1/**2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low**

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
								✓				

Subject Code: EMBT22I01	Subject Name : TERM PAPER	TY/ LB / ETL /IE	L	T	P/ R	C
	Prerequisite: All core papers	IE	0	0/0	0/4	2

A term paper is an elaborate research-based work on a particular topic in the domain of study. The student must choose a topic of his interest from the domain of study for a term paper. The term paper can be an original research article or review article. In case of review article, the student must refer at least 50 research/review articles and critically review other researcher's work. The term paper may be 10 -20 pages in length. The general guidelines for writing the term paper as follows:

1. Abstract
2. Introduction to explain about the broad and general statement on the topic chosen.
3. Aim /Objective of the term paper.
4. Description of methodology, concepts and arguments.
5. Identify the research gap and suggest possible future works.
6. Conclusion

Three reviews will be conducted to monitor the progress of the work. At the end of the semester, presentation must be made by the student and Viva-Voce examination will be conducted by the internal Examiner duly appointed by the Head of the department and the students will be evaluated.

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SEMESTER-III

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Subject Code: EMBT22005	Subject Name : PHARMACEUTICAL TECHNOLOGY	TY/ LB / ETL /IE	L	T / S.Lr	P/ R	C
	Prerequisite: Biochemistry	Ty	3	0/0	0/0	3

T/L Theory/Lab L : Lecture T:Tutorial SLr : Supervised Learning P : practical/Project R : Research C:Credits

OBJECTIVE: The goal is to emphasize the importance of pharmaceutical research and its usefulness in biotechnology. To impart basic concepts of drug metabolism and pharmacokinetics, manufacturing principles, and biopharmaceuticals.

COURSE OUTCOMES (COs) : By doing this course students will acquire basic fundamental knowledge

CO1	About the pharmaceutical industries and process of new drug discovery.
CO2	To understand the pharmacokinetic aspects of the drug
CO3	To understand the pharmacodynamics aspects of drugs.
CO4	To acquire basic knowledge about the preparations of various therapeutic agents
CO5	To study in detail about several biopharmaceuticals.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO8	PO9	PO10	PO11	PO12
3CO1	2	3	3	3	3	2	3	3	2	2	2	3
CO2	2	3	3	3	3	2	3	3	2	2	2	3
CO3	2	3	3	3	3	2	3	3	2	2	2	3
CO4	2	3	3	3	3	2	3	3	2	2	2	3
CO5	2	3	3	3	3	2	3	3	2	2	2	3

COs / PSOs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

1/2/3 **indicates Strength of Correlation 3- High, 2- Medium, 1-Low**

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

Subject Code: EMBT22005	Subject Name : PHARMACEUTICAL TECHNOLOGY	TY/ LB / ETL /IE	L	T / S.Lr	P/ R	C
	Prerequisite: Biochemistry	Ty	3	0/0	0/0	3

UNIT –IINTRODUCTION **9Hrs**

Pharmaceutical industry & development of drugs; types of therapeutic agents and their uses; economics and regulatory aspects.

UNIT– II DRUG ACTION, METABOLISMANDPHARMACOKINETICS **9Hrs**

Mechanism of drug action; physico-chemical principles of drug metabolism; pharmacokinetics, Pharmacodynamics

UNIT–IIICHEMOTHERAPEUTICS **9Hrs**

Chemotherapy for bacterial, fungal, viral infections, drugs acting on protozoal infection, malarial infection and Helminth parasites. Cancer chemotherapy, Drug interactions

UNIT– IV PRINCIPLES OFDRUG MANUFACTURE **9Hrs**

Compressed tablets; dry and wet granulation; slugging or direct compression; tablet presses; coating of tablets; capsule preparation; oral liquids – vegetable drugs – topical applications; preservation of drugs; analytical methods and other tests used in drug manufacture; packing techniques; quality management; GMP.

UNIT –VBIOPHARMACEUTICALS **9Hrs**

Various categories of therapeutics like vitamins, laxatives, analgesics, Contraceptives and hormones

Total Number of Hours: 45

REFERENCES:

- Gareth Thomas. Medicinal Chemistry. An introduction. John Wiley.2000.
- Katzung B.G. Basic and Clinical Pharmacology, Prentice Hall of Intl.1995.

Subject Code: EMOL22I01	Subject Name : OPEN ELECTIVE (NPTEL/SWAYAM/Any MOOC approved by AICTE/UGC)	TY/ LB / ETL /IE	L	T / S.Lr	P/ R	C
	Prerequisite: ALL PAPERS	IE	3	0/0	0/0	3

Students should register for the online course with a minimum course duration of 8 weeks through the online portals such as NPTEL/SWAYAM/Any MOOC in the beginning of the semester. The course can be core/interdisciplinary in such a way that the same course is not repeated during the course of his study.
Students are expected to attend the online classes regularly and submit the weekly assignments before the due dates. Students should appear for the online examination and submit the certificate at the end of the semester. Internal examination will be conducted by the examiners duly appointed by the head of the department.

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Subject Code: EMBT22L05	Subject Name : DESSERTATION PHASE-I	TY/ LB / ETL /IE	L	T / S.Lr	P/ R	C
	Prerequisite: All core papers	Lb	0	0/0	0/10	5

Ty/Lb Theory/Lab L: Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:

- Students have to choose a research problem in any one of the major domains and should find solutions by doing systematic research procedure.

COURSE OUTCOMES (COs) : The students are expected

CO1	Formulate a particular research problem
CO2	To know how to collect literature in support of their research problem.
CO3	To understand technical procedure to be followed for solving it
CO4	About the execution of the project in solving the problem
CO5	To know the presentation of the solution he/she has obtained.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	3	3	3	1	2	3
CO2	3	3	3	3	3	3	3	3	3	1	2	3
CO3	3	3	3	3	3	3	3	3	3	1	2	3
CO4	3	3	3	3	3	3	3	3	3	1	2	3
CO5	3	3	3	3	3	3	3	3	3	1	2	3

COs / PSOs	PSO1	PSO2	PSO3
CO1	2	2	2
CO2	2	2	2
CO3	2	2	2
CO4	2	2	2
CO5	2	2	2

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					

Subject Code: EMBT22L05	Subject Name : DESSERTATION PHASE-I	TY/ LB / ETL /IE	L	T	P/ R	C
	Prerequisite: All core papers	Lb	0	0/0	0/10	5

Students are expected to do the Project individually. He or she should identify the area/topic of the Project and should collect the literatures related to the project. Students intending to do Industrial projects will approach the industries with the support of the university, identify the industrial problem and finalize the project. In case of Industrial projects apart from Industry guide, a guide has to be appointed by the department. At the end of the Semester the students should submit their Project Phase - I report to the Department and Viva -Voce examination will be conducted by the examiners duly appointed by the Head of the department.

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Subject Code: EMBT22I02	Subject Name :SUMMER INTERNSHIP	TY/ LB / ETL /IE	L	T	P/ R	C
	Prerequisite: All core papers	IE	0	0/0	4/0	2

Ty/Lb Theory/Lab L: Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:

Students have to choose a research problem in any one of the major domains and should find solutions by doing systematic research procedure.

COURSE OUTCOMES (COs) : The students will have to know

CO1	About the nature of the research problems
CO2	About the technical procedure to be followed for solving it
CO3	About the execution and presentation of the solution he has obtained.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2	2	2	2	2	2	1	2	3
CO2	2	2	2	2	2	2	2	2	2	1	2	3
CO3	2	2	2	2	2	2	2	2	2	1	2	3

COs / PSOs	PSO1	PSO2	PSO3
CO1	2	2	2
CO2	2	2	2
CO3	2	2	2

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
								✓				

Subject Code: EMBT22I02	Subject Name : SUMMER INTERNSHIP	TY/ LB / ETL /IE	L	T	P/ R	C
	Prerequisite: All core papers	IE	0	0/0	4/0	2

Students are supposed to undergo internship in related Industries for a minimum period of 30days cumulatively during the semester. They have to prepare a report on the Internship with a certificate in proof from competent authority in the industry. At the end of the semester Viva-Voce examination will be conducted by the Examiners duly appointed by the Head of the department and the students will be evaluated.

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SEMESTER-IV

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Subject Code: EMBT22L06	Subject Name : DESSERTATION PHASE-II	TY/ LB / ETL /IE	L	T / S.Lr	P/ R	C
	Prerequisite: All core papers	Lb	0	0/0	10/10	10

Ty/Lb Theory/Lab L: Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:

- The objective of the Main Project is to culminate the academic study and provide an opportunity to explore a problem or issue, address through focused and applied research under the direction of a faculty mentor. The project demonstrates the student's ability to synthesize and apply the knowledge and skills acquired to real-world issues and problems. This project affirms the students to think critically and creatively, find an optimal solution, make ethical decisions and to present effectively.

COURSE OUTCOMES (COs) : The students will have to know

CO1	Apply the knowledge and skills acquired in the course of study addressing a specific problem or issue.
CO2	To encourage students to think critically and creatively about societal issues and develop user friendly and reachable solutions
CO3	To refine research skills and demonstrate their proficiency in communication skills.
CO4	To take on the challenges of teamwork, prepare a presentation and demonstrate the innate talents.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	3	2	2	2	3	3
CO2	3	3	3	3	3	3	3	2	2	2	3	3
CO3	3	3	3	3	3	3	3	2	2	2	3	3
CO4	3	3	3	3	3	3	3	2	2	2	3	3

COs / PSOs	PSO1	PSO 2	PSO 3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					

Subject Code: EMBT22L06	Subject Name : DESSERTATION - PHASE-II	TY/ LB / ETL /IE	L	T / S.Lr	P/ R	C
	Prerequisite: All core papers	Lb	0	0/0	10/10	10

To make the students to make use of the knowledge and skill developed during their four years of study and to apply them for making an innovative product/process for the development of society and industries.

Students are expected to do a Project work either in an Industry or at the University in the field of relevant Engineering /inter-disciplinary /multi-disciplinary area in a group of 3 or 4 students. The work to be carried out in Phase II should be continuation of Phase I. Each group will be allotted a guide based on the area of Project work. In case of industrial Project external guide has to be allotted from Industry. Inter disciplinary/multi-disciplinary project can be done with students of different disciplines as a group. Monthly reviews will be conducted during the semester to monitor the progress ofthe project by the project review committee. Students have to submit the Project thesis at the end of the semester and appear for the Project Viva-Voce examination conducted by the examinersduly appointed by the Controller of Examination.In case of industrial project certificate in proof has to be included in the report along with the bonofide certificate.

Subject Code: EMBT22I03	Subject Name : RESEARCH PUBLICATION	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: All core papers	IE	0	0/0	2/2	2

T/L Theory/Lab L: Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:

- The objective is to make students write manuscript and publish it in the form of paper in reputed journals

COURSE OUTCOMES (COs) : The students will have to know

CO1	How to search literature supporting their research findings
CO2	To encourage students to present their findings in the form of abstract
CO3	To write their research findings in the form of introduction materials and methods and results and discussion as per journal format .
CO4	To get familiarize with journal reference writing .

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	3	2	2	2	3	3
CO2	3	3	3	3	3	3	3	2	2	2	3	3
CO3	3	3	3	3	3	3	3	2	2	2	3	3
CO4	3	3	3	3	3	3	3	2	2	2	3	3

COs / PSOs	PSO1	PSO 2	PSO 3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3

1/**2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low**

Category	Program Core	Program elective	Humanities and social Science	Open Elective	Skill enhancing elective	Inter Disciplinary/Allied	Skill Component	Practical /Project/internship	Others			
								✓				

Subject Code: EMBT22I03	Subject Name : RESEARCH PUBLICATION	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: All core papers	IE	0	0/0	2/2	2

Students are supposed to prepare and publish the article based on either his term paper or area of research in peer reviewed referred journal. Code of research publication ethics should be followed. After publishing the article students should present a seminar in presence of department faculties and PG students. At the end of semester viva examination will be conducted by the examiners appointed by the Head of the department.

