FACULTY OF ENGINEERING AND TECHNOLOGY

OUTCOME BASED EDUCATION

Curriculum and Syllabus

B.Tech (Biotechnology)

2022

DEPARTMENT OF BIOTECHNOLOGY

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

Mission No.	Mission Statements
M1	To provide knowledge in biological processes to apply the learned skills in research discoveries to improve human health, protect environment and to enrich economy.
M2	To provide an outstanding environment of learning where students and faculty can apply the knowledge innovatively to create useful products or processes for the society.
M3	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 (PO)

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

Program specific outcomes

PSO 1: Graduates will be able to apply to understand the major biological concepts, analyze The problem, design/develop, and apply the appropriate technique and ability to implement in the various sector 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

B. Tech – Biotechnology (Full Time)
Curriculum and Syllabus
2022 Regulation
SEMESTER – I

S.NO	Course Code	Course Title	Ty/Lb/ETL/IE	L	T/SLr	P/R	C	category
1	EBEN22001	TECHNICAL ENGLISH	Ty	2	0/0	0/0	2	HS
2	EBMA22002	BIO MATHEMATICS	Ty	3	1/0	0/0	4	BS
3	EBPH22ET1	ENGINEERING PHYSICS	ETL	2	0/0	2/0	3	BS
4	EBCH22ET1	ENGINEERING CHEMISTRY	ETL	2	0/0	2/0	3	BS
5	EBEE22ET1	BASIC ELECTRICAL & ELECTRONICS ENGINEERING	ETL	2	0/0	2/0	3	ES
6	EBCS22ET1	C PROGRAMMING AND MS OFFICE TOOLS	ETL	1	0/0	2/0	2	ES
7	EBCC22I01	ORIENTATION TO ENTREPRENEURSHIP & PROJECT LAB	IE	1	0/0	1/0	1	ES

Credits Sub Total: 18

SEMESTER – II

S.NO	Course Code	Course Title	Ty/Lb/ETL/IE	L	T/SLr	P/R	C	category
1	EBMA22004	BIO STATISTICS	Ty	3	1/0	0/0	4	BS
2	EBPH22003	BIO MATERIALS	Ty	3	0/0	0/0	3	BS
3	EBCH22002	INDUSTRIAL CHEMISTRY	Ty	3	0/0	0/0	3	BS
4	EBME22001	ENGINEERING GRAPHICS	Ty	2	0/0	2/0	3	ES
5	EBBT22001	CELL BIOLOGY	Ty	3	0/0	0/0	3	PC
6	EBCC22I02	COMMUNICATIVE ENGLISH LAB	IE	1	0/0	1/0	1	HS
7	EBCS22ET2	PYTHON PROGRAMMING	ETL	1	0/0	2/0	2	ES
8	EBCC22I03	ENVIRONMENTAL SCIENCE (Audit course)	IE	1	0/0	1/0	0	HS

Credits Sub Total: 19

TOTAL CREDITS: 37

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 – III

S.NO	Course Code	Course Title	Ty/Lb/ ETL/IE	L	T/SLr	P/R	C	Category
THEORY								
1	EBBT22002	BIOCHEMISTRY	Ty	3	1/0	0/0	4	PC
2	EBBT22003	MICROBIOLOGY	Ty	3	1/0	0/0	4	PC
3	EBBT22004	BIOTHERMODYNAMICS	Ty	3	0/0	0/0	3	PC
4	EBCS22ID3	OBJECT ORIENTED PROGRMMING FOR BIOTECHNOLOGISTS	Ty	3	0/0	0/0	3	ID
PRACTICALS								
1	EBCC22ET1	UNIVERSAL HUMAN VALUES UNDERSTANDING HARMONY	ETL	1	0/0	2/0	2	HS
2	EBBT22L01	BIOCHEMISTRY LAB	Lb	0	0/0	3/0	1	PC
3	EBBT22L02	MICROBIOLOGY LAB	Lb	0	0/0	3/0	1	PC
4	EBCS22IL2	OBJECT ORIENTED PROGRMMING FOR BIOTECHNOLOGISTS LAB	Lb	0	0/0	3/0	1	ID
5	EBBT22ET1	GENETICS	ETL	2	0/0	2/0	3	PC

Credits Sub Total: 22

SEMESTER – IV

S.NO	Course Code	Course Title	Ty/Lb/ ETL/IE	L	T/SLr	P/R	C	Category
THEORY								
1	EBMA22012	ADVANCED MATHEMATICS FOR BIO TECHNOLOGY	Ty	3	1/0	0/0	4	BS
2	EBBT22005	INSTRUMENTATION METHODS AND ANALYSIS	Ty	3	0/0	0/0	3	PC
3	EBBT22006	MICROBIAL BIOTECHNOLOGY	Ty	3	1/0	0/0	4	PC
4	EBCS22ID4	BIO DATABASE MANAGEMENT SYSTEM	Ty	3	0/0	0/0	3	ID
5	EBEE22ID5	BIOPROCESS INSTRUMENTATION AND CONTROL SYSTEM	Ty	3	0/0	0/0	3	ID
6	EBCC22I04/ EBCC22I05	THE INDIAN CONSTITUTION/THE INDIAN TRADITIONAL KNOWLEDGE (Audit course)	IE	2	0/0	0/0	0	HS
PRACTICALS								
1	EBCS22IL4	BIO DATABASE MANAGEMENT SYSTEM LAB	Lb	0	0/0	3/0	1	ID
2	EBBT22L03	INSTRUMENTAL METHODS OF ANALYSIS LAB	Lb	0	0/0	3/0	1	PC
3	EBBT22L04	MICROBIAL BIOTECHNOLOGY LAB	Lb	0	0/0	3/0	1	PC
4	EBEE22IL2	BIOPROCESS CONTROL SYSTEM LAB	Lb	0	0/0	3/0	1	ID

5	EBBT22I01	TECHNICAL SKILL –I	IE	0	0/0	2/0	1	SC
6	EBCC22I06	SOFT SKILL I - Employability skills	IE	0	0/0	2/0	1	SC

Credits Sub Total: 23

SEMESTER – V

S.NO	Course Code	Course Title	Ty/Lb/ ETL/IE	L	T/SLr	P/R	C	Category
THEORY								
1	EBBT22007	MOLECULAR BIOLOGY AND RECOMBINANT DNA TECHNOLOGY	Ty	3	1/0	0/0	4	PC
2	EBBT22008	IMMUNOLOGY	Ty	3	1/0	0/0	4	PC
3	EBBT22009	PHARMACEUTICAL TECHNOLOGY	Ty	3	0/0	0/0	3	PC
4	EBBT22EXX	PROGRAM ELECTIVE –I	Ty	3	0/0	0/0	3	PE
5	EBXX22OEX	OPEN ELECTIVE –I	Ty	3	0/0	0/0	3	ID
6	EBOL22I01	ONLINE COURSE (NPTEL/SWAYAM/Any MOOC online course approved by AICTE/UGC)	IE	1	0/0	1/0	1	ID
PRACTICALS								
1	EBBT22L05	MOLECULAR BIOLOGY AND RECOMBINANT DNA TECHNOLOGY LAB	Lb	0	0/0	3/0	1	PC
2	EBBT22L06	IMMUNOLOGY LAB	Lb	0	0/0	3/0	1	PC
3	EBBT22I02	TECHNICAL SKILL –II	IE	0	0/0	2/0	1	SC
4	EBBT22ET2	ENZYME TECHNOLOGY	ETL	2	0/0	2/0	3	PC

Credits Sub Total: 24

SEMESTER – VI

S.NO	Course Code	Course Title	Ty/Lb/ ETL/IE	L	T/SLr	P/R	C	Category
THEORY								
1	EBBT22010	BIOPROCESS ENGINEERING	Ty	3	1/0	0/0	4	PC
2	EBBT22011	BIOINFORMATICS	Ty	3	0/0	0/0	3	PC
3	EBBT22012	PROTEIN CHEMISTRY	Ty	3	0/0	0/0	3	PC
4	EBBT22EXX	PROGRAM ELECTIVE- II	Ty	3	0/0	0/0	3	PE
5	EBXX22OEX	OPEN ELECTIVE –II	Ty	3	0/0	0/0	3	ID
PRACTICALS								
1	EBBT22L07	BIOPROCESS ENGINEERING LAB	Lb	0	0/0	3/0	1	PC
2	EBBT22L08	BIOINFORMATICS LAB	Lb	0	0/0	3/0	1	PC

3	EBCC22I07	SOFT SKILL II - Qualitative & Quantitative skill	IE	0	0/0	2/0	1	HS
4	EBBT22I03	TECHNICAL SKILL –III	IE	0	0/0	2/0	1	SC
5	EBBT22I04	MINI PROJECT/INTERNSHIP	IE	0	0/0	3/0	1	SC

Credits Sub Total: 21

SEMESTER – VII

S.NO	Course Code	Course Title	Ty/Lb/ ETL/IE	L	T/SLr	P/R	C	Category
THEORY								
1	EBBT22013	DOWNSTREAM PROCESSING	Ty	3	1/0	0/0	4	PC
2	EBBT22014	ANIMAL TISSUE CULTURE	Ty	3	0/0	0/0	3	PC
3	EBBT22015	FOOD BIOTECHNOLOGY	Ty	3	0/0	0/0	3	PC
4	EBBT22016	BIO FUELS	Ty	3	0/0	0/0	3	PC
5	EBBT22EXX	PROGRAM ELECTIVE –III	Ty	3	0/0	0/0	3	PE
PRACTICALS								
1	EBXX22OLX	OPEN LAB	Lb	0	0/0	3/0	1	ID
2	EBBT22L09	DOWNSTREAM PROCESSING LAB	Lb	0	0/0	3/0	1	PC
3	EBBT22L10	ANIMAL TISSUE CULTURE LAB	Lb	0	0/0	3/0	1	PC
4	EBBT22I05	PROJECT PHASE –I	IE	0	0/0	3/3	2	P
5	EBFL22IXX	FOREIGN LANGUAGE	IE	1	0/0	1/0	1	HS

Credits Sub Total: 22

SEMESTER – VIII

S.NO	Course Code	Course Title	Ty/Lb/ ETL/IE	L	T/SLr	P/R	C	category
THEORY								
1	EBCC22ID3	TOTAL QUALITY MANAGEMENT	Ty	3	0/0	0/0	3	ID
2	EBBT22EXX	PROGRAM ELECTIVE –IV	Ty	3	0/0	0/0	3	PE
3	EBBT22EXX	PROGRAM ELECTIVE –V	Ty	3	0/0	0/0	3	PE
PRACTICALS								
1	EBBT22L11	PROJECT PHASE –II	Lb	0	0/0	12/12	8	P

Credits Sub Total: 17

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

ELECTIVE LIST

ELECTIVES (THEORY)								
S.No	**Course Code**	**Course Title**	**TY / LB/ ETL/IE**	**L**	**T/SLr**	**P/R**	**C**	**Category**
		PROGRAM ELECTIVE –I						
1	EBBT22E01	Plant Biotechnology	Ty	3	0/0	0/0	3	PE
2	EBBT22E02	Environmental Impact Assessment	Ty	3	0/0	0/0	3	PE
3	EBBT22E03	Stem cells and Developmental Biology	Ty	3	0/0	0/0	3	PE
		PROGRAM ELECTIVE –II						
4.	EBBT22E04	Cancer Biology	Ty	3	0/0	0/0	3	PE
5.	EBBT22E05	Herbal Drug technology	Ty	3	0/0	0/0	3	PE
6.	EBBT22E06	Solid and Hazardous waste management	Ty	3	0/0	0/0	3	PE
		PROGRAM ELECTIVE –III						
7	EBBT22E07	Biomaterials and Tissue Engineering	Ty	3	0/0	0/0	3	PE
8	EBBT22E08	Human cytogenetics	Ty	3	0/0	0/0	3	PE
9	EBBT22E09	Environmental toxicology	Ty	3	0/0	0/0	3	PE
10	EBBT22E10	Marine Biotechnology	Ty	3	0/0	0/0	3	PE
		PROGRAM ELECTIVE -IV						
11	EBBT22E11	Agricultural Biotechnology	Ty	3	0/0	0/0	3	PE
12	EBBT22E12	Molecular pathogenesis	Ty	3	0/0	0/0	3	PE
13	EBBT22E13	Legal Aspects of Biotechnology	Ty	3	0/0	0/0	3	PE
		PROGRAM ELECTIVE -V						
14	EBBT22E14	Human Genomics	Ty	3	0/0	0/0	3	PE
15	EBBT22E15	Nanotechnology	Ty	3	0/0	0/0	3	PE
16	EBBT22E16	Bioremediation of Industrial Effluents	Ty	3	0/0	0/0	3	PE

OPEN ELECTIVE (THEORY)
(OFFERED BY OTHER DEPARTMENT TO BIOTECHNOLOGY STUDENTS)
COMPUTER SCIENCE AND ENGINEERING

S.NO	Course Code	Course Title	Ty/Lb/ETL/IE	L	T/SLr	P/R	C
1	EBCS22OE1	Cyber security & Forensics	Ty	3	0/0	0/0	3
2	EBCS22OE2	Artificial Intelligence	Ty	3	0/0	0/0	3
3	EBCS22OE3	Data Base Concepts	Ty	3	0/0	0/0	3
4	EBCS22OE4	Software Engineering	Ty	3	0/0	0/0	3

INFORMATION TECHNOLOGY

S.NO	Course Code	Course Title	Ty/Lb/ETL/IE	L	T/SLr	P/R	C
1	EBIT22OE1	Web Design	Ty	3	0/0	0/0	3
2	EBIT22OE 2	Digital Marketing	TY	3	0/0	0/0	3
3	EBIT22OE3	Cyber Security Essentials	Ty	3	0/0	0/0	3
4	EBIT22OE4	Introduction to Multimedia	Ty	3	0/0	0/0	3

ELECTRONICS AND COMMUNICATION ENGINEERING

S.NO	Course Code	Course Title	Ty/Lb/ETL/IE	L	T/SLr	P/R	C
1	EBEC22OE1	Internet of Things and its Applications	Ty	3	0/0	0/0	3
2	EBEC22OE2	Cellular Mobile communication	TY	3	0/0	0/0	3
3	EBEC22OE3	Satellite and its Applications	Ty	3	0/0	0/0	3
4	EBEC22OE4	Fundamentals of Sensors	Ty	3	0/0	0/0	3
5	EBEC22OE5	Microprocessor Based System Design	Ty	3	0/0	0/0	3
6	EBEC22OE6	Industry 4.0 Concepts	Ty	3	0/0	0/0	3

ELECTRICAL AND ELECTRONICS ENGINEERING

S.NO	Course Code	Course Title	Ty/Lb/ETL/IE	L	T/SLr	P/R	C
1	EBEE22OE1	Electrical Safety for Engineers	Ty	3	0/0	0/0	3
2	EBEE22OE2	Energy Conservation Techniques	TY	3	0/0	0/0	3
3	EBEE22OE3	Electric Vehicle Technology	Ty	3	0/0	0/0	3
4	EBEE22OE4	Biomedical Instrumentation	Ty	3	0/0	0/0	3
5	EBEE22OE5	Industrial Instrumentation	Ty	3	0/0	0/0	3
6	EBEE22OE6	Solar Energy Conversion System	Ty	3	0/0	0/0	3
7	EBEE22OE7	Wind Energy Conversion System	Ty	3	0/0	0/0	3
8	EBEE22OE8	Energy Storage Technology	Ty	3	0/0	0/0	3
9	EBEE22OE9	Electrical Machines	Ty	3	0/0	0/0	3

MECHANICAL ENGINEERING

S.NO	Course Code	Course Title	Ty/Lb/ETL/IE	L	T/SLr	P/R	C
1	EBME22OE1	Industrial Engineering	Ty	3	0/0	0/0	3
2	EBME22OE2	Refrigeration and Air conditioning	TY	3	0/0	0/0	3
3	EBME22OE3	Automobile Engineering	Ty	3	0/0	0/0	3
4	EBME22OE4	Industrial Robotics	Ty	3	0/0	0/0	3
5	EBME22OE5	Sustainable Energy	Ty	3	0/0	0/0	3
6	EBME22OE6	Composite Materials	Ty	3	0/0	0/0	3
7	EBME22OE7	Industry 4.0	Ty	3	0/0	0/0	3
8	EBME22OE8	Virtual and Augmented Reality	Ty	3	0/0	0/0	3

CIVIL ENGINEERING

S.NO	Course Code	Course Title	Ty/Lb/ETL/IE	L	T/SLr	P/R	C
1	EBCE22OE1	Water Pollution and Its management	Ty	3	0/0	0/0	3
2	EBCE22OE2	Air Pollution Control	TY	3	0/0	0/0	3
3	EBCE22OE3	Green Building and Vastu Concepts	Ty	3	0/0	0/0	3
4	EBCE22OE4	Climate Change and Sustainable Development	Ty	3	0/0	0/0	3
5	EBCE22OE5	Intelligent Transportation Systems	Ty	3	0/0	0/0	3
6	EBCE22OE6	Environment, Health and Safety in Industries	Ty	3	0/0	0/0	3
7	EBCE22OE7	Industrial Pollution Prevention and Cleaner Production	Ty	3	0/0	0/0	3
8	EBCE22OE8	Fundamentals of nanoscience	Ty	3	0/0	0/0	3