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ELECTIVE -I

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Subject Code: EMBT22E01	Subject Name :FOOD BIOTECHNOLOGY	TY/ LB / ETL /IE	L	T / S.Lr	P/ R	C
	Prerequisite: Biochemistry/Microbiology	Ty	3	0/0	0/0	3

Ty/Lb Theory/Lab L: Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE :

- To learn role of food additives in food processing and preservation. To know the role of bacteria, yeast andmould in food processing and role of fermentation offood.

COURSE OUTCOMES (COs) : At the end of studying this course the student to

CO1	To understand the role of microorganism in various food products
CO2	To have a knowledge of starter cultures and its various applications
CO3	To improve the preservation technologies and the storage stability of food preservation
CO4	To be aware of food borne diseases .
CO5	To understand consumer perspective of food biotechnology

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	3	3	3	2	2	3	3	2	1	3
CO2	1	3	3	3	3	2	2	3	3	2	1	3
CO3	1	3	3	3	3	2	2	3	3	2	1	3
CO4	1	3	3	3	3	2	2	3	3	2	1	3
CO5	1	3	3	3	3	2	2	3	3	2	1	3

COs / PSOs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

1/**2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low**

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

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Subject Code: EMBT22E01	Subject Name :FOOD BIOTECHNOLOGY	TY/ LB / ETL /IE	L	T / S.Lr	P/ R	C
	Prerequisite: Biochemistry/Microbiology	Ty	3	0/0	0/0	3

UNIT I:HISTORICALBACKGROUND **9Hrs**

History of microorganism in food, Historical developments, Taxonomy: role and significance of microorganism in foods, Intrinsic and extrinsic parameters of foods that affect microbial growth, Microorganisms in fresh meats and poultry, Processed meats, sea foods, Fermented and fermented dairy products and miscellaneous food products.

UNIT II:STARTERCULTURES **9Hrs**

Cheeses, beer, wine and distilled spirits, SCP, Medical foods, Probiotics and Health benefits of fermented milk and food products; Brewing ,malting ,mashing, hops, Primary and secondary fermentation: Biotechnological improvements, catabolic repression ,High gravity brewing , B – glucan problem, Getting rid of diacetyl, Beer , wine and distilled spirits.

UNIT III: NUTRITIONAL BOOSTS ANDFLAVOUR ENHANCERS **9Hrs**

Emerging processing and preservation technologies for milk and dairy products. Microbiological examination of surfaces, Air sampling, metabolically injured organisms, Enumeration and detection of food – borne organisms. Bioassay and related methods.

UNIT IV:FOODPRESERVATION **9Hrs**

Food preservation using irradiation, Characteristics of radiations of interest in Food preservation, Principle underlying the destruction of microorganisms by irradiation, Processing of foods for irradiation, Application of Radiation, Radappertization, Radicidation, and Radurization of foods legal status of food irradiation,Effect of irradiation of food constituents.

UNIT V: STORAGE STABILITY FOOD PRESERVATION WITHLOWTEMPERATURES **9Hrs**

Food preservation with temperatures, Preservation of food by drying, Indicator and food- borne pathogens, Other proven and food- borne pathogens. Psychrotrophs, Thermophiles and radiation resistant microorganisms, Characteristic and growth of thermophilic microorganisms, Nature and radiation resistance in microorganism, Rheology of food products. Consumer perspective and future of food biotechnology

Total Number of Hours: 45

TEXT/REFERENCE BOOKS:

- Modern food microbiology by James M .jay, food- borne pathogens 2000

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Subject Code: EMBT22E02	Subject Name : DEVELOPMENTAL BIOLOGY	TY/ LB / ETL /IE	L	T / S.Lr	P/ R	C
	Prerequisite: Cell Biology	Ty	3	0/0	0/0	3

Ty/Lb Theory/Lab L: Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE: To study the principles of developmental biology in the early embryonic development.

COURSE OUTCOMES (COs) :At the end of this course the students gain knowledge about

CO1	The history of embryology
CO2	The basic concepts of developmental signal and its importance
CO3	To know about the phenotypic and genotypic determination using the model systems such as *Drosophila* and *C.elegans*
CO4	The basic concepts of morphogenesis stages
CO5	The molting and metamorphosis stages in the development

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	3	3	3	3	3	3	2	1	3
CO2	2	3	3	3	3	3	3	3	3	2	1	3
CO3	2	3	3	3	3	3	3	3	3	2	1	3
CO4	2	3	3	3	3	3	3	3	3	2	1	3
CO5	2	3	3	3	3	3	3	3	3	2	1	3

COs / PSOs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

1/**2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low**

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

Subject Code:	Subject Name : DEVELOPMENTAL BIOLOGY	TY/ LB / ETL /IE	L	T / S.Lr	P/ R	C
EMBT22E02	Prerequisite: Cell Biology	Ty	3	0/0	0/0	3

UNIT I: HISTORY &BASICCONCEPTS **9 Hrs**

The origins of developmental biology, concepts in development – developmental signals in cell division & differentiation, role of gene expression in development, identifying developmental genes, cell commitment & differentiation & induction of cell fate, concept of morphogen& positional information. An introduction to Model systems : Model vertebrate organisms : *X. laevis*, Chicken, Mouse, Zebrafish, Model invertebrate organisms: *D. melanogaster*, *C.elegans*, Model Plant: *A.thaliana*

UNIT II: GERM CELLS& SEX **9Hrs**

Genotypic&phenotypicsex-determinationinmammals,*D.melanogaster*&*C.elegans*,structure&Formationofgermcells, fertilization.PatterningtheVertebrateBodyPlan:Axes&Germlayers,settingupthebodyaxes,theorigin&specification ofbodyaxes&roleofmaternalgenes,theMesoderm&EarlyNervoussystem,Somiteformation&Patterning,roleofthe organizer region & neural induction.

UNIT III: DEVELOPMENT OFTHEDROSOPHILA **9Hrs**

Body plan, specification of body axes & role of maternal genes, polarization of body axes during oncogenesis, patterning of early embryo & role of zygotic genes, segmentation & role of pair-rule genes, compartments & role of segment polarity genes. Development of Nematodes & Cellular Slime Molds : Developmental axes determination in *C.elegans*, Cell fate specification in *C.elegans*, Larval development in *C.elegans*, Vulva development in *C.elegans*, patterning of the slug in slime mould, cell differentiation in slime mold, aggregation

UNITIV:MORPHOGENESIS **9Hrs**

Kinds of cleavage &blastulation, types of tissue movement in gastrulation, gastrulation in amphibians & mammals, neural tube formation & neural crest migration Cell Differentiation & Organogenesis : Amphibian metamorphosis, insect imaginal disc & wing development

UNIT V: MOLTING&METAMORPHOSIS **9Hrs**

Amphibian metamorphosis, insect metamorphosis Plant Development: Pattern development in early embryogenesis of angiosperms, floral development

Total Number of Hours: 45

TEXT/REFERENCE BOOK:

❖ Developmental Biology by Scott F.Gilbert (1997), Sinauer Associates,Inc.

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Subject Code: EMBT22E03	Subject Name :Protein Science	TY/ LB / ETL /IE	L	T / S.Lr	P/ R	C
	Prerequisite: Biochemistry	Ty	3	0/0	0/0	3

Ty/Lb Theory/Lab L: Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:

- To impart knowledge on the different aspects of protein such as structure characterization and diseases associated with the protein folding and misfolding

COURSE OUTCOMES (COs) : The students will be able

CO1	To recapitulate the knowledge on protein structure and its properties
CO2	To learn different methods in characterizing proteins.
CO3	To remember the protein structure determination
CO4	To Understand the mechanism of protein folding and misfolding
CO5	To learn protein structure prediction and modeling

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	3	3	2	2	1	3
CO2	3	3	3	3	3	3	3	3	2	2	1	3
CO3	3	3	3	3	3	3	3	3	2	2	1	3
CO4	3	3	3	3	3	3	3	3	2	2	1	3
CO5	3	3	3	3	3	3	3	3	2	2	1	3

COs/PSOs	PSO1	PSO2	PSO3				
CO1	3	3	3				
CO2	3	3	3				
CO3	3	3	3				
CO4	3	3	3				
CO5	3	3	3				

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

Subject Code: EMBT22E03	Subject Name :Protein Science	TY/ LB / ETL /IE	L	T / S.Lr	P/ R	C
	Prerequisite: Biochemistry	Ty	3	0/0	0/0	3

UNIT I: PROTEIN STRUCTUREANDCLASSIFICATION **9Hrs**

Protein Structure and Classification: Amino acids classification, primary, secondary, tertiary and quaternary structure of proteins, protein stability and denaturation. General classes of protein structures and function. Protein folding patterns. Protein databases, Molecular Viewers to display protein structures.

UNIT II: METHODS OF CHARACTERIZING PROTEINSINSOLUTION **9Hrs**

Methods of Characterizing Proteins in solution, Absorbance and fluorescence of proteins, Fluorescence resonance energy transfer, circular dichroism, Protein structure determination – X-ray crystallography, Nuclear magnetic resonance spectroscopy,Lowtemperatureelectronmicroscopy,Massspectrometry,ProteinSequencing,Catalysisbyenzymes-serine proteases; protein conformational changes, control of proteinactivity.

UNITIII:MOTIFS **9Hrs**

MOTIFS, helix turn helix motifs, BETA structures, folding and flexibility, signal transduction, Membrane proteins fibrous proteins.

UNIT IV:PROTEINENGINEERING **9Hrs**

Protein Engineering, folding, prediction and design-Protein folding, effect of denaturants on rate of folding and unfolding, chaperones, folding funnels, protein misfolding and GroEL – GroES chaperone protein. Protein structure prediction and modelling – CASP, homology modeling, threading, prediction of novel folds, prediction of protein function. evolution of NAD-binding domain of dehydrogenases; mechanisms of protein evolution – divergence, recruitment and mixing and matching of domains.

UNITV: PROTEIN INTERACTIONS AND PROTEINSINDISEASE **9Hrs**

Protein Interactions and Proteins in disease – General properties of protein-protein interfaces, protein-DNA interaction& transcription factors eg. – Lambda cro, leucine zippers, zinc fingers, membrane proteins. Diseases due to absent or dysfunctional proteins and protein aggregation

Total no of Hours: 45

TEXT BOOK:

- ArthurM.Lesk,(2004)*IntroductiontoProteinScience:Architecture,FunctionandGenomics.*OxfordUniversity Press

REFERENCE BOOK

- Carl Barnden and Tooze, (1999) *Introduction to Protein Structure* , (2nd Ed) Garland publishing Inc.

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ELECTIVE -II

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Subject Code: EMBT22E04	Subject Name :GENOMICS AND PROTEOMICS	TY/ LB / ETL /IE	L	T / S.Lr	P/ R	C
	Prerequisite: Molecular Biology/Recombinant DNA Technology	Ty	3	0/0	0/0	3

T/L/ : Theory/Lab L : Lecture T:Tutorial SLr : Supervised Learning P :Practical / Project R : Research C:Credits

OBJECTIVE: To enlighten the students about the prokaryotic and eukaryotic genome .To give a background idea about the protein such as characterization including their structure and associated diseases due to their misfolding.