CHEMICAL ENGINEERING

S.NO	Course Code	Course Title	Ty/Lb/ETL/IE	L	T/SLr	P/R	C
1	EBCT22OE1	Fundamentals of Nanoscience	Ty	3	0/0	0/0	3
2	EBCT22OE2	Electrochemical Engineering	TY	3	0/0	0/0	3
3	EBCT22OE3	Alternative Fuels And Energy System	Ty	3	0/0	0/0	3
4	EBCT22OE4	Petrochemical Unit Processes	Ty	3	0/0	0/0	3
5	EBCT22OE5	Principles of Desalination Technologies	Ty	3	0/0	0/0	3
6	EBCT22OE6	Piping Design Engineering	Ty	3	0/0	0/0	3
7	EBCT22OE7	E- Waste Management	Ty	3	0/0	0/0	3

Dr APJ Abdul Kalam Center for Research

S.NO	Course Code	Course Title	Ty/Lb/ETL/IE	L	T/SLr	P/R	C
1	EBMG22OE1	Technical Entrepreneurship	Ty	3	0/0	0/0	3
2	EBMG22OE2	Advanced Program in Entrepreneurship	TY	3	0/0	0/0	3

OPEN ELECTIVES LAB

COMPUTER SCIENCE AND ENGINEERING

S.NO	Course Code	Course Title	Ty/Lb/ ETL/ IE	L	T/SLr	P/R	C
1	EBCS22OL1	Artificial Intelligence Lab	Lb	0	0/0	3/0	1
2	EBCS22OL2	PHP/My SQL Programming Lab	Lb	0	0/0	3/0	1
3	EBCS22OL3	Database Lab	Lb	0	0/0	3/0	1

INFORMATION TECHNOLOGY

S.NO	Course Code	Course Title	Ty/Lb/ ETL/ IE	L	T/SLr	P/R	C
1	EBIT22OL1	Visual Programming Lab	Lb	0	0/0	3/0	1
2	EBIT22OL2	Web Design Lab	Lb	0	0/0	3/0	1
3	EBIT22OL3	Digital content creation Lab	Lb	0	0/0	3/0	1
4	EBIT22OL4	Computer Network Lab	Lb	0	0/0	3/0	1
5	EBIT22OL5	PHP/My SQL Programming Lab	Lb	0	0/0	3/0	1

ELECTRONICS AND COMMUNICATION ENGINEERING

S.NO	Course Code	Course Title	Ty/Lb/ETL/ IE	L	T/SLr	P/R	C
1	EBEC22OL1	Sensors and IoT Lab	Lb	0	0/0	3/0	1
2	EBEC22OL2	Robotics Control Lab	Lb	0	0/0	3/0	1
3	EBEC22OL3	Basics of MATLAB	Lb	0	0/0	3/0	1

ELECTRICAL AND ELECTRONICS ENGINEERING

S.NO	Course Code	Course Title	Ty/Lb/ ETL/ IE	L	T/SLr	P/R	C
1	EBEE22OL1	Transducer Lab	Lb	0	0/0	3/0	1
2	EBEE22OL2	PLC and SCADA Lab	Lb	0	0/0	3/0	1
3	EBEE22OL3	Electrical Maintenance Lab	Lb	0	0/0	3/0	1
4	EBEE22OL4	Power Electronics Lab	Lb	0	0/0	3/0	1
5	EBEE22OL5	Bio Medical Instrumentation Lab	Lb	0	0/0	3/0	1
6	EBEE220L6	Electrical Machines Lab	Lb	0	0/0	3/0	1

MECHANICAL ENGINEERING

S.NO	Course Code	Course Title	Ty/Lb/ ETL/ IE	L	T/SLr	P/R	C
1	EBME22OL1	Internal Combustion Engines and Steam Lab	Lb	0	0/0	3/0	1
2	EBME22OL2	Computer Aided Design and Simulation Lab	Lb	0	0/0	3/0	1
3	EBME22OL3	Mechanical Measurements & Metallurgy Lab	Lb	0	0/0	3/0	1
4	EBME22OL4	Automation Lab	Lb	0	0/0	3/0	1
5	EBME22OL5	Virtual and Augmented Reality Lab	Lb	0	0/0	3/0	1

CIVIL ENGINEERING

S.NO	Course Code	Course Title	Ty/Lb/ ETL/IE	L	T/SLr	P/R	C
1	EBCE22OL1	Building Drawing Practice using Auto CADD	Lb	0	0/0	3/0	1
2	EBCE22OL2	Geographical Information System And Mapping Lab	Lb	0	0/0	3/0	1
3	EBCE22OL3	Environmental Engineering Laboratory	Lb	0	0/0	3/0	1

CHEMICAL ENGINEERING

S.NO	Course Code	Course Title	Ty/Lb/ ETL/IE	L	T/S Lr	P/R	C
1	EBCT22OL1	Chemical Separation Lab	Lb	0	0/0	3/0	1
2	EBCT22OL2	Chemical Composition Analysis Lab	Lb	0	0/0	3/0	1
3	EBCT22OL3	Alternate Fuel Lab	Lb	0	0/0	3/0	1
4	EBCT22OL4	Food Testing Laboratory	Lb	0	0/0	3/0	1

(OFFERED BY BIOTECHNOLOGY DEPARTMENT TO OTHER DEPARTMENT STUDENTS)

OPEN ELECTIVE

S.No	Course Code	Course Title	TY / LB/ ETL/IE	L	T/SLr	P/R	C
1.	EBBT22OE1	Food and Nutrition	Ty	3	0/0	0/0	3
2	EBBT22OE2	Human physiology	Ty	3	0/0	0/0	3
3	EBBT22OE3	Basic Bioinformatics	Ty	3	0/0	0/0	3
4	EBBT22OE4	Bioprocess principles	Ty	3	0/0	0/0	3
5	EBBT22OE5	Biosensors and biomedical Devices in diagnostics	Ty	3	0/0	0/0	3

OPEN LAB

S.NO	Course Code	Course Title	TY / LB/ ETL/IE	L	T/SLr	P/R	C
1.	EBBT22OL1	Basic Biochemistry lab	Lb	0	0/0	3/0	1
2	EBBT22OL2	Basic Microbiology lab	Lb	0	0/0	3/0	1
3	EBBT22OL3	Basic Bioprocess lab	Lb	0	0/0	3/0	1
4	EBBT22OL4	Basic Bioinformatics lab	Lb	0	0/0	3/0	1

FOREIGN LANGUAGE

S.NO	Course Code	Course Title
1.	EBFL22I01	FRENCH
2	EBFL22I02	GERMAN
3	EBFL22I03	JAPANESE
4	EBFL22I04	ARABIC
5	EBFL22I05	CHINESE
6	EBFL22I06	RUSSIAN
7	EBFL22I07	SPANISH

CREDIT SUMMARY

Semester 1 : 18 Credits

Semester 2 : 19 Credits

Semester 3 : 22 Credits

Semester 4 : 23 Credits

Semester 5 : 24 Credits

Semester 6 : 21 Credits

Semester 7 : 22 Credits

Semester 8 : 17 Credits

TOTAL CREDITS - 166

Table 1: Credit Distribution Format

S. No	CATEGORY	Description	No. of Courses	Credits	Total	Credit Weightage	Contact hours
1	CORE COURSES	Core Theory	19	65	75	45.1	1215
		Core Lab	10	10			450
2	ELECTIVE COURSES	Department Core Electives/ Skill enhancement electives	5	15	15	9.03	225
3	OPEN ELECTIVES	Open Elective theory	2	6	7	4.21	90
		Open Elective Lab	1	1			45
4	INTERDISCIPLINARY/ ALLIED COURSES	Allied Theory	11	35	42	25.3	525
		Allied Lab	5	7			180
5	HUMANITIES & SOCIAL SCIENCES , LIFE SKILLS &SOFT SKILLS	Language 1 & 2			10	6.2	
		English 1 & 2	2	3			45
		Soft Skills	2	2			90
		Foreign Language	1	1			30
		Environmental Studies	1	-			30
		Management Papers	1	3			45
		Entrepreneurship Development	1	1			30
6	PROJECTS/INTERNSHIP/ CORE SKILL	Project	2	10	14	8.4	45
		Core Skills	3	3			90
		Internship / NSS / NCC	1	1			
7	ANY OTHER	Human Values And Indian Constitution	2	3	3	1.80	75
8	RESEARCH COMPONENT	Research methodology, Publication, IPR and patents etc.	-	-	-	-	-
Total			**69**	**166**	**166**	**100**	**3210**

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
1	BBT22001	CELL BIOLOGY		REVAMP OF SYLLABUS. THE COURSE SHIFTED TO SECOND SEMESTER FROM THIRD SEMESTER	100
2	BBT22003	BIOCHEMISTRY		REARRANGEMENT OF EXISTING UNITS	
3	BBT22004	MICROBIOLOGY		IN UNIT I HISTORY AND SCOPE INTRODUCED. KINGDOM AND CLASSIFICATION .UNIT III VARIOUS FUNGAL GENUS WAS INTRODUCED. UNIT IV BACTERIOPHAGES INTRODUCED	35
4	BBT22006	INSTRUMENTATION METHODS OF ANALYSIS		UNIT 2,3,4,5 COMPLETELY REVAMPED	80
5		BIOINFORMATICS		MOLECULAR VISUALIZATION TOOLS WAS INTRODUCED IN THE SYLLABUS	5
6	BBT22E08	HUMAN CYTOGENETICS		NEW ELECTIVE INTRODUCED	100

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	Human Cytogenetics	C Programming and MS office tools	Universal Human Values 2: Understanding harmony (Internal Evaluation)	Human Cytogenetics	Bio Database Management System	Instrumental Methods of Analysis Lab
2		Python Programming	Communication Lab		Advanced Mathematics for Biotechnologists	Microbial Technology Lab
3			Soft skill 1		Object Oriented Programming	Bioprocess control system lab
4			Soft skill 2		Bio Database Systems Lab	Molecular Biology Lab
5						Immunology Lab
6						Technical Skill 1
7						Technical Skill 2
						Technical Skill 2
8						Downstream Processing Lab
9						Animal Tissue Culture Lab
10						Project Phase -I
						Project Phase – II
						Mini Project/In plant Training/Industrial training

SEMESTER - I

Subject Code	Subject Name :TECHNICAL ENGLISH	Ty/Lb/ETL/IE	L	T/SLr	P/R	C
EBEN22001	Prerequisite :Higher Secondary English	**Ty**	**2**	**0/0**	**0/0**	**2**

C: Credits, L: Lecture, T: Tutorial, SLr: Supervised Learning, P: Problem / PracticalR: Research, Ty/Lb/ETL/IE: Theory /Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES

To refresh and stimulate students' English learning through Content Integrated Language Learning to have an in-depth understanding of the components of English language and its use in communication that they are competent in inter-personal and academic communication for a successful career.

COURSE OUTCOMES (Cos)

Students completing this course were able to

CO1	Refresh and stimulate their English learning through Content Integrated Language Learning
CO2	Have an in-depth understanding of the components of English language and its use in communication.
CO3	Strengthen their vocabulary and syntactic knowledge for use in academic and technical communication
CO4	Learn to negotiate meaning in inter-personal and academic communication for a successful career
CO5	Engage in organized academic and professional writing for life-long learning and research

Mapping of Course Outcome with Program Outcome (POs)

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

COs/PSOs	PSO1	PSO2	PSO3		
CO1	2	1			
CO2	1				
CO3		1	1		
CO4					
CO5	1	1	1		

3/2/1 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 :TECHNICAL ENGLISH	Ty/Lb/ETL/IE	L	T/SLr	P/R	C
EBEN22001	Prerequisite :Pass in Plus 2 English	**Ty**	**2**	**0/0**	**0/0**	**2**

Unit I Vocabulary Development: **6 Hrs**

Affixes: prefixes and suffixes and word formation–synonyms and antonyms-nominal compounds, expanding using numbers and approximation - preposition, prepositional phrases, preposition + relative pronoun- adjective: degrees of comparison, formation of adjectives, irregular comparatives- Infinitive and Gerunds

Unit II Grammar **6 Hrs**

Tenses- auxiliary and modal –voice: active, passive and impersonal passive - Questions: Wh-pattern, Yes/no questions, tag questions – adverbs and adverbial clauses- 'If' clause, 'cause and effect', 'purpose'- Concord: subject-verb agreement

Unit III Reading **6 Hrs**

Comprehension: extracting relevant information from the text, by skimming and scanning and inferring, identifying lexical and contextual meaning for specific information, identifying the topic sentence and its role in each paragraph, comprehension exercises - Note - making - Précis writing-instructions, suggestions and recommendations.

Unit IV Writing **6 Hrs**

Jumbled sentences - paragraph writing coherence devices- discourse markers. Essay writing- Letter writing, Informal and formal: seeking permission to undergo practical training, letter to an editor of a newspaper complaining about civic problems and suggesting suitable solutions

Unit V Visual Aids in Communication **6 Hrs**

Interpretation of diagrams - tables, flow charts, pie charts and bar charts, and their use in Business reports

Total Periods: 30

Text book

- Panorama_: Content Integrated Language Learning for Engineers, M. Chandrasena Rajeswaran & R. Pushkala, Vijay Nicole Imprints Pvt. Ltd., Chennai

References

- Bhatnagar & Bhatnagar, Communicative English for Engineers and Professionals, Pearson
- Wren and Martin: Grammar and Composition, Chand & Co, 2006
- https://learnenglish.britishcouncil.org
- www.better-english.com/grammar/preposition.

Subject Code EBMA22002	Subject Name :BIO MATHEMATICS (For BT&BME)	Ty/Lb/ETL/IE	L	T/S.Lr	P/R	C
	Prerequisite: Higher secondary Mathematics	Ty	3	1/0	0/0	4

C: Credits, L: Lecture, T: Tutorial, SLr: Supervised Learning, P: Problem / Practical R: Research, Ty/Lb/ETL/IE: Theory /Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES :

The student should be made to:

To understand the Basic concepts in Matrices

To understand the concepts in Differentiation

To analyze the Basic concepts in Integration

To be able to understand concepts in Interpolation

To understand the Basic concepts in Numerical Differentiation and Integration

COURSE OUTCOMES (COs) :

CO1	Apply concepts in Matrices
CO2	Know the Evaluation of basics in differentiation
CO3	Know the basic concepts of integration and its application
CO4	Understand the concept of inert poling techniques
CO5	Explore the knowledge of Numerical Differentiation and Integration

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	2	2	3	1	1	2	3	2	1	3
CO2	2	2	1	2	2	2	2	2	3	1	2	3
CO3	2	3	1	2	2	3	1	1	2	2	2	3
CO4	3	2	2	3	1	2	2	2	2	1	2	3
CO5	3	3	1	3	1	1	2	1	3	2	1	2

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

3/2/1 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 EBMA22002	Subject Name :BIO MATHEMATICS (For BT &BME)	Ty/Lb/ETL/IE	L	T/S.Lr	P/R	C
	Prerequisite: Higher secondary Mathematics	Ty	3	1/0	0/0	4

UNITI MATRICES **12 Hrs**

Elementary operations on Matrices – Inverse of a Matrix – Solving simultaneous equations (at most three equations with three unknowns) using Cramer's rule.

UNIT II DIFFERENTIATION **12Hrs**

Basic concepts of Differentiation – Elementary differentiation methods –Parametric functions – Implicit function–Maxima and Minima (simple problems).

UNIT III INTEGRATION **12 Hrs**

Basic concepts of Integration–Methods of Integration–Integration by substitution –Integration by parts –Definite Integrals – Properties of Definite Integrals –Problems on finding Area using single integrals (simple problems).

UNIT IV INTERPOLATION **12 Hrs**

Interpolation: Newton's forward, Newton's backward formulae –Newton's divided differences –Lagrange's polynomial (simple problems).

UNIT V NUMERICAL DIFFERENTIATION AND INTEGRATION **12 Hrs**

Numerical differentiation with interpolation polynomials (Newton's forward and backward only) – Numerical integration by Trapezoidal and Simpson's (both $1/3^{rd}$& $3/8^{th}$) rules (simple problems).

Total Periods: 60

Reference Books:

- Shanti Narayanan, *Differential Calculus*, S.Chand&Co.,New Delhi, (2005).
- Shanti Narayanan, *Integral Calculus*, S.Chand&Co.,New Delhi, (2005).
- Veerarajan T., *Engineering Mathematics (for first year)*, Tata McGraw Hill Publishing Co., (2008).
- John Bird, *Basic Engineering Mathematics (5th ed.)*, Elsevier Ltd, (2010).
- Veerarajan T., *Numerical Methods*, Tata McGraw Hill Publishing Co., (2007).