COURSE OUTCOMES (COs) : At the end of this course the students gain knowledge about

CO1	Structure and organization of prokaryotic and eukaryotic genome
CO2	Understanding the Pharmacogenetics and Epigenetics concepts
CO3	On different methods in characterizing proteins and protein structure determination
CO4	The protein structure prediction and modeling and mechanism of protein folding and misfolding
CO5	The importance of Human genome project in health and illness

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	3	3	3	1	3	3	3	2	1	3
CO2	1	3	3	3	3	1	3	3	3	2	1	3
CO3	1	3	3	3	3	1	3	3	3	2	1	3
CO4	1	3	3	3	3	1	3	3	3	2	1	3
CO5	1	3	3	3	3	1	3	3	3	2	1	3

COs / PSOs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

Subject Code: EMBT22E04	Subject Name :GENOMICS AND PROTEOMICS	TY/ LB / ETL /IE	L	T / S.Lr	P/ R	C
	Prerequisite: Molecular Biology/Recombinant DNA Technology	Ty	3	0/0	0/0	3

UNITI:INTRODUCTION **9Hrs**

Features of prokaryotic, eukaryotic, and organellar genomes, Genome sizes – C value paradox**,** gene counting; Principles of DNA sequencing, automated DNA sequencing, Shotgun sequencing, counting assembly.

UNIT II: WHOLE GENOMEANALYSISMETHODS **9Hrs**

Physical vs. Genetic mapping, Gene finding methods for prokaryotes, eukaryotes, RNA structural analyses, analysis of sequences, Gene Ontology, examples with bacterial, plant and animal model organisms.

UNIT III:FUNCTIONALGENOMICS **9Hrs**

Analysis of Gene Expression, subtractive cDNA library, differential display analysis, SAGE, TOGA, cDNA microarrays, creation of knockout plants and animal cell lines.

UNITIV: PROTEOMICS **9Hrs**

Methodsforproteincharacterization:2-DGels,westernblotting,Edmanproteinmicrosequencing,aminoacidcomposition, mass spectrometry; protein-protein interactions screening methods and databases, protein ligandinteractions.

UNIT V: **9Hr**

Human Genome Project, Genes and Diseases, SNP analysis, pharmacogenomics, Metabolic Engineering

Total Number of Hours: 45

TEXT BOOK:

- Functional Genomics , Practical Approach, edited by S.P.Hunt and F.J. Livesay,Oxford Indian Edition(2002)
- Principles of Protein structure, G.E. Schulz and R.H. Schirmer, SpringerInternational Edition (2004)

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Subject Code: EMBT22E05	Subject Name :BIOLOGY OF THE IMMUNE SYSTEM	TY/ LB / ETL /IE	L	T / S.Lr	P/ R	C
	Prerequisite: Biochemistry & Microbiology	Ty	3	0/0	0/0	3

Ty/Lb Theory/Lab L: Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:

- To understand the role of immune system, to gain knowledge on different lymphoid organs and types ofimmunity and immune responses produced. To acquire knowledge on development, maturation, activation and differentiation of T-cells and B-cells

COURSE OUTCOMES (COs) : At the end of studying this course students would be able

CO1	To have a wide knowledge on the introduction of immunology. with molecular level of antibody and antigen reactions
CO2	To understand the mechanism of immune response
CO3	Understand the molecular level antigen and antibody reactions
CO4	Understand the mechanism of hypersensitive reactions
CO5	To have wide knowledge of various application in the field of immunology

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	3	2	2	3	3	2	2	2	3
CO2	2	3	3	3	2	2	3	3	2	2	2	3
CO3	2	3	3	3	2	2	3	3	2	2	2	3
CO4	2	3	3	3	2	2	3	3	2	2	2	3
CO5	2	3	3	3	2	2	3	3	2	2	2	3

COs / PSOs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

1/**2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low**

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

Subject Code: EMBT22E05	Subject Name :BIOLOGY OF THE IMMUNE SYSTEM	TY/ LB / ETL /IE	L	T / S.Lr	P/ R	C
	Prerequisite: Biochemistry & Microbiology	Ty	3	0/0	0/0	3

UNIT I: INTRODUCTIONTOIMMUNOLOGY **9Hrs**

Properties of immune response, Innate and acquired immunity, Active and passive immunity, Cells and tissue of immune system: Lymphocytes, classes of lymphocytes, Antigen presenting cells, NK cells, Mast cells, Dendritic cell, Organ of immune system, Bone marrow, Thymus, Lymph node, Spleen, CALT, MALT.

UNIT II:MOLECULARIMMUNOLOGY **9Hrs**

Molecular structure of antibody, Classification, Isotypes, Synthesis assembly and expression of immunoglobulin molecules, Nature of antigens, Function and diversity, Generation of antibody diversity.

UNITIII:ANTIGENS **9Hrs**

Different characteristics of antigens, Mitogens, Hapten, Immunogen, Adjuvants. MHC: Discovery of MHC complex,Role of MHC, Structure of MHC molecule, binding of peptides to MHC molecules, MHCrestriction.

UNIT IV: EFFECTER MECHANISM OFIMMUNERESPONSE **9Hrs**

Cytokines, T-cell receptors, Cell activation Complement system, Antigen processing and presentation, Regulation of immune response. Immunological techniques: Antigen – antibody reactions, Immuno diffusion, Immuno electrophoresis, ELISA, RIA, and Fluorescence activated cell sorter.

UNIT V:APPLIEDIMMUNOLOGY **9Hrs**

Immune system in health and disease, autoimmunity, Hypersensitivity, Tumour immunity, Tissue and Organ transplant, Synthetic vaccines. Hybridoma Technology: Fusion of myeloma cells with lymphocytes, Production of monoclonal antibodies and their application.

Total Number of Hours: 45

TEXT/REFERENCE BOOKS

- Kuby- immunology (4th edition) by R.A Goldsby, T.J Kindt, B.A.Osborne
- Essentials of immunology (6th edition): Ivan Riot- Blakswell scientific publications, Oxford,1988.
- Fundamentals of immunology: Paul W. E. (Eds.) Raven press, New York,1988
- Antibodies A laboratory Manual: Harlow and David Lane (1988), Cold spring Harborlaboratory.

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Subject Code: EMBT22E06	Subject Name :INSTRUMENTATION AND ANALYSIS	TY/ LB / ETL /IE	L	T	P/ R	C
	Prerequisite: Electronics & Electrical	Ty	3	0	0/0	3

Ty/Lb Theory/Lab L: Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:

- To impart adequate knowledge of scientific understanding of the basic concepts in instrumentation used inBiotechnology

COURSE OUTCOMES (COs) : At the end of this course the students would be able

CO1	To provide an understanding and skills in advanced methods of separation
CO2	To provide practical experience in selected instrumental methods of analysis
CO3	To familiarize with advanced methods of analysis of separated molecules
CO4	To make the students to know the principle behind each instruments
CO5	To develop skills of students in instrumentation and biological techniques

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	3	3	2	2	3	3
CO2	3	3	3	3	3	3	3	3	2	2	3	3
CO3	3	3	3	3	3	3	3	3	2	2	3	3
CO4	3	3	3	3	3	3	3	3	2	2	3	3
CO5	3	3	3	3	3	3	3	3	2	2	3	3

COs / PSOs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

Subject Code: EMBT22E06	Subject Name :INSTRUMENTATION AND ANALYSIS	TY/ LB / ETL /IE	L	T	P/ R	C
	Prerequisite: Electronics & Electrical	Ty	3	0	0/0	3

UNIT I: **SPECTROSCOPY - I &THERMALMETHODS** **9 Hrs**

Introduction to principles and applications of spectroscopic methods – UV-Vis, IR, Fluorescence &Phosphorescence ORD, CD, DSC

UNIT II: SPECTROSCOPY - II&DIFFRACTION **9Hrs**

Introduction to principles and applications of spectroscopic methods ESR, AAS, AFS, AES, Mass spectrometry, NMR, XRD

UNIT III: MICROSCOPY–TECHNIQUES **9Hrs**

Introduction to principles and applications of Polarised light microscopy, phase contrast microscopy, interference microscopy, Fluorescence microscopy, confocal microscopy, electron microscopy - TEM, SEM

UNIT IV: CHROMATOGRAPHY&CENTRIFUGATION **9Hrs**

Introduction to principles and applications of Chromatography - adsorption, affinity, partition - GLC, GC, HPLC, TLC, HPTLC, RPC.

UNIT V: ELECTROPHORETIC–TECHNIQUES **9Hrs**

Introduction to principles and applications of Electrophoresis of proteins and nucleic acids - 1D & 2D gels, SDS-PAGE, Agarose gel electrophoresis, Western Blotting, Gel documentation

Total Number of Hours: 45

REFERENCES

- Principles of Instrumental Analysis, Skoog DA, Thomspon Brooks and Cole, 5th Edition
- Instrumental Methods of Chemical Analysis, Chatwal GR, Himalaya PublishingHouse
- Instrumental Methods of Chemical Analysis, Sharma BK, Krishna Prakashan MediaPvtLtd

InstrumentalmethodsofanalysisbyWillard,MeritDean&Settle,CBSPublishersandDistributers,6thEdition

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ELECTIVE -III

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Subject Code: EMBT22E07	Subject Name :CANCER BIOLOGY	TY/ LB/ ETL/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: : Biochemistry and physiology	Ty	3	0/0	0/0	3

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:

To understand the fundamentals of cancer biology regarding cell cycle, mutational changes in signaling molecules, types of cancer, early detection methods and cancer screening methods, etc

COURSE OUTCOMES (COs) : The students will be able to

CO1	To understand the basic knowledge about the environmental factors causing cancer
CO2	To learn their mode of entry and carcinogenesis
CO3	To Understand the molecular biology of cancer cells
CO4	To learn the cancer metastatic pathways
CO5	To learn overview of cancer chemotherapy

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	**1**	**1**	3	2	3	3
CO2	3	3	3	3	3	3	**1**	**1**	3	2	3	3
CO3	3	3	3	3	3	3	**1**	**1**	3	2	3	3
CO4	3	3	3	3	3	3	**1**	**1**	3	2	3	3
CO5	3	3	3	3	3	3	**1**	**1**	3	2	3	3

COs / PSOs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

Subject Code: EMBT22E07	Subject Name :CANCER BIOLOGY	TY/ LB/ ETL/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: : Biochemistry and physiology	Ty	3	0/0	0/0	3

UNIT -1 FUNDAMENTALS OF CANCER BIOLOGY **9 Hrs**

Regulation of cell cycle, 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. Cancer screening and early detection, Detection using biochemical assays, tumor markers, molecular tools for early diagnosis of cancer.

UNIT II - PRINCIPLES OF CARCINOGENESIS **9 Hrs**

Theory of carcinogenesis, Chemical carcinogenesis, metabolism of carcinogenesis, principles of physical carcinogenesis, x-ray radiation-mechanisms of radiation carcinogenesis.

UNIT III - PRINCIPLES OF MOLECULAR CELL BIOLOGY OF CANCER **9 Hrs**

Signal targets and cancer, activation of kinases; Oncogenes, identification of oncogenes,retroviruses and oncogenes, detection of oncogenes. Oncogenes/proto oncogene activity. Growth factors related to transformation. Telomerases.

UNIT IV - PRINCIPLES OF CANCER METASTASIS **9 Hrs**

Clinical significances of invasion, heterogeneity of metastatic phenotype, metastatic cascade, basement membrane disruption, three step theory of invasion, proteinases and tumour cell invasion.

UNIT V - NEW MOLECULES FOR CANCER THERAPY **9 Hrs**

Different forms of therapy, chemotherapy, radiation therapy, detection of cancers, prediction of aggressiveness of cancer, advances in cancer detection. Use of signal targets towards therapy of cancer; Gene therapy.

Total no of Hours: 45

TEXT BOOK

- L M Franks and N M Teich. (1991)"An Introduction Top Cellular And Molecular Biology Of Cancer", Oxford Medical Publications,
- Robin Hesketh, Introduction to Cancer Biology, Cambridge University Press (2013)
- Raymond W. Ruddon, Cancer Biology, Oxford University Press,

REFERENCE BOOKS

Maly B.W.J,(1987) " Virology A Practical Approach ", IRLl Press, Oxford,

- Dunmock N.J And Primrose S.B., (1988) " Introduction To Modern Virology ",Blackwell Scientific Publications, Oxford. Press

Roger J. B. King, Cancer Biology, Prentice Hall (2000)

Maika G. Mitchell, Cell Biology: Translational Impact in Cancer Biology and Bioinformatics, Academic Press (2016)

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Subject Code: EMBT22E08	Subject Name : HERBAL DRUG TECHNOLOGY	TY/ LB / ETL /IE	L	T / S.Lr	P/ R	C
	Prerequisite: Biochemistry/Pharmaceutical	Ty	3	0/0	0/0	3

L : Lecture T:Tutorial P : Project R : Research C: Credits T/L :Theory/Lab

OBJECTIVE :

- To explain the concept of phytochemical technology and various methods of its extraction. The objectivealso includes the analysis of plant drugs and standardization of herbaldrugs.

COURSE OUTCOMES (COs) : After studying this course the student would be able to

CO1	Get an idea about Medicinal Plants
CO2	Know about the different extraction procedures
CO3	Get familiarize with chromatography techniques
CO4	Understand the methods of separation of important phyto molecules
CO5	Understand the standardization procedures for the commercial use of herbal drugs

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	3	3	3	1	2	3	3	2	1	3
CO2	1	3	3	3	3	1	2	3	3	2	1	3
CO3	1	3	3	3	3	1	2	3	3	2	1	3
CO4	1	3	3	3	3	1	2	3	3	2	1	3
CO5	1	3	3	3	3	1	2	3	3	2	1	3

COs / PSOs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

Subject Code: EMBT22E08	Subject Name : HERBAL DRUG TECHNOLOGY	TY/ LB / ETL /IE	L	T / S.Lr	P/ R	C
	Prerequisite: Biochemistry/Pharmaceutical	Ty	3	0/0	0/0	3

UNITI: INTRODUCTION TOMEDICINALPLANTS **9Hrs**

Introduction to Medicinal Plants, Classification of secondary metabolites, Medicinal importance of secondary metabolites like Flavonoids, Phenols, Alkaloids, Tannins Terpenes and Saponins.

UNIT II: EXTRACTION OFPHYTOPHARMACEUTICALS **9Hrs**

Extraction of Phyto pharmaceuticals – Infusion, Decoction, Digestion, Maceration, Percolation, Successive Solvent Extraction, Super Critical Fluid Extraction

UNIT III: EXTRACTION OFPHYTOPHARMACEUTICALS **9Hrs**

Steam Distillation, Headspace Techniques, Sepbox, Selection of Suitable Extraction Process, Carbohydrates, Proteins, Alkaloids, Glycosides.

UNIT IV: APPLICATION OF CHROMOTOGRAPHY AND SPECTROSCOPY IN PLANT DRUG ANALYSIS **9 Hrs**

Application of Chromatography and Spectroscopy in Plant Drug Analysis – Infrared Spectroscopy, NMR Spectroscopy, Mass Spectroscopy

UNITV: STANDARDIZATION OFHERBALDRUGS **9Hrs**

Standardization of Herbal Drugs – Importance of Standardization and Problems Involved in the Standardization of Herbs, Standardization of Single Drugs and Compound Formulations, WHO Guidelines for Quality Standardized Herbal Formulation, Estimation of Parameter Limits used for Standardization, Herbal Extracts.

Total Number of Hours: 45

REFERENCE BOOK:

- S.S. Agarwal, M.Paridhavi (2013) Herbal Drug Technology (2nd Ed) Orient Blackswan.

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Subject Code: EMBT22E09	Subject Name :ANIMAL AND PLANT TISSUE CULTURE	TY/ LB / ETL /IE	L	T / S.Lr	P/ R	C
	Prerequisite: Cell Biology	Ty	3	0/0	0/0	3

L : Lecture T:Tutorial P : Project R : Research C: Credits T/L/ETL :Theory/Lab

OBJECTIVE:

- To understand the basic concepts of Animal tissue culture in terms of infrastructure requirement for animal cell culture. To give an idea about different types of animal tissue culture in fermentor level and its productrecovery.

COURSE OUTCOMES (COs) : By doing this course students will acquire basic fundamental knowledge

CO1	About the introduction and need for cell culture
CO2	About the cell culture laboratory design & equipment.
CO3	About the different types of cell cultures and their applications
CO4	About the scale up process using bioreactors
CO5	About the application of tissue culture

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	3	3	2	3	3	2	2	3	3
CO2	2	3	3	3	3	2	3	3	2	2	3	3
CO3	2	3	3	3	3	2	3	3	2	2	3	3
CO4	2	3	3	3	3	2	3	3	2	2	3	3
CO5	2	3	3	3	3	2	3	3	2	2	3	3

COs / PSOs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

1/2/3 **indicates Strength of Correlation 3- High, 2- Medium, 1-Low**

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

Subject Code: EMBT22E09	Subject Name :ANIMAL AND PLANT TISSUE CULTURE	TY/ LB / ETL /IE	L	T / S.Lr	P/ R	C
	Prerequisite: Cell Biology	Ty	3	0/0	0/0	3

UNIT I: INTRODUCTION TOTISSUECULTURE **9Hrs**

Definition, principle and significance oftissueculture,Animaltissueculture,Maintenanceofsterilityanduseofantibiotics, Mycoplasma and viral contaminants, Various systems of tissue culture - their distinguishing features advantages and limitations , Culture medium: Logic of formulation (natural media, synthetic media, and sera)Methodology: i. Primary culture: Behaviour of cells, properties, utility. Development of plant tissue culture: Totipotency of plant cells and its realizationinvitroNutrientmedia:obligatoryandoptionalconstituents,Incubationsystems:staticagitatedculturesystems, Explant culture.Suspension culture.

UNIT II: ANIMAL CELL ORGAN CULTURECELL LINES **9Hrs**

Definition, development, maintenance and management and Cell adaptation, Established cell lines: Their characteristic features and utility,Cross contamination hazards , Characteristics of cells in culture: Contact inhibition, anchorage (in)dependence, cell-cell communication etc, Cell senescence, Cell and tissue response to tropic factors, Culturing of different cells. Designing of an experiment in tissue culture and response assessment. Significance of various controls, Growthstudies:Cellproliferation,cellcycle,mitosisingrowingcells,Organculture:Methods,behaviouroforganexplant, and utility of organ culture, Organ transplants. Freeze storing of cells and transport ofcultures.

UNIT III: MASS PRODUCTION OF BIOLOGICALLYIMPORTANTCOMPOUND **9Hrs**

Harvesting of products,purificationandassays,Propagationofviruses(viralsensitivityofcelllines),Cellcloningandcell synchronization, Separation of cell types: Various methods: advantages and limitations; Flow cytometry, Nuclear transplantation, Cell hybridization, Transfection studies

UNIT IV: PLANT CELL, TISSUE ANDORGANCULTURE **9Hrs**

Growth and differentiation of cultured cells and tissues, Cytodifferentiation, organogenesis and embryogenesis, In vitro culture: physical, chemical and genotypic factor , Culture systems: organ, callus, cell and protoplast cultures, Assessment of growth and development in vitro , Plant Growth Regulators: mode and mechanism of action, Secondary metabolism in cultured cells, increase of secondary metabolite production by suitable media supplements like elicitors, stress factors, precursor , Tissue culture of lower plants, algae, lichens and bryophytes, Genetic and epigenetic variation, spontaneous genetic variation, in vitro variation existing in cell populations or induced by culture conditions.

UNIT V: APPLICATIONS OFTISSUECULTURE **9Hrs**

Commercial applications of animal tissue culture: Tissue culture as a screening system; Cytotoxicity and diagnostic test, Development and preparation of vaccines against infecting organisms, In vitro fertilization and dolly, Mutant cell lines: Significance in biomedical research, identification and isolation of mutants. Applications of Genetic manipulations, Commercial applications of plant tissue culture: Mass propagation, medicinally important compounds, Screening of cell lines for novel variations: disease resistant, stress tolerant, transgenic plants

Total Number of Hours: 45

TEXT/REFERENCE:

- Plant biotechnology New products and Applications by J.Hammond,P.MCGarevy and VYusibov

Springer International Edition

- Plant Cell Biology (2nd edition) by Chris Hawes and BeatricSatiat- Jeunemaitre – OxfordUniversityPress
- Text Book of Animal Tissue culture By Freshney

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ELECTIVE -IV

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Subject Code: EMBT22E10	Subject Name :SEPARATION TECHNIQUES	TY/ LB / ETL /IE	L	T / S.Lr	P/ R	C
	Prerequisite: DOWNSTREAM PROCESSING	Ty	3	0/0	0/0	3

L : Lecture T:Tutorial P : Project R : Research C: Credits Ty/Lb: Theory/Lab

OBJECTIVE:

To study the various types of separation techniques required to isolate the biologically synthesized products in a pure state

COURSE OUTCOMES (COs) : By doing this course students will acquire basic fundamental knowledge

CO1	To understand the recent advances in separation techniques.
CO2	To know about the design of membrane separation.
CO3	To learn about the separation by adsorption
CO4	To learn about the separation by ionic Techniques
CO5	To get familiarize with other specialized techniques of speration

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	3	3	2	3	3	2	2	3	3
CO2	2	3	3	3	3	2	3	3	2	2	3	3
CO3	2	3	3	3	3	2	3	3	2	2	3	3
CO4	2	3	3	3	3	2	3	3	2	2	3	3
CO5	2	3	3	3	3	2	3	3	2	2	3	3

COs / PSOs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

Subject Code: EMBT22E10	Subject Name :SEPARATION TECHNIQUES	TY/ LB / ETL /IE	L	T / S.Lr	P/ R	C
	Prerequisite: DOWNSTREAM PROCESSING	Ty	3	0/0	0/0	3

UNITI:GENERAL **9Hrs**

Review of conventional processes, recent advances in separation techniques based on size, surface properties, ionic properties and other special characteristics of substances, Process concept, Theory and equipment used in cross flow filtration, cross flow electro filtration, dual functional filter, Surface based solid – liquid separations involving a second liquid, Sirofloc filter.

UNIT II:MEMBRANESEPARATIONS **9Hrs**

Types and choice of membranes, Plate and frame, tubular, spiral wound and hollow fibre membrane reactors and their relative merits, Commercial, pilot plant and laboratory membrane permeators involving dialysis, reverse osmosis, Nano filtration, ultrafiltration, Microfiltration and Donnan dialysis, Economics of membrane operations, Ceramic membranes

UNIT III: SEPARATIONS BYADSORPTIONTECHNIQUES **9Hrs**

Mechanism, Types and choice of adsorbents, Normal adsorption techniques, Affinity chromatography and immuno Chromatography, Types of equipment and commercial process, recent advances and process economics.