Subject Code	Subject Name :**ENGINEERING PHYSICS**	Ty/Lb/ETL/IE	L	T/SLr	P/R	C
EBPH22ET1	**Prerequisite :Higher Sec. Physics**	**ETL**	**2**	**0/0**	**2/0**	**3**

C: Credits, L: Lecture, T: Tutorial, SLr: Supervised Learning, P: Problem / Practical
R: Research, Ty/Lb/ETL/IE: Theory /Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES

- Outline the relation between Science, Engineering & Technology.
- Demonstrate competency in understanding basic concepts.
- Apply fundamental laws of Physics in Engineering & Technology.
- To identify & solve problems using physics concepts.
- Produce and present activities associated with the course through effective technical communication

COURSE OUTCOMES (Cos)
Students completing this course were able to

CO1	Demonstrate competency in understanding basic concepts.
CO2	Utilize scientific methods for formal investigations & demonstrate competency with experimental methods and verify the concept to content knowledge.
CO3	Identify and provide solutions for engineering problems.
CO4	Relate the technical concepts to day to day life and to practical situations.
CO5	Think analytically to interpret concepts.

Mapping of Course Outcome with Program Outcome (POs)

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

COs/PSOs	PSO1	PSO2	PSO3	
CO1	3	1	1	
CO2	3		2	
CO3	3	2		
CO4	3	1	1	
CO5	3	2		

3/2/1 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 :**ENGINEERING PHYSICS**	Ty/Lb/ETL/IE	L	T/SLr	P/R	C
EBPH22ET1	**Prerequisite :Higher Sec. Physics**	**ETL**	**2**	**0/0**	**2/0**	**3**

UNIT I PROPERTIES OF MATTER **12**

Elasticity - stress, strain and Hook's law - Poisson's ratio - three moduli of elasticity - twisting couple on a wire – Shafts – Solid & Hollow Shafts – Bending moment – Young's Modulus Determination by Non Uniform Bending - I form of girders.

viscosity - flow of liquid through a narrow tube: Poiseuille's law (Qualitative) - Ostwald`s viscometer – Lubrication

Lab Component – 1. Coefficient of Viscosity determination using Poiseuille's Method

UNIT II ACOUSTICS & ULTRASONICS **12**

Fundamentals of acoustics - reverberation- reverberation time - factors affecting acoustics. Ultrasonics -Production of ultrasonic waves - detection of ultrasonic waves+ - acoustic grating - application of ultrasonic waves.

Lab Component – 2. Ultrasonic Velocity Determination

UNIT III WAVE OPTICS **12**

Huygen`s principle - interference of light – wave front splitting and amplitude – air wedge - Newton`s rings - Michelson interferometer and its applications - Fraunhofer diffraction from a single slit - diffraction grating

Lab Component – 3. Spectrometer – Grating

UNIT IV LASER **12**

Laser principle and characteristics - amplification of light by population inversion - properties of laser beams: mono-chromaticity, coherence, directionality and brightness - different types of lasers - Ruby laser-Nd-YAG laser-He-Ne laser-CO_2 laser - semiconductor laser - applications of lasers in science, engineering and medicine.

Lab Component – 4. Determination of Wavelength of the given Laser source& Particle Size Determination

UNIT V FIBER OPTIC COMMUNICATION **12**

Total Internal Reflection – Propagation of Light in Optical Fibers – Numerical aperture and Acceptance Angle – Types of Optical Fibers (material, refractive index, mode) – Fiber Optical Communication system (Block diagram) – Attenuation–Transmitter, Receiver, Dispersion, Modulation/Demodulation Advantages of Fiber Optical Communication System – IMT, PMT, Wavelength Modulated & Polarization Modulated Sensors – Endoscope Applications.

Lab Component – 5. Determination of Numerical Aperture of Optical Fiber

Total Periods: 60

TEXT BOOKS

1. Brijlal, M. N. Avadhanulu & N. Subrahmanyam, Text Book of Optics, S. Chand Publications, 25th edition, 2012
2. R. Murugeshan, Electricity and Magnetism, S.Chand Publications, 10th edition, 2017
3. R. Murugeshan & Kiruthiga Sivaprasath, Modern Physics, S.Chand Publications, 2016

REFERENCE BOOKS

1. Dr. Senthil Kumar Engineering Physics I VRB Publishers, 2016
2. N Subrahmanyam & Brijlal, Waves and Oscillations, Vikas Publications, New Delhi,1988
3. N Subrahmanyam & Brijlal, Properties of Matter, S. Chand Co., New Delhi, 1982
4. N Subrahmanyam & Brijlal, Text book of Optics, S. Chand Co., New Delhi, 1989
5. R. Murugeshan, Electricity and Magnetism, S. Chand & Co., New Delhi, 1995
6. Thygarajan K & Ajay Ghatak, Laser Theory and Applications, Macmillan, New Delhi, 1988
7. Dr. S. Muthukumaran, Dr.G.Balaji, S.Masilamani - PHYSICS LABORATORY I & II by Sri Krishna Hitech Publishing Company Pvt.Ltd.

Total Periods: 45

References

- Jain &Jain *Engineering Chemistry* 17th Edition, Dhanpat Rai Publishing Company
- Vasant R. Gowariker,, N. V. Viswanathan, Jayadev Sreedhar, *Polymer Science*, New Age International, 1986
- B.K. Sharma, *Polymer Chemistry*, Goal Publishing House
- Y. R. Sharma, Elementary *Organic Spectroscopy*, S.Chand & Company Ltd.
- N.Krishnamurthy, K.Jeyasubramanian, P.Vallinayagam, Applied Chemistry, Tata McGraw-Hill Publishing Company Limited, 1999.
- Chichester, polymer-clay-nano composites,Johnwiley(2000)

Subject Code	Subject Name	Ty/Lb/ETL/IE	L	T/SLr	P/R	C
	ENGINEERING CHEMISTRY					
EBCH22ET1	**Prerequisite :Higher Sec. Chemistry**	**ETL**	**2**	**0/0**	**2/0**	**3**

C: Credits, L: Lecture, T: Tutorial, SLr: Supervised Learning, P: Problem / Practical
R: Research, Ty/Lb/ETL/IE: Theory /Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES

1.To deduce practical application of theoretical concepts
2.To provide and insight into fundamental concepts of chemical thermodynamics
3.To articulate the water treatment methods
4. To impart the knowledge in electrical conductance and EMF
5. To create awareness about the modern Nano composites along with concepts of polymers
6.To introduce analytical tools for characterization techniques**.**

COURSE OUTCOMES (Cos)

Students completing this course were able to

CO1	Apply relevant instrumentation techniques to solve complex problems
CO2	Recall the fundamentals and demonstrate by understanding the first principles of Engineering sciences.
CO3	Examine the appropriate techniques to interpret data to provide valid conclusion
CO4	Demonstrate the collaboration of science and Engineering to recognize the need for lifelong learning.
CO5	Analyse the impact of contextual knowledge to access the health and society issues.

Mapping of Course Outcome with Program Outcome (POs)

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

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

3/2/1 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 **ENGINEERING CHEMISTRY**	Ty/Lb/ETL /IE	L	T/SLr	P/R	C
EBCH22ET1	**Prerequisite :Higher Sec. Chemistry**	**ETL**	**2**	**0/0**	**2/0**	**3**

UNIT -I CHEMICAL THERMODYNAMICS 12 Hrs

Introduction, Terminology in thermodynamics –System, Surrounding, State and Path functions, Extensive and intensive properties. Laws of thermodynamics – I and II laws-Need for the II law. Enthalpy, Entropy, Gibbs free energy, Helmholtz free energy - Spontaneity and its criteria. Maxwell relations, Gibbs -Helmholtz equation (relating E & A) and (relating H & G).

UNIT -II TECHNOLOGY OF WATER **12 Hrs**

Water quality parameters – Definition and expression. Analysis of water – alkalinity, hardness and its determination (EDTA method only). Boiler feed water and Boiler Troubles-Scales and sludges, Caustic embrittlement, Priming and Foaming and Boiler corrosion. Water softening processes – Internal conditioning, external conditioning – Demineralization methods. Desalination processes-RO and Electrodialysis.

Lab Component-1. Analyze the water quality parameters for the given water sample.

UNIT -III ANALYTICAL AND CHARACTERIZATION TECHNIQUES **12 Hrs**

Chromatographic techniques – column, thin layer and paper. Instrumentation-working with block diagram- UV-Visible Spectroscopy , IR Spectroscopy , Scanning electron microscope ,Transmission electron microscope.

Lab Component-2.Determination of Rf values of various components using thin layer chromatography.

3. Compute and interpret the structures of the given molecules using Chem Draw.

UNIT – IV ELECTROCHEMISTRY **12 Hrs**

Conductance – Types of conductance and its Measurement. Electrodes and electrode potential, Nernst equation – EMF measurement and its applications-Electrochemical series- Types of electrodes- Reference electrodes- Standard hydrogen electrode- Saturated calomel electrode-Determination of P^H using these electrode.