UNIT IV:IONIC SEPARATIONS **9Hrs**

Controlling factors, Applications, Types of equipment employed for electrophoresis, Di electrophoresis, ion exchange chromatography and electro dialysis, Commercial processes.

UNIT V:OTHERTECHNIQUES **9 Hrs**

Separations involving Lyophilisation, Pervaporation and permeation techniques for solids, liquids and gases, Industrial viability and examples, zone melting, Addluctive crystallization, Other separation processes, Supercritical fluidextraction, Oil spill Management, Industrial effluent treatment by moderntechniques.

Total Number of Hours: 45

TEXT BOOKS

- Lacey, R.E. and S.Looeb – Industrial Processing with Membranes Wiley – Inter Science,N.Y.1972.
- King, C.J. Separation Processes, Tata McGraw–Hill Publishing Co. Ltd.,1982.

REFERENCES

- Schoew, H.M. – New Chemical Engineering Separation Techniques, Interscience Publishers,1972.
- Ronald W. Roussel – Handbook of Separation Process Technology, John Wiley, New York,1987.
- Kestory, R.E. – Synthetic polymeric membranes, Wiley. Interscience, N.Y.1985.
- Osadar, VaridNakagawal – Membrane Science and Technology, Marcel Dekkar(1992).

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Subject Code: EMBT22E11	Subject Name : STEM CELLS BIOLOGY	T / L/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Cell Biology	Ty	3	0/0	0/0	3

L : Lecture T:Tutorial P : Project R : Research C: Credits Ty/Lb: Theory/Lab

OBJECTIVE: To study the principles of developmental biology in the early embryonic development. To study the stem cell processing and its therapeutic applications.

COURSE OUTCOMES (COs) :At the end of this course the students gain knowledge about to

CO1	Developmental biology in terms of embryonic cells.
CO2	The concept and basic knowledge about stem cells.
CO3	Know about the processing and transplantation of stem cells
CO4	To familiarize with stem cell therapy
CO5	Understand the applications of stem cells

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	3	3	3	3	3	3	2	1	3
CO2	2	3	3	3	3	3	3	3	3	2	1	3
CO3	2	3	3	3	3	3	3	3	3	2	1	3
CO4	2	3	3	3	3	3	3	3	3	2	1	3
CO5	2	3	3	3	3	3	3	3	3	2	1	3

COs / PSOs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

1/**2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low**

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

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Subject Code: EMBT22E11	Subject Name : STEM CELLS BIOLOGY	T / L/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Cell Biology	Ty	3	0/0	0/0	3

UNIT I: INTRODUCTION TO EMBRYONIC DEVELOPMENT ANDSTEMCELLS **9Hrs**

Embryonicdevelopment,Blastocystandinnercellmass,Developmentofdifferentiatedtissuesfromembryonicgermlayers, Function of placenta, amniotic fluid and umbilical chord; Stem cells : Definition, Classification and Properties; Properties and application of Embryonic stemcells.

UNIT II: HEMATOPOIETICSTEMCELLS **9Hrs**

Haematopoiesis – Hierarchy, Properties of Hematopoietic Stem Cells (HSCs), HSCs, Types of HSCs: Long term HSCs, ShorttermHSCs;HematopoieticandStromalcelldifferentiation;characteristicsofBonemarrowstromalcells;Cellsurface Markers forHSCs.

UNIT III: STEM CELL PROCESSINGAND TRANSPLANTATION **9Hrs**

Sources of stem cells; Cell types for transplantation: Bone marrow, Peripheral stem cells, cord blood stem cells; Types of transplants;Methodsofobtainingbonemarrowandperipheralbloodfortransplant,Stemcellprocessingandstorage;HLA matching; Advantages and drawbacks of autologous and allogeneictransplants.

UNIT IV: ADULTSTEMCELLS **9Hrs**

Adultstemcellplasticity,Comparisonofadultstemcellsvsembryonicstemcells,myogenesis;skeletalmusclestemcells; epidermalstemcells,Liverstemcells,Stemcelltherapiesinanimalmodels:Theiroutcomeandpossiblebenefitsinhumans

UNIT V: STEM CELLSANDTHERAPY **9Hrs**

Normal stem cells vs. Cancer stem cells, Clinical uses of hematopoietic stem cells in leukaemia, lymphoma and inherited blood disorders; Use of stem cells in diabetes, myocardial infarction, Parkinson's disease.

Total no of Hours: 45

TEXT BOOKS:

- Robert Lonza(2009)*Essentials of Stem CellBiology*(2nd Ed) AcademicPress.
- Anthony Atala, Robert Lonza, James A.Thomson, Robert Nerem (2011)*Principles of Regenerative Medicine* (2nd Ed)AcademicPress

REFERENCE BOOKS

- DovZipori (2009) *Biology of Stem cells and the Molecular basis of the Stem State*. HumanaPress.
- StemBook Cambridge (MA): Harvard Stem Cell Institute;2008.

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Subject Code: EMBT22E12	Subject Name :BIOSENSORS AND BIOMEDICAL DEVICES IN DIAGNOSTICS	TY/ LB / ETL /IE	L	T / S.Lr	P/ R	C
	Prerequisite: Biochemistry/Immunology/IMA	Ty	3	0/0	0/0	3

L : Lecture T:Tutorial P : Project R : Research C: Credits T/L/ :Theory/Lab

OBJECTIVES:

- To understand the fundamentals of biosensors and types of biosensors. To study the uses of clinical and non-clinical uses of biosensors. To study the concepts behind the reagent less biosensors & array-basedchips.

COURSE OUTCOMES (COs) : After studying this course the student would be able to

CO1	Understand the concept of biosensors.
CO2	Know the fundamental and types of Biosensors.
CO3	Know about the clinical and Non clinical uses of Biosensors
CO4	Have awareness about the non-reagent biosensors
CO5	Create awareness about the chip based Biosensors

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	3	3	3	1	2	3	3	2	1	3
CO2	1	3	3	3	3	1	2	3	3	2	1	3
CO3	1	3	3	3	3	1	2	3	3	2	1	3
CO4	1	3	3	3	3	1	2	3	3	2	1	3
CO5	1	3	3	3	3	1	2	3	3	2	1	3

COs / PSOs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

Subject Code: EMBT22E12	Subject Name :BIOSENSORS AND BIOMEDICAL DEVICES IN DIAGNOSTICS	TY/ LB / ETL /IE	L	T / S.Lr	P/ R	C
	Prerequisite: Biochemistry/Immunology/IMA	Ty	3	0/0	0/0	3

UNIT I: FUNDAMENTALSOF BIOSENSORS **9Hrs**

Biosensors as Functional Analogs of Chemo receptors- Immobilization and biosensor construction, Biosensor instrumentation-Transductionprinciplesusedinabiosensor,Biocomponentofthesensor.Biologicalsensingelementsand transducer systems- their sensitivity specificity andlinearity.

UNIT II: TYPESOFBIOSENSORS **9Hrs**

Thermometric Indication with Thermistors, Opto electronic Sensors, Piezoelectric Sensors, Electrochemical Sensors, Potentiometric Electrodes, Amperometric Electrodes, Conductometric Measurement. Flow injection analysis based biosensors, fiber optics biosensors, Bioluminescence biosensors, Microbial biosensors, Affinity biosensors, immunosensors.DNA Probes, organic acid probes, antigen-antibodies reaction, biochemical detection of organelles, receptors, sensors for pollution gases stability and reusability of sensors.

UNIT III: BIOSENSORS FORCLINICALANALYSIS **9Hrs**

Biosensors for personal diabetes management (Glucose, Galactose, Gluconate, Lactate, Pyruvate Sensors) Non-invasive Biosensors in Clinical analysis and health care.

UNIT IV: NON CLINICAL APPLICATIONOFBIOSENSORS **9Hrs**

Applications in Veterinary, Agriculture, Food production, environmental control and pollution monitoring, and bioprocess industry.

UNIT V: REAGENTLESS BIOSENSORS &ARRAY-BASEDCHIPS **9Hrs**

Surface Dielectric Enhancement, Gold nanoparticle enhanced surface Plasmon resonance, carbon nanotube and silicon nanowireenhancedconductivity,catalyticactivation,electrocatalyticdetection,catalyticallyenabledopticalandmagnetic detection, Reagent less Immunoelectrodes, biomolecule conformational modulated effects, Biosensors based on DNA conformation changes, Biosensors based on protein conformationchanges

Total no of Hours: 45

TEXT BOOK

- Turner A.P.F, Karube I and Wilson G.S, (1987) *Biosensors- Fundamentals and applications,* OxfordUniv.Press.

REFERENCE BOOKS

- Yang V.C. and T.T.Ngo,(2000) *Biosensors and their Applications*, Academic/PlenumPublishers.
- Ashok Mulchandani and Kim R Rogers,(1998)*Enzyme and Microbial bio sensors: Techniques and Protocols*,Humana Press Totowa,NJ.
- TurnerA.P.FandWilsonsG.S,(1997)*Biosensors:FundamentalsandApplications*,OxfordSciencePublications.

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ELECTIVE -V

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Subject Code: EMBT22E13	Subject Name : APPLIED ENVIRONMENTAL MICROBIOLOGY	TY/ LB / ETL /IE	L	T / S.Lr	P/ R	C
	Prerequisite: Microbiology	Ty	3	0/0	0/0	3

L : Lecture T:Tutorial P : Project R : Research C: Credits T/L/ :Theory/Lab

OBJECTIVES:

This course prepares the student in addressing environmental challenges by developing a fundamental understandingof the microbial communities and processes in natural and builtenvironments

COURSE OUTCOMES (COs) : After studying this course the student would be able

CO1	To understand the basics of microbiology
CO2	To get familiarize with microbial energetic and diversity.
CO3	To Know about how to use the microbial population in reducing the environmental concerns
CO4	To have an idea about the microbial process involved in biogeochemical cycling
CO5	To understand the microbial process of bio deterioration and bioremediation

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	1	2	3	3	2	1	3
CO2	3	3	3	3	3	1	2	3	3	2	1	3
CO3	3	3	3	3	3	1	2	3	3	2	1	3
CO4	3	3	3	3	3	1	2	3	3	2	1	3
CO5	3	3	3	3	3	1	2	3	3	2	1	3

COs / PSOs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

Subject Code: EMBT22E13	Subject Name : APPLIED ENVIRONMENTAL MICROBIOLOGY	TY/ LB / ETL /IE	L	T / S.Lr	P/ R	C
	Prerequisite: Microbiology	Ty	3	0/0	0/0	3

UNIT-IINTRODUCTION OFCELL ELEMENTS **9Hrs**

Introduction; cell elements and composition Cell and its composition, cytoplasmic membrane Prokaryotic cell division Microbes and their environmental niches Historical roots of microbiology Nucleic acids and amino acids DNA structure, replication, and manipulation Protein and its structure Regulation Microbial nutrition Microscopy: Light microscopy, 3D Imaging, AFM, Confocal scanning laser microscopy

UNIT- IIMICROBIAL ENERGETICS **9 Hrs**

MicrobialenergeticsanddiversityStoichiometryandbioenergeticsOxidation-reductionNAD,energy-richcompoundsand energy storage Mathematics of microbial growth Glycolysis Respiration Citric-acid cycle Catabolic Alternatives Phototrophy, Chemolithotrophy, anaerobic respiration (Nitrate and Sulfate reduction; Acetogenesis; Methanogenesis; Metal, Chlorate, and organic electronacceptors)

UNIT- III MICROBIAL METABOLISM ANDFUNCTIONALDIVERSITY **9Hrs**

Microbial metabolism and functional diversity of bacteria Prokaryotic diversity Classical taxonomy Origin of life Tree of life Major catabolic pathways Catalysis and enzymes Energy conservation Sugars and polysaccharides, amino acids, nucleotides, lipids Microbial ecosystems Population, guilds, and communities Environments and microenvironments Microbial growth on surfaces Environmental effects on microbial growth.

UNIT- IIIENVIRONMENTALGENOMICS **9Hrs**

EnvironmentalgenomicsandmicrobialecologygeneticexchangeEnvironmentalgenomicsMicrobialecologyHorizontal and vertical gene transfer: Replication, Transformation Transduction Microbial symbiosis and virus, Mutation and itsrate ,Genetic recombination, Population dynamics ,Virus ,Viroid, Prion, Application of environmental microbes

UNIT- IV INVESTIGATIONS INENVIRONMENTALMICROBIOLOGY **9Hrs**

Investigations in environmental microbiology: sampling, detection, isolation, taxonomic and functional annotation and quantification; Introductory bioinformatics and data analysis Microbial sampling Culture based and culture independent tools Molecular biology tools: Cloning, amplification, sequencing, Case study. Bioremediation and wastewater microbiology, Bioremediation and examples, Acid mine drainage, Enhanced metal recovery, Wastewater microbiology Drinking water microbiology, Drinking water microbiome and treatment, Microbial instability, Waterborne microbialdiseases

UNITV **9Hrs**

Solid waste microbiology and antimicrobial resistance, Landfills, Leachate, Anaerobic degradation phases, Antimicrobial resistance Epidemiology and biosensors ,Public health, Epidemics, Biosensors ,Wearable biosensors, Built microbiology, exposomes and bioinformatics, Exposure routes ,Microbes living around us, Exposomes Basic bioinformatics, Bioinformatics tools available online

Total no of Hours: 45

Text Book s a nd References

- Bruce E. Rittmann, and Perry L. McCarty. Environmental Biotechnology: Principles and Applications. McGraw-Hill, 2001. ISBN: 0071181849.2017.
- Madigan, M., Bender K. S., Buckley D.H., Sattley W M. and Stahl D.A.. Brock Biology ofMicroorganisms. 15th ed. New York: Pearson, 2017. ISBN: 0134261925.2001

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Subject Code: EMBT22E14	Subject Name : MEDICAL BIOMATERIALS	TY/ LB / ETL /IE	L	T / S.Lr	P/ R	C
	Prerequisite: Biochemistry/Pharmaceutical technology	Ty	3	0/0	0/0	3

L : Lecture T:Tutorial P : Project R : Research C: Credits T/L/ :Theory/Lab

OBJECTIVES:

After studying the course the student gets an idea about the various types of biomaterial used in the medical field which are used to replace the natural organs and tissues for the comfort of the host.

COURSE OUTCOMES (COs) : After studying this course the student would be able

CO1	To Understand the concepts of Biomaterials
CO2	To understand the nature of the synthetic material which can be used to restore the function of the natural living tissue or organ
CO3	To Know biocompatibility and various adverse systemic reaction incurred in host due to the biomaterials
CO4	To know about the types of biomaterial such as polymer, metal ceramic or combination of these and the time duration of their existence in the body
CO5	To know the applications of biomaterials

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	1	2	3	3	2	1	3
CO2	3	3	3	3	3	1	2	3	3	2	1	3
CO3	3	3	3	3	3	1	2	3	3	2	1	3
CO4	3	3	3	3	3	1	2	3	3	2	1	3
CO5	3	3	3	3	3	1	2	3	3	2	1	3

COs / PSOs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

Subject Code: EMBT22E14	Subject Name : MEDICAL BIOMATERIALS	TY/ LB / ETL /IE	L	T / S.Lr	P/ R	C
	Prerequisite: Biochemistry/Pharmaceutical technology	Ty	3	0/0	0/0	3

UNIT-I INTRODUCTIONTOBIOMATERIALS **9Hrs**

Background history, History Properties, Mechanical and Physio-chemical Properties

UNIT-II MECHANICALPROPERTIES **9Hrs**

Mechanical Properties, Resorbability, biodegradation, Biofilm, Biofilm-material characterization

UNIT-III ANALYTICALINSTRUMENTS **9Hrs**

Analytical instruments, Biological responses, compatibility, cytotoxicity, Proteins, Tissue and blood Response Cell-biomaterial interaction

UNIT-IV ANIMAL TRIALS(INVIVO) **9Hrs**

Metals-types, Classifications, applications, properties, Biological responses, Polymers-types Classifications, applications, Blends/compositesBiopolymersHydrogelsPreparationofdifferentmorphologieswithexperiments)Surfacemodifications with experiments)

UNIT-V CERAMICS **9Hrs**

Drug delivery systems/encapsulation Biomaterials for cardiovascular/pulmonary/ophthalmological applications Biomaterials for urinary/dental/skin applications Sterilization of implants, device failures, unique issues, conclusion

Total no of Hours: 45

TEXT BOOKS:

- Ratner,BuddyD.,etal. *BiomaterialsScience:AnIntroductiontoMaterialsinMedicine*.2nded.Burlington,MA: Academic Press, 2004. ISBN:9780125824637

REFERENCE BOOKS:

- Kothari CR (2004) Research Methodology-Methods and techniques (2nd Ed) New age international Limited publishers, NewDelhi.
- Suresh C. Sinha and Anil K. Dhiman (2002) Research Methodology (1 st Ed)New Delhi, 2 volumes, 860p.
- Gupta SP(2005) Statistical Methods (6 th Ed) Sultan Chand & Sons, NewDelhi.
- Jerrold H. Zar (2003)Bio Statistical Analysis .Tan Prints(I) Pvt. Ltd., NewDelhi.

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Subject Code: EMBT22E15	Subject Name : NUTRITIONAL AND CLINICAL BIOCHEMISTRY	TY/ LB / ETL /IE	L	T / S.Lr	P/ R	C
	Prerequisite: Biochemistry	Ty	3	0/0	0/0	3

L : Lecture T:Tutorial P : Project R : Research C: Credits T/L/ :Theory/Lab

OBJECTIVES: After completion of the course the students will have a better understanding on chemical properties of nutrients and other dietary constituents with scientific approach by describing their functions at cellular and molecular levels. The course will also provide an in depth knowledge about how a clinical investigation of laboratory tests in human(such as body fluids) are used for diagnosis of disease and its therapeutic purposes

COURSE OUTCOMES (COs) : After studying this course the student would be able to

CO1	To understand the basics of nutrition and their components in the form of macro nutrients such as carbohydrates ,proteins ,fats
CO2	To understand the importance of micronutrients in diet in the form of vitamins and minerals
CO3	To understand the nutritional requirement for different conditions and types and uses of bio chemistry tests to identify malnutrition
CO4	To know about the different biochemical estimations performed clinically to identify the different types of diseases associated with different organs
CO5	To study the enzyme patterns in the human body in normal and diseased conditions

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	1	2	3	3	2	1	3
CO2	3	3	3	3	3	1	2	3	3	2	1	3
CO3	3	3	3	3	3	1	2	3	3	2	1	3
CO4	3	3	3	3	3	1	2	3	3	2	1	3
CO5	3	3	3	3	3	1	2	3	3	2	1	3

COs / PSOs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

Subject Code: EMBT22E15	Subject Name : NUTRITIONAL AND CLINICAL BIOCHEMISTRY	TY/ LB / ETL /IE	L	T / S.Lr	P/ R	C
	Prerequisite: Biochemistry	Ty	3	0/0	0/0	3

UNIT –I INTRODUCTION OF FOODANDNUTRITION **9Hrs**

Introduction and definition of food and nutrition, Basic food groups: energy yielding, body building and protectivefoods, Physiology and nutrition of carbohydrates and fats, Physiology and nutrition of proteins and water.

UNIT–II VITAMINS **9Hrs**

Fat soluble vitamins: Vitamin A, D, E, K, Water soluble vitamins: vitamin B complex and vitamin C, Minerals (Ca, Fe and iodine) and their biological functions, Composition of balanced diet and recommended dietary allowance (RDA).Basic concepts of energy expenditure, units of energy, The basal metabolic rate (BMR) and its determination, Specific dynamic action (SDA) of foods,

UNIT–III NUTRITION **9Hrs**

Planning of dietary regimes for infants, pregnancy and old age, Nutrition and brain development, Mother's milk versus formulated milk feeding, Food adulterations and precautions Basic concepts of Clinical Biochemistry, Types and uses of biochemical tests, Types and uses of biochemical tests-II, Clinical Biochemistry laboratory, Specimen collection, processing and transportation, Specimen collection, processing and transportation-II, Blood cell count &anaemia, Haemophilia

UNIT–IV DISEASES RELATEDTOMETABOLISM **9Hrs**

Diseases related to carbohydrate metabolism, Diabetes mellitus, Diseases related to amino acid and nucleic acid metabolism Phenylketonuria, hyperuricemia, Diseases related to lipid metabolism, Liver Function tests kidney function tests

UNIT–V CLINICALBIOCHEMISTRY **9Hrs**

Clinical Enzymology, Isozymes and diagnostic tests, Isozymes and diagnostic tests-II, Enzyme patterns in acute pancreatitis, liver damages and myocardial infarction

Total no of Hours: 45

TEXT BOOKS:

- Tom Brody: Nutritional Biochemistry, AcademicPress
- Gerald F., Jr Combs: The Vitamins: Fundamental Aspects in Nutrition and Health, AcademicPress

REFERENCE BOOKS:

- Dawn B. Marks, et al.: Basic Medical Biochemistry: A Clinical Approach, Lippincott, Williams &Wilkins
- Paul F. Torrence (Editor): Biomedical Chemistry: Applying Chemical Principles to the Understandingand Treatment of Disease, John Wiley &Sons

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AUDIT COURSE-I &II

Subject Code: EMCC22I01	Subject Name : ENGLISH FOR RESEARCH PAPER WRITING	TY/ LB / ETL /IE	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	IE	2	0/0	0/0	0

L : Lecture T:Tutorial P : Project R : Research C: Credits Ty/Lb: Theory/Lab

Objectives To know the art of writing the research paper and thesis to Ensure the good quality of paper at very first-time submission.

COURSE OUTCOMES (COs) : At the end of this course the students would be able to

CO1	Understand that how to improve your writing skills and level of readability
CO2	Learn about what to write in each section
CO3	Understand the skills needed when writing a Title
CO4	Understand the skills needed when writing a Abstract
CO5	Understand the skills needed for writing a manuscript ready for submission

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2	2	3	2	2	2	3	2	2
CO2	2	2	2	2	2	3	2	2	2	3	2	2
CO3	2	2	2	2	2	3	2	2	2	3	2	2
CO4	2	2	2	2	2	3	2	2	2	3	2	2
CO5	2	2	2	2	2	3	2	2	2	3	2	2

COs / PSOs	PSO1	PSO2	PSO3
CO1	2	2	2
CO2	2	2	2
CO3	2	2	2
CO4	2	2	2
CO5	2	2	2

1/2/3 **indicates Strength of Correlation 3- High, 2- Medium, 1-Low**

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills	Audit Course		
										✓		

Subject Code: EMCC22I01	Subject Name ENGLISH FOR RESEARCH PAPER WRITING	TY/ LB / ETL /IE	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	IE	2	0/0	0/0	0

UNITI: **6Hrs**

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNITII: **6Hrs**

ClarifyingWhoDidWhat,HighlightingYourFindings,HedgingandCriticising,ParaphrasingandPlagiarism,Sectionsof a Paper, Abstracts.Introduction

UNITIII: **6Hrs**

Review of the Literature, Methods, Results, Discussion, Conclusions, the Final Check.