Lab Component-4. Studies on acid-base conductometric titration.

5. Determination of redox potentials using potentiometry

UNIT -VPOLYMERS AND NANO COMPOSITES **12 Hrs**

Polymers-Introduction-Monomers – Functionality – Degree of polymerization-Tacticity. Classification- Plastics – Thermoplastics and thermosetting plastics, Compounding of plastics – Compression moulding, injection moulding and extrusion processes. Nano composites: particulates, clay and carbon nano tubes. Graphene nano composites and its applications.

Lab Component-6.Polymeric analysis using capillary viscometer

Total Periods : 60

References

1. Jain &Jain*Engineering Chemistry* 17th Edition, Dhanpat Rai Publishing Company
2. Vasant R. Gowariker,, N. V. Viswanathan, Jayadev Sreedhar, *Polymer Science*,New Age International, 1986
3. B.K. Sharma, *Polymer Chemistry*, Goel Publishing House
4. Y. R. Sharma ,*Elementary Organic Spectroscopy*, S.Chand& Company Ltd.
5. N.Krishnamurthy, K.Jeyasubramanian, P.Vallinayagam, Applied Chemistry, Tata McGraw-Hill Publishing Company Limited, 1999.
6.Chichester,polymer-clay-nano composites,John wiley(2000)

Subject Code	Subject Name :**BASIC ELECTRICAL & ELECTRONICS ENGINEERING**	Ty/Lb/ETL/IE	L	T/SLr	P/R	C
EBEE22ET1	**Prerequisite : None**	**ETL**	**2**	**0/0**	**2/0**	**3**

C: Credits, L: Lecture, T: Tutorial, SLr: Supervised Learning, P: Problem / Practical
R: Research, Ty/Lb/ETL/IE: Theory /Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES

- Understand the concepts of circuit elements, circuit laws and coupled circuits.
- Gain information on measurement of electrical parameters.
- Acquire knowledge on conventional &non-conventional energy production.
- Identify basic theoretical principles behind the working of modern electronic gadgets.
- Demonstrate digital electronic circuits and assemble simple devices.

COURSE OUTCOMES (Cos)
Students completing this course were able to

CO1	Compute the electric circuit parameters for simple problems
CO2	Elaborate the concepts of Electrical machines and measurement principles
CO3	Identify conventional and Non-conventional Electrical power Generation, Transmission and Distribution
CO4	Analyze the working principles and characteristics of analog electronic devices
CO5	Understand basics of digital electronics and solving problems and design combinational circuits

Mapping of Course Outcome with Program Outcome (POs)

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

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

3/2/1 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 :**BASIC ELECTRICAL & ELECTRONICS ENGINEERING**	Ty/Lb/ETL/IE	L	T/SLr	P/R	C
EBEE22ET1	**Prerequisite : None**	**ETL**	**2**	**0/0**	**2/0**	**3**

UNIT I ELECTRIC CIRCUITS 12 Hrs

Electrical Quantities – Ohms Law – Kirchhoff's Law – Series and Parallel Connections – Current Division and Voltage Division Rule - Source Transformation – Wye (Y) – Delta (Δ) , Delta (Δ) – Wye (Y) Transformation – Rectangular to Polar and Polar to Rectangular

Lab Components – Measurement of Electrical Quantities

UNIT II MACHINES & MEASURING INSTRUMENTS 12 Hrs

Construction & Principle of Operation of DC motor & DC Generator – EMF equation of Generator – Torque Equation of Motor – Construction & Principle of operation of Transformer –Operating principles and Types of measuring instruments – Moving coil, Moving iron – Principle of Energy meter

Lab Component – Measurement of Energy using energy meter

UNIT III BASICS OF POWER SYSTEM 12 Hrs

Generation of Electric Power (Thermal, Hydro, Wind and Solar) – Basic structure of Power system – Types of Transmission & Distribution Schemes – Representation of Substation.

Lab Component – Residential house wiring

Stair case wiring

UNIT IV ELECTRON DEVICES 12 Hrs

Semiconductor Materials: Silicon and Germanium – PN Junction Diode, Zener Diode – Characteristics and Applications – Bipolar Junction Transistor - JFET, SCR, MOSFET, IGBT –Characteristics and Applications – Operating principle - Rectifiers and Inverters

Lab Component – Resistor colour coding -Resistance Measurement

UNIT V DIGITAL SYSTEM 12 Hrs

Number System – Binary, Decimal, Octal, Hexadecimal – Binary Addition, Subtraction, Multiplication & Division – Boolean Algebra – Reduction of Boolean Expressions – Logic Gates - De-Morgan's Theorem - Adder – Subtractor

Lab Component - Soldering practice Logic Gates

Total Periods: 60

TEXT BOOKS:

- D P Kothari, I J Nagrath, 2017, Basic Electrical Engineering, Second Edition, Tata McGraw-Hill Publisher
- A.K. Sawhney, 2015 A Course in Electrical and Electronic Measurements and Instrumentation, Dhanpat Rai & CO publisher
- B.L. Theraja, A.K. Theraja, Text Book of Electrical Technology: Volume 3: Transmission, Distribution and Utilization, S. Chand publisher
- Morris Mano, M, 2016 Digital Logic and Computer Design, Prentice Hall of India
- Millman and Halkias 2015, Electronic Devices and Circuits, Tata McGraw Hill

REFERENCE BOOKS:

- R. Muthusubramanian, S. Salivahanan, K A Muraleedharan, Basic Electrical, Electronics and Computer Engineering, Second Edition, Tata McGraw-Hill publisher

Subject code EBCS22ET1	Subject name C PROGRAMMING AND MS OFFICE TOOLS	Ty/Lb/ETL/ IE	L	T/S.Lr	P/R	C
	Prerequisite: Nil	ETL	1	0/0	2/0	2

C: Credits, L: Lecture, T: Tutorial, SLr: Supervised Learning, P: Problem / Practical
R: Research, Ty/Lb/ETL/IE: Theory /Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES :

The student should be made to:

- learn a programming language.
- learn problem solving techniques.
- write programs in C and to solve the problems.
- familiarize the students in preparation of documents and presentations with office automation tools.

COURSE OUTCOMES (COs) : After Completing the course, the student can be able to

CO1	Understand and trace the execution of programs written in C language.
CO2	Write the C code for a given algorithm.
CO3	Apply Arrays and Functions concepts to write Programs
CO4	Apply Structures and pointers concepts for writing Programs
CO5	To perform documentation , accounting operations and presentation skills

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12
CO1	2	2	2	2	1	1	1	1	1	1	2	2
CO2	2	2	2	2	1	1	1	1	1	1	2	2
CO3	2	2	3	2	1	1	1	1	1	1	3	2
CO4	2	2	3	3	1	1	1	1	1	1	3	2
CO5	1	1	1	1	1	1			2	3	2	0

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

3/2/1 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 EBCS22ET1	Subject name C PROGRAMMING AND MS OFFICE TOOLS	Ty/Lb/ETL/ IE	L	T/S.Lr	P/R	C
	Prerequisite: Nil	ETL	1	0/0	2/0	2

UNIT I INTRODUCTION **3 Hrs**

Basic Structure of C programme- Constants, Variables and data Types, Keywords, Identifiers- Operators and expressions- executing a C Program

UNIT II DECISION MAKING STATEMENTS AND LOOPING STATEMENTS 3 Hrs

Decision making with if statement, Simple if statement, else-if statement, Nesting if-else statement, The else if ladder,The switch statement, The goto statement, The while statement,, The do while statement,
The for statement, jumps in loops

UNIT III ARRAYS AND FUNCTIONS **3 Hrs**

Introduction to Arrays- One dimensional arrays, Two dimensional array, and Multidimensional array- Introduction to Functions- calling a function, category of functions- arguments with return values, argument with no return values- parameter passing Mechanism: Call by Value and Call by Reference. Recursion.

UNIT IVSTRUCTURES & POINTERS **3 Hrs**

Structures definition, giving values to members, Structure initialization, comparison of structure variables, Structure within structures,Understanding pointers, accessing the address of the variable, declaring and initializing pointer, accessing a variable through its pointer and arrays

UNIT VMS-OFFICE **3 Hrs**

Introduction to MS-Word- Menus- Introduction to MS-Excel: features of MS- Excel, spread sheet/worksheet, parts of MS-excel window, functions in excel sheet, chart, Introduction to MS-Power point

Total Periods: 15

TEXT BOOKS:

1. E.Balaguruswamy, Programming in ANSI C
2. Padma Reddy ,Computer Concepts & 'C' Programming
3. ShobhaHangirke,Computer Application For Business

List of Experiments : C PROGRAMMING **30 Periods**

1. Find the factorial of a given positive number using function.
2. Calculate X raised to y using function.
3. Find GCD and LCM of two given integer numbers using function.
4. Find the sum of N natural numbers using function.
5. Book information using Structure.
6. Student information using Structure.
7. Print the address of a variable and its value using Pointer
8. Find area and perimeter of a circle
9. Check whether the given number is palindrome or not
10. Check whether the given number is prime or not
11. Calculate sum of the digits of the given number
12. Display Fibonacci series up to N terms
13. Check whether a given character is alphabetic, numeric or special character
14. Count vowels and consonants in a given string
15. Find product of two matrices

MS-OFFICE

16. Preparing a news letter:

17. To prepare a newsletter with borders, two columns text, header and footer and inserting a graphic image and page layout.
18. Creating and editing the table
19. Printing envelopes and mail merge.
20. Using formulas and functions: To prepare a Worksheet showing the monthly sales of a company in different branch offices
21. Prepare a Statement for displaying Result of 10 students in 5 subjects

SUBJECT CODE	Subject Name : ORIENTATION TO ENTREPRENEURSHIP & PROJECT LAB	Ty/Lb/ETL/IE	L	T/SLr	P/R	C
EBCC22I01	Prerequisite : None	**ETL**	**1**	**0/0**	**1/0**	**1**

C: Credits, L: Lecture, T: Tutorial, SLr: Supervised Learning, P: Problem / Practical
R: Research, Ty/Lb/ETL/IE: Theory /Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES

- Understand how entrepreneurship Education transforms individuals into successful leaders.
- Identify individual potential &S have career dreams
- Understand difference between ideas & opportunities
- Identify components & create action plan.
- Use brainstorming in a group to generate ideas.

COURSE OUTCOMES (Cos)

Students completing this course were able to

CO1	Develop a Business plan & improve ability to recognize business opportunity
CO2	Do a self-analysis to build an entrepreneurial career.
CO3	Articulate an effective elevator pitch.
CO4	Analyze the local market environment & demonstrate the ability to find an attractive market
CO5	Identify the required skills for entrepreneurship & develop

Mapping of Course Outcome with Program Outcome (POs)

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

COs/PSOs	PSO1	PSO2	PSO3
CO1		1	
CO2			1
CO3	1	1	
CO4	1	2	1
CO5			

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engg.Science	Humanities & social Science	Program Core	Program Elective	Open Elective	Practical/Project	Internships/ Technical Skills
								√

Subject Code	Subject Name :ORIENTATION TO ENTREPRENEURSHIP & PROJECT LAB	Ty/Lb/ETL/IE	L	T/SLr	P/R	C
EBCC22I01	Prerequisite : None	**ETL**	**1**	**0/0**	**1/0**	**1**

UNIT I CHARACTERISTICS OF A SUCCESSFUL ENTREPRENEUR 3Hrs

Introduction to entrepreneurship education – Myths about entrepreneurship – How has entrepreneurship changed the country – Dream it. Do it - Idea planes - Some success stories – Global Legends – Identify your own heroes.

UNITII ENTREPRENEURIAL STYLE 3Hrs

Entrepreneurial styles – Introduction, concept & Different Types - Barrier to Communication – Body language speaks louder than words

UNIT IIIDESIGN THINKING 3Hrs

Introduction to Design thinking – Myth busters – Design thinking Process - Customer profiling – Wowing your customer – Personal selling – concept & process – show & tell concept – Introduction to the concept of Elevator Pitch

UNIT I RISK MANAGEMENT 3Hrs

Introduction to risk taking & Resilience – Managing risks (Learning from failures, Myth Buster) – Understanding risks through risk takers – Why do I do? – what do I do?

UNIT VPROJECT 3Hrs

How to choose a topic – basic skill sets necessary to take up a project – creating a prototype – Pitch your project – Project presentation.

Total Periods : 15

IDEA GENERATION, EVALUATION AND PROJECT PRESENTATION 15 Hrs

Total Periods: 30

Reference Books& Website

- Encyclopedia of Small Business (2011) – (e book)
- Oxford Handbook of Entrepreneurship (2014)–(e book)
- lms.learnwise.org

SEMESTER II

Subject Code **EBMA22004**	Subject Name **:BIO-STATISTICS**	**y/Lb/ETL/ IE**	**L**	**/S.Lr**	**P/R**	**C**
	Prerequisite: Higher secondary Mathematics	Ty	3	1/0	0/0	4

C: Credits, L: Lecture, T: Tutorial, SLr: Supervised Learning, P: Problem / Practical
R: Research, Ty/Lb/ETL/IE: Theory /Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES :

The student should be made to:

Understand the basic concepts in Statistics
Understand the concepts in Correlation
Understand the basic concepts in Probability theory
Understand concepts in Testing of Hypothesis
Analyze the concept in Design of Experiments

COURSE OUTCOMES (COs) :

CO1	Find the measures of central tendency and measures of dispersion
CO2	Evaluate the measures of skewness , kurtosis ,correlation and regression
CO3	Apply knowledge and concepts in finding the probability of a random variable and use addition and multiplication laws of probability
CO4	Test and give conclusion in testing of hypothesis
CO5	Analyze and interpret results through one and two way ANOVA

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	2	2	3	3	1	2	2	2	1	2
CO2	3	3	1	2	2	3	2	2	1	1	2	3
CO3	3	3	1	2	2	2	1	1	1	2	2	3
CO4	3	3	1	2	1	2	2	2	2	1	2	3
CO5	3	3	2	2	1	1	2	1	2	2	1	3

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

3/2/1 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 **EBMA22004**	Subject Name **:BIO-STATISTICS**	**y/Lb/ETL/ IE**	**L**	**/S.Lr**	**P/R**	**C**
	Prerequisite: Higher secondary Mathematics	Ty	3	1/0	0/0	4

UNIT I BASICS OF STATISTICS **12Hrs**

Variables – Uni-variate Data – Frequency Distribution – Measures of Central Tendency – Mean –Median –Mode – Quartiles – Measures of Dispersion – The Range – Quartile Deviation –Standard Deviation.

UNIT II CORRELATION **12 Hrs**

Measures of Skewness & Kurtosis –Bi-variate data – Correlation & Regression.

UNIT III PROBABILITY AND RANDOM VARIABLE **12Hrs**

Definition of Random Experiment - Sample Space – Events: Mutually exclusive events - Exhaustive events - Dependent events and Independent events - Mathematical and Statistical definition of probability - Theorems of addition and multiplication laws of Probability (Without proof) - Conditional probability (Simple problems).

UNIT IV SAMPLING **12Hrs**

Tests of Significance – Large Sample Tests – Mean – Proportions – Small Sample Tests – t, F & Chi-square Tests – Independence of Attributes – Goodness of Fit.

UNIT V DESIGN OF EXPERIMENTS **12 Hrs**

Analysis of Variance: One Way & Two-Way Classification – Design of Experiments – Randomized Block Design –Completely Randomized Block Design –Latin Square Design.

Total Periods: 60

Reference Books:

- Gupta S.P, *Statistical Methods*,S.Chand& Co., New Delhi (2003).
- Gupta S.C, KapoorV.K, *Fundamentals of Mathematical Statistics*,S.Chand& Co, New Delhi (2003).
- Veerarajan T., *ProbabiliTy, Statistics and, Random Processes*, Tata McGraw Hill Publishing Co., (2008).
- Singaravelu, *ProbabiliTy and Random Processes*, Meenakshi Agency, (2017).
- Richard Johnson A., *Miller & Freund's Probability and statistics for Engineers (9thed)*, Prentice Hall of India, (2016).

Subject Code: **EBPH22003**	Subject Name :**BIO MATERIALS**	Ty/Lb/ETL/ IE	L	T/SLr	P/R	C
	Prerequisite :Engg.Physics	Ty	3	0/0	0/0	3

C: Credits, L: Lecture, T: Tutorial, SLr: Supervised Learning, P: Problem / Practical
R: Research, Ty/Lb/ETL/IE: Theory /Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES

- Design, conduct experiment and analyze data.
- Develop a Scientific attitude at micro and nano scale of materials
- Understand the concepts of Modern Physics
- Apply the science of materials to Engineering & Technology

COURSE OUTCOMES (Cos)

Students completing this course were able to

CO1	Analyze different Types of Biomaterials and its classification and apply the concept of nanotechnology towards biomaterials use.
CO2	Identify significant gap required to overcome challenges and further development in metallic and ceramic materials
CO3	Identify significant gap required to overcome challenges and further development in polymeric materials
CO4	Create combinations of materials that could be used as a tissue replacement implant.
CO5	Understand the testing standards applied for biomaterials.