UNITIV: **6Hrs**

Key skills are needed when writing a Title, Abstract, Review of the Literature, Methods, Results, Discussion and conclusions

UNITV: **6Hrs**

Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

Total No. of Hours: 30

TEXT / REFERENCE BOOKS

- Goldbort R (2006) Writing for Science, Yale University Press (available on GoogleBooks)
- Day R (2006) How to Write and Publish a Scientific Paper, Cambridge UniversityPress
- Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM.Highman'sbook.
- AdrianWallwork,EnglishforWritingResearchPapers,SpringerNewYorkDordrechtHeidelbergLondon,2011

Subject Code: EMCC22I02	Subject Name DISASTER MANAGEMENT	TY/ LB / ETL /IE	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	IE	2	0/0	0/0	0

L : Lecture T:Tutorial P : Project R : Research C: Credits Ty/Lb: Theory/Lab

Objectives: Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.

COURSE OUTCOMES (COs) : At the end of this course the students would be able to

CO1	Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
CO2	Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
CO3	critically understand the strengths and weaknesses of disaster management approaches
CO4	Understand inter-relationships between disastersanddevelopment
CO5	Understand the Planning and programming in different countries, particularly their home country or the countries they work in

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2	2	3	2	2	2	2	2	2
CO2	2	2	2	2	2	3	2	2	2	2	2	2
CO3	2	2	2	2	2	3	2	2	2	2	2	2
CO4	2	2	2	2	2	3	2	2	2	2	2	2
CO5	2	2	2	2	2	3	2	2	2	2	2	2

COs / PSOs	PSO1	PSO2	PSO3
CO1	2	2	2
CO2	2	2	2
CO3	2	2	2
CO4	2	2	2
CO5	2	2	2

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills	Audit Course		
										✓		

Subject Code: EMCC22I02	Subject Name DISASTER MANAGEMENT	TY/ LB / ETL /IE	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	IE	2	0/0	0/0	0

UNIT I INTRODUCTIONTODISASTERS **6Hrs**

Concepts,anddefinitions-Disaster,Hazard,Vulnerability,Resilience,RisksDisasters:Classification,Causes,Impacts-including social, economic, political, environmental, health, psychosocial, etc.

UNIT IIRISKMANAGEMENT **6Hrs**

GoalsandobjectivesofISDRProgramme-Riskidentification–Risksharing–Disasteranddevelopment:Development plans and disaster management –Alternative to dominant approach –disaster-development linkages - Principle of risk partnership.

UNIT IIIRISKREDUCTION **6Hrs**

Triggermechanism–constitutionoftriggermechanism–riskreductionbyeducation–disasterinformationnetwork–risk reduction by public awareness Application of various technologies: Data bases – RDBMS – Management Information systems – Decision support system and other systems – Geographic information systems Remote sensing-an insight – contribution of remote sensing and GIS - Casestudy.

UNIT IV INTER-RELATIONSHIPS BETWEEN DISASTERSANDDEVELOPMENT: **6Hrs**

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc. Climate Change Adaptation. Relevance of indigenous knowledge, appropriate technology and local resources financial arrangements – areas of improvement –disaster preparedness — emergency response.

UNIT V DISASTER RISK MANAGEMENTININDIA **6Hrs**

Hazard and Vulnerability profile of India Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management Institutional arrangements (Mitigation, Response and Preparedness, DM Act and Policy, Other related policies, plans, programmes and legislation)

Total No. of Hours: 30

TEXT BOOKS

- PardeepSahni, MadhaviMalalgoda and Ariyabandu, “Disaster risk reduction in South Asia”,PHI
- AmitaSinvhal, “Understanding earthquake disasters” TMH,2010.

REFERENCE

- Pardeepsahni,AlkaDhamejaandUmaMedury,“Disastermitigation:Experiencesandreflections”,PHI

Subject Code: EMCC22I03	Subject Name SANSKRIT FOR TECHNICAL KNOWLEDGE	TY/ LB / ETL /IE	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	IE	2	0/0	0/0	0

L : Lecture T:Tutorial P : Project R : Research C: Credits Ty/Lb: Theory/Lab

Objectives To get a working knowledge in illustrious Sanskrit, the scientific language in the world Learning of Sanskrit to improve brain functioning, to develop the logic in mathematics, science & other subjects enhancing the memorypower. The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancientliterature.

COURSE OUTCOMES (COs) : At the end of this course the students would be able to

CO1	Understanding basic Sanskrit language
CO2	Ancient Sanskrit literature about science & technology can be understood
CO3	Being a logical language will help to develop logic in students

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	1	3	1	1	1	1	1	1
CO2	1	1	1	1	1	3	1	1	1	1	1	1
CO3	1	1	1	1	1	3	1	1	1	1	1	1

COs / PSOs	PSO1	PSO2	PSO3
CO1	1	1	1
CO2	1	1	1
CO3	1	1	1

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills	Audit Course		
										✓		

Subject Code: EMCC22I03	Subject Name SANSKRIT FOR TECHNICAL KNOWLEDGE	TY/ LB / ETL /IE	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	IE	2	0/0	0/0	0

UNIT I **10Hrs**

Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences

UNITII **10Hrs**

Order Introduction of roots Technical information about Sanskrit Literature

UNIT III **10Hrs**

Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

Total No. of Hours: 30

TEXT BOOKS/ REFERENCE

- Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, NewDelhi
- "Teach Yourself Sanskrit" Prathama Deeksha-VempatiKutumbshastri, Rashtriya Sanskrit Sansthanam, New DelhiPublication
- "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., NewDelhi.

Subject Code: EMCC22I04	**Subject Name VALUE EDUCATION**	**TY/ LB / ETL /IE**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: Nil	IE	2	0/0	0/0	0

L : Lecture T:Tutorial P : Project R : Research C: Credits Ty/Lb: Theory/Lab

Objectives .Understand value of education and self- development, Imbibe good values in students. Let them should know about the importance of character

COURSE OUTCOMES (COs) : At the end of this course the students would be able to

CO1	Knowledge of self-development
CO2	Learn the importance of Human values
CO3	Developing the overall personality

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	1	1	1	1	1	3	1	1	1	1	1	1
CO2	1	1	1	1	1	3	1	1	1	1	1	1
CO3	1	1	1	1	1	3	1	1	1	1	1	1

COs / PSOs	**PSO1**	**PSO2**	**PSO3**
CO1	1	1	1
CO2	1	1	1
CO3	1	1	1

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills	Audit Course		
										✓		

Subject Code: EMCC22I04	Subject Name VALUE EDUCATION	TY/ LB / ETL /IE	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	IE	2	0/0	0/0	0

UNIT I **6Hrs**

Values and self-development –Social values and individual attitudes. ork ethics, Indian vision of humanism.Moral and non-moral valuation. Standards and principles. Value judgments

UNITII **6Hrs**

Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty,Humanity. Power of faith, National Unity. Patriotism. Love for nature, Discipline

UNIT III **6 Hrs**

Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance

UNIT IV **6 Hrs**

True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature

UNIT V **6 Hrs**

Character and Competence –Holy books vs Blind faith. Self-management and Good health.Science of reincarnation. Equality**,** Nonviolence, Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively

Total No. of Hours: 30

TEXT BOOKS/ REFERENCE

❖ Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi

SubjectCode: EMCC22I05	Subject Name : CONSTITUTION OF INDIA	TY/ LB / ETL /IE	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	IE	2	0/0	0/0	0

L : Lecture T:Tutorial P : Project R : Research C: Credits Ty/Lb: Theory/Lab

Objectives Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism To address therole of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

COURSE OUTCOMES (COs) : At the end of this course the students would be able to know

CO1	Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
CO2	Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
CO3	. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] underthe leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections throughadult suffrage in the IndianConstitution.
CO4	Discuss the passage of the Hindu Code Bill of 1956.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	1	3	1	1	1	1	1	1
CO2	1	1	1	1	1	3	1	1	1	1	1	1
CO3	1	1	1	1	1	3	1	1	1	1	1	1
CO4	1	1	1	1	1	3	1	1	1	1	1	1

COs / PSOs	PSO1	PSO2	PSO3
CO1	1	1	1
CO2	1	1	1
CO3	1	1	1
CO4	1	1	1

1/2/3 **indicates Strength of Correlation 3- High, 2- Medium, 1-Low**

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills	Audit Course		

SubjectCode: EMCC22I05	Subject Name : CONSTITUTION OF INDIA	TY/ LB / ETL /IE	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	IE	2	0/0	0/0	0

UNIT I: HISTORY OF MAKING OF THEINDIANCONSTITUTION: **6Hrs**
History Drafting Committee, (Composition & Working) Philosophy of the Indian Constitution: Preamble SalientFeatures

UNIT II: CONTOURS OF CONSTITUTIONAL RIGHTS&DUTIES: **6Hrs**
Fundamental Rights, Right to Equality , Right to Freedom , Right against Exploitation, Right to Freedom of Religion , Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy and Fundamental Duties.

UNIT III: ORGANSOFGOVERNANCE **6Hrs**
Parliament Composition, Qualifications and Disqualifications, Powers and Functions Executive President, Governor Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications Powers and Functions.

UNIT IV:LOCALADMINISTRATION: **6Hrs**
District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative,CEOofMunicipalCorporation.Panchayatraj:Introduction,PRI:ZilaPachayat.Electedofficialsandtheir roles, CEO ZilaPachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass rootdemocracy

UNIT V:ELECTIONCOMMISSION **6 Hrs**
Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

Total Number of Hours: 30

TEXT / REFERENCE BOOKS:

- The Constitution of India, 1950 (Bare Act), GovernmentPublication.
- Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition,2015.
- M. P. Jain, Indian Constitution Law, 7th Edn. Lexis Nexis, 2014. 4. D.D. Basu, Introduction to theConstitution of India, Lexis Nexis,2015.

Subject Code: EMCC22I06	**Subject Name : PEDAGOGY STUDIES**	**TY/ LB / ETL /IE**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: Nil	IE	2	0/0	0/0	0

L : Lecture T:Tutorial P : Project R : Research C: Credits Ty/Lb: Theory/Lab

Objectives Students will be able to: 4. Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers. 5. Identify critical evidence gaps to guide the development.

COURSE OUTCOMES (COs) : At the end of this course the students would be able to know

CO1	What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
CO2	What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
CO3	How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	1	1	1	1	1	3	1	1	1	1	1	1
CO2	1	1	1	1	1	3	1	1	1	1	1	1
CO3	1	1	1	1	1	3	1	1	1	1	1	1

COs / PSOs	**PSO1**	**PSO2**	**PSO3**
CO1	1	1	1
CO2	1	1	1
CO3	1	1	1

1**/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low**

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills	Audit Course		

Subject Code: EMCC22I06	Subject Name : PEDAGOGY STUDIES	TY/ LB / ETL /IE	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	IE	2	0/0	0/0	0

UNIT I: INTRODUCTIONANDMETHODOLOGY: **6Hrs**

Aimsandrationale,Policybackground,Conceptualframeworkandterminology,Theoriesoflearning,Curriculum,Teacher education. Conceptual framework, Research questions. Overview of methodology andSearching.

UNIT II:THEMATICOVERVIEW: **6Hrs**

Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.

UNIT III: EVIDENCE ON THE EFFECTIVENESS OFPEDAGOGICALPRACTICES **6Hrs**

Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum)andtheschoolcurriculumandguidancematerialsbestsupporteffectivepedagogy?Theoryofchange.Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogicstrategies.

UNIT IV:PROFESSIONAL DEVELOPMENT: **6Hrs**

Alignment with classroom practices and follow up support Peer support from the head teacher and the community. Curriculum and assessment, Barriers to learning: limited resources and large class sizes

UNIT V: RESEARCH GAPS ANDFUTUREDIRECTIONS **6Hrs**

ResearchdesignContexts,Pedagogy,Teachereducation,Curriculumandassessment,Disseminationandresearchimpact.

Total Number of Hours: 30

TEXT / REFERENCE BOOKS:

- Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261. 2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.3.
- Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education researchproject (MUSTER) country report 1. London:DFID.
- Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3):272–282. 5.
- Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxfordand Boston:Blackwell.
- Chavan M (2003) Read India: A mass scale, rapid, 'learning to read'campaign.
- www.pratham.org/images/resource%20working%20paper%202.pdf.

Subject Code: EMCC22I07	Subject Name: STRESS MANAGEMENT BY YOGA	TY/ LB / ETL /IE	L	T / S.Lr	P/R	C
	Prerequisite : **Basic Knowledge of Yoga**	**IE**	**2**	**0/0**	**0/0**	**0**

- To Understand the Basic Concepts ofYoga
- To Gain knowledge on Ashtangayoga
- To Acquire knowledge of Techniques and Practice ofYogasanas
- To understand stress and the causes. To Attain the knowledge about stress busting throughyoga

CO1	Understand the Basic Concepts of Yoga
CO2	Gain knowledge on Ashtanga yoga
CO3	To Understand stress and the causes
CO4	Acquire knowledge of Techniques and Practice of Yogasanas
CO5	Attain the knowledge about stress busting through yoga

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	1	3	1	1	1	1	1	1
CO2	1	1	1	1	1	3	1	1	1	1	1	1
CO3	1	1	1	1	1	3	1	1	1	1	1	1
CO4	1	1	1	1	1	3	1	1	1	1	1	1
CO5	1	1	1	1	1	3	1	1	1	1	1	1

COs / PSOs	PSO1	PSO2	PSO3
CO1	1	1	1
CO2	1	1	1
CO3	1	1	1
CO4	1	1	1
CO5	1	1	1

1/**2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low**

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills	Audit Course		

Subject Code: EMCC22I07	Subject Name: STRESS MANAGEMENT BY YOGA	TY/ LB / ETL /IE	L	T / S.Lr	P/R	C
	Prerequisite : **Basic Knowledge of Yoga**	**IE**	**2**	**0/0**	**0/0**	**0**

UNITI: **6Hrs**

What is stress - Symptoms of stress - Why is stress helpful - Why is stress harmful - Stress versus burnout - Main typesof stress - Know your stressors - Tips to ManageStress

UNITII: **6Hrs**

Strength,Weaknesses,OpportunitiesandThreats(SWOT)Analysis,WhoamI,Attributes,ImportanceofSelfConfidence, Self Esteem. Emotional Intelligence, What is Emotional Intelligence, emotional quotient why Emotional Intelligence matters, Emotion Scales. ManagingEmotions

UNITIII: **6Hrs**

What is Yoga – Definition and Its Branches - Hatha Yoga – Kundalini Yoga – Tantra Yoga – Kriya Yoga, Introduction to AshtangaYoga.

UNITIV: **6Hrs**

Mechanism of Stress related diseases: Psychic, Psychosomatic, Somatic and Organic phase. Role of Meditation &Pranayamaonstress–physiologicalaspectofMeditation. Constantstress&strain,anxiety,conflictsresulting in fatigue among Executive. Contribution of Yoga to solve the stress related problems ofExecutive.

UNITV: **6Hrs**

Meaning and definition of Health – various dimensions of health (Physical, Mental, Social and Spiritual) – Yoga and health – Yoga as therapy. Physical fitness. Stress control exercise – Sitting meditation, Walking meditation, Progressive muscular relaxation, Gentle stretches and Massage.

Total Number of Hours: 30

TEXT / REFERENCE BOOKS:

- Andrews, Linda Wasmer., (2005). Stress Control for peace of Mind. London: GreenwichEditions Lalvani, Vimla., (1998). Yoga for stress. London:Hamlyn
- Nagendra, H.R., and Nagarathana, R., (2004). Yoga perspective in stress management.Bangalore: Swami Vivekananda YogaPrakashana.
- Nagendra, H.R., and Nagarathana, R., (2004). Yoga practices for anxiety & depression.Bangalore: Swami Sukhabodhanandha YogaPrakashana.
- Sukhabodhanandha, Swami. (2002). Stress Management. Bangalore: Prasannatrust.
- Udupa, K.N., (1996). Stress management by Yoga. NewDelhi: MotilalBanaridass PublishersPrivate Limited

Subject Code: EMCC22I08	Subject Name PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS	TY/ LB / ETL /IE	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	IE	2	0/0	0/0	0

L : Lecture T:Tutorial P : Project R : Research C: Credits Ty/Lb: Theory/Lab

Objectives To learn to achieve the highest goal happily, To become a person with stable mind, pleasing personality and determination. To awaken wisdom in student

COURSE OUTCOMES (COs) : At the end of this course the students would be able to know

CO1	Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
CO2	The person who has studied Geeta will lead the nation and mankind to peace and prosperity
CO3	Study of Neetishatakam will help in developing versatile personality of students.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	1	3	1	1	1	1	1	1
CO2	1	1	1	1	1	3	1	1	1	1	1	1
CO3	1	1	1	1	1	3	1	1	1	1	1	1

COs / PSOs	PSO1	PSO2	PSO3
CO1	1	1	1
CO2	1	1	1
CO3	1	1	1

1/2/3 **indicates Strength of Correlation 3- High, 2- Medium, 1-Low**

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills	Audit Course		
										✓		

Subject Code: EMCC22I08	Subject Name PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS	TY/ LB / ETL /IE	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	IE	2	0/0	0/0	0

UNIT I: Neetisatakam-Holistic developmentofpersonality **10Hrs**

Verses-19,20,21,22(wisdom)Verses-29,31,32(pride&heroism)Verses-26,28,63,65(virtue)Verses-52,53,59(dont's) Verses-71, 73, 75, 78 (do's)

UNIT II Approach to day to day workandduties. **10hrs**

ShrimadBhagwadGeeta:Chapter2-Verses41,47,48,Chapter3-Verses13,21,27,35,Chapter6-Verses5,13,17,23, 35, Chapter 18-Verses 45, 46, 48.

UNIT III Statements **ofbasicknowledge.** **10hrs**

ShrimadBhagwadGeeta:Chapter2-Verses56,62,68Chapter12-Verses13,14,15,16,17,18PersonalityofRolemodel. ShrimadBhagwadGeeta:Chapter2-Verses17,Chapter3-Verses36,37,42,Chapter4-Verses18,38,39Chapter18– Verses 37, 38, 63

Total Number of Hours: 30

TEXT / REFERENCE BOOKS

- "Srimad Bhagavad Gita" by Swami SwarupanandaAdvaita Ashram (Publication Department),Kolkata
- .Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, NewDelhi.

Subject Code: EMCC22I09	Subject Name : RESEARCH AND PUBLICATION ETHICS	Ty / Lb/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Core subjects	IE	2	0/0	0/0	0

Ty/Lb/ : Theory/Lab L : Lecture T : TutorialP : Practical/Project R : Research C: Credits Ty/Lb Theory/Lab

OBJECTIVE:

- To understand the philosophy of science and ethics, research integrity and publication ethics.
- To identify research misconduct and predatory publications.
- To understand indexing and citation databases, open access publications, research metrics (citations, h-index, impact Factor, etc.).

COURSE OUTCOMES (COs) : By doing this course students will

CO1	Understand the ethical issues related to Research and Publication
CO2	know about different types of plagiarism and ways for avoiding plagiarism
CO3	Know about best practices in publication ethics and also learns to avoid Publication misconduct
CO5	Get to know about Violation of publication ethics, authorship and contributor ship and get to identify about Predatory publishers and journals.
CO4	Get to know about various open sources database and research metrics like indexing, citation etc.,

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	3	3	2	3	3	2	3	2	3
CO2	2	3	3	3	3	2	3	3	2	3	2	3
CO3	2	3	3	3	3	2	3	3	2	3	2	3
CO4	2	3	3	3	3	3	3	3	3	3	3	3
CO5	2	3	3	3	3	2	3	3	2	3	2	3

COs / PSOs	PSO1	PSO2	PSO3
CO1	2	3	3
CO2	2	3	3
CO3	2	3	3
CO4	2	3	3
CO5	2	3	3

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills	Audit Course		
										✓		

Subject Code: EMCC22I10	Subject Name : RESEARCH AND PUBLICATION ETHICS	TY/ LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Core subjects	IE	2	0/0	0/0	0
Ty/Lb/ : Theory/Lab L : Lecture T : TutorialP : Practical/Project R : Research C: Credits Ty/Lb Theory/Lab						

Unit I: Introduction **6 Hrs**

Introduction to philosophy: Definition, nature and scope, concept, branches - Ethics: Definition, moral philosophy, nature of moral judgments and reactions – Ethics with respect to Science and Research Intellectual honesty and research integrity

Unit II: Scientific Conduct **6 Hrs**

Scientific misconducts:Falsification, Fabrication, and Plagiarism(FFP) ,Redundant Publications: Duplicate and over lapping publications, salami slicing – Selective reporting and misrepresentation of data

Unit III: Publication Ethics–I **6 Hrs**

Publication ethics: Definition, introduction and importance – Best practices/standards setting initiatives and guidelines: COPE, WAME etc. Publication misconduct: definition, Concept, problems that lead to unethical behavior and vice-versa,types.

Unit IV: Publication Ethics–II **6 Hrs**

Violation of publication ethics, authorship and contributor ship – Identification of publication mis conduct, complaints and appeals – Predatory publishers and journals – Subject specific ethical issues, Complaints andappeals:examplesandfraudfromIndiaandAbroad

Unit V: Data Bases and Research Metrics **6 Hrs**

OpenAccesspublicationandInitiatives–Indexingdatabases–Citationdatabases,Web of Science,Scopus, etc. – Impact factor of journals as per Journal Citation report .SNIP, SJR, IPP, Cite Score -Metrics:h-index,gindex,i10index,altmetrics–Conflictof interest.

Total no of Hours: 30

References:

1. BirdA2006,Philosophy of Science,Routledge
2. MacIntyre&Alasdair,1967,AShortHistoryofEthics,London.
3. Chaddah,P20 18,EthicsinCompetitiveResearch:Donotgetscooped; do notgetplagiarized,ISBN:9789387480865.
4. OnBeingaScientist:AGuidetoResponsibleConductinResearch,2009,NationalAcademyofSciences,NationalAcademy ofEngineeringandInstituteofMedicine.3rdedition,NationalAcademiesPress.
5. Resnik,D.B2011,whatisethicsinresearch&whyisitimportant.NationalInstituteofEnvironmentalHealthSciences,pp.1—10.https://www.niehs.nih.gov/research/reso_uuces/bioethics/whatis/index.cfm
6. Bcall,J2012,Predatorypublishersarecorruptingopenaccess,Nature,Vol.489,no.7415,pp.179—179.https://d0i.org/lO.1038/48917%
7. Ethics in Science Education, 2019Indian National Science Academy (INSA), Research and Governance,ISBN: 978-81-939482-1-7.http://www.insaindia.rcs.Wpdf/Ethics_Book.pdf