Mapping of Course Outcome with Program Outcome (POs)

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

COs/PSOs	PSO1	PSO2	PSO3	
CO1	3	3	2	
CO2	1	2	1	
CO3	1	1	2	
CO4		2	1	
CO5	1	2	2	

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engg.Science	Humanities & social Science	Program Core	Program Elective	Open Elective	Practical/ Project	Internships/ Technical Skills
	√							

Subject Code	Subject Name :**BIO MATERIALS**	Ty/Lb/ETL/ IE	L	T/SLr	P/R	C
EBPH22003	Prerequisite :Engg.Physics	Ty	3	0/0	0/0	3

UNIT I **INTRODUCTION TO BIO MATERIALS** **9Hrs**

Introduction to biomaterials and requirements for biomaterial. Classification of biomaterials: metallic, ceramic, synthetic and natural polymers. Surface, Physical, Mechanical & bulk Properties of biomaterials: Comparison of properties of some common biomaterials. Effects of physiological fluid on the properties of biomaterials.

UNIT II TYPES OF BIO MATERIALS **9Hrs**

Metallic and Ceramic Materials - Metallic implants – Stainless steels, co-based alloys, Ti-based alloys, shape memory alloy, nanostructured metallic implants,– common Types Polymeric implant materials - Biodegradable polymers for medical purposes, Biopolymers in controlled release systems. Synthetic polymeric membranes and their biological applications. Composite implant materials:

UNIT III SURFACE CHARACTERIZATION **9Hrs**

Surface properties and adhesion, contact angle measurement, scanning electron microscopy (SEM), transmission electron microcopy (TEM), scanning tunneling microscopy and atomic force microscopy (AFM).Secondary ion mass spectrometry and confocal laser scanning microscopy.

UNIT IV TESTING OF BIOMATERIALS **9Hrs**

Biocompatibility, blood compatibility and tissue compatibility tests, Toxicity tests, sensitization, carcinogenicity, mutagen city and special tests, Invitro and Invivo testing; Sterilization of implants and devices: ETO, gamma radiation, autoclaving. Effects of sterilization.

UNIT VBIOMATERIALS APPLICATIONS **9 Hrs**

Materials for bone and joint replacement – stainless steel, titanium based materials and porous metals. Ceramics: alumina, zirconia, calcium phosphate and bioactive glass, bone cement. Polymers: PMMA and polyethylene, rubber and fluorocarbon polymers. Materials for oral and maxillofacial surgery, ophthalmology and intelligent textiles for medical applications. (Examples for each).

Total Periods: 45

TEXT BOOKS& REFERENCE BOOKS

- Biomaterials Science: An Introduction to Materials in Medicine, By Buddy D. Ratner, et. al. Academic Press, San Diego, 1996.
- Sujata V. Bhat, Biomaterials, Narosa Publishing House, 2002.
- J B Park, Biomaterials – Science and Engineering, Plenum Press, 1984.

Subject Code: EBCH22002	Subject Name :INDUSTRIAL CHEMISTRY	Ty/Lb/ ETL/IE	L	T/SLr	P/R	C
	Prerequisite :Engg. Chemistry	Ty	3	0/0	0/0	3

C: Credits, L: Lecture, T: Tutorial, SLr: Supervised Learning, P: Problem / Practical
R: Research, Ty/Lb/ETL/IE: Theory /Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES :
1.Tounderstand and apply the basic concepts of fuels and combustion in automobiles.
2. To analyze the moisture and protein in food through physical and chemical methods.
3.To detect the industrial development aiming at job creators.
4.To demonstrate the operations of pulp and paper Industry.
5. To illustrate the fundamentals of industrial wastewater treatment.

COURSE OUTCOMES (Cos)
Students completing this course were able to

CO1	Reproduce the understanding of industry oriented chemical science
CO2	Analyze the solutions for industry based problems for sustainable development following professional ethics.
CO3	Apply appropriate techniques for industrial development as a resource of lifelong learning.
CO4	Develop the reasoning nature by the knowledge acquired to assess the health and safety issues.
CO5	Describe the tools used to apply the engineering knowledge

Mapping of Course Outcome with Program Outcome (POs)

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

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

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engg.Science	Humanities & social Science	Program Core	Program Elective	Open Elective	Practical/ Project	Internships/ Technical Skills	Soft Skills
	√								

Subject Code: EBCH22002	Subject Name :INDUSTRIAL CHEMISTRY	Ty/Lb/ ETL/IE	L	T/SLr	P/R	C
	Prerequisite :Engg. Chemistry	Ty	3	0/0	0/0	3

UNIT – 1FUELS & COMBUSTION **9 Hrs**

Fuels - classification, calorific value, GCV, NCV, Solid fuels-coal – varieties and ranking, analysis –Proximate Carbonisation of coal, Coke –manufacture , Beehive coke oven method, Otto Hoffmann method – recovering by - products - Liquid fuels – petrol –refining-cracking- thermal & catalytic , Synthetic petrol – Hydrogenation of coal (Fischer Tropsch Process and Bergius process) – Polymerization, Knocking properties of Gasoline –octane number, cetane number – Ignition lag, Leaded petrol, Reforming, Gaseous fuels- manufacture and uses Combustion - Flue gas analysis – Orsatapparatus.Alternative fuel-Electric vehicles

UNIT2 FOOD ANALYSIS **9Hrs**

Food analysis-Introduction. Moisture Analysis-Introduction-Moisture content of foods-Sample collection and handling-Forms of water in foods- Distillation procedure-Reflux distillation with immiscible solvent,-Physical methods-Direct method-Hydrometer, -Refractometry –Chemical method-Karl Fischer titration- Protein analysis-Kjeldahl method-Dumas combustion method.

UNIT – 3 APPLICATIONS IN PAPER INDUSTRY **9Hrs**

Introduction-Manufacture of pulp-Mechanical process-Chemical process-Beating, Refining, Filling, Sizing and Colouring-Manufacture of paper- Calendering- Bagasse utilization in paper industry.

UNIT – 4 BUSINESS CHEMICALS **9Hrs**

Toiletry formulations-Soaps and detergent, shampoo, Shaving cream, production. Preparation of cosmetics-moisturizing cream, talcum powder, Nail enamel, Lipstick. Disinfectants- phenyl, hand sanitizer,bleach,causticsoda,naphthalene balls production.

UNIT – 5 INDUSTRIAL WASTES AND TREATMENT PROCESS **9Hrs**

Introduction-Characteristics of industrial waste-Types of industrial wastes-Solid industrial wastes-Principles of industrial waste treatment-Treatment and disposal of industrial waste-Sanitary-Chemical analysis of industrial effluents or sewage-Method of treating industrial sludge.

Total Periods : 45

References

- Rama Rao Nadendla,*Principles of Organic Medicinal Chemistry*, New Age International (P) Limited, Publishers.
- H.D.Belitz, W.Grosch,P.Schieberle ,*Food Chemistry* Springer
- Industrial chemistry by B.K.Sharma,KrisnaPrakashan Media(P) Ltd,Publishers.
- Industrial Chemistry – C. S. Unnithan, T. Jayachandran & P. Udhayakala, Sree Lakshmi Publications - 2010
- John A.Tyrell, *Fundamentals of Industrial Chemistry* , , Wiley.
- Ernest M. Flick, *Cosmetic and Toiletry Formulations*, 2nd Edition, Volume 8, Noyes Publications, William Andrew Publishing, LLC.

Subject Code: **EBME22001**	Subject Name :**ENGINEERING GRAPHICS**	Ty/Lb/ETL/ IE	L	T/SLr	P/R	C
	Prerequisite : None	ETL	2	0/0	2/0	3

C: Credits, L: Lecture, T: Tutorial, SLr: Supervised Learning, P: Problem / Practical
R: Research, Ty/Lb/ETL/IE: Theory /Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES

- To acquire knowledge in geometrical drawing.
- To expose the students in computer aided drafting**.**

COURSE OUTCOMES (Cos)

Students completing this course were able to

CO1	Utilize the concept of Engineering Graphics Techniques to draft letters, Numbers, Dimensioning in Indian Standards
CO2	Demonstrate the drafting practice visualization and projection skills useful for conveying ideas in engineering applications.
CO3	Identify basic sketching techniques of engineering equipments
CO4	Demonstrate the projections of Points, Lines, Planes and Solids. And
CO5	Draw the sectional view of simple building drawing.

Mapping of Course Outcome with Program Outcome (POs)

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

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

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engg. Science	Humanities & social Science	Program Core	Program Elective	Open Elective	Practical /Project	Internships/ Technical Skills	Soft Skills
		√							

Subject Code:	Subject Name **ENGINEERING GRAPHICS**	Ty/Lb/ ETL/IE	L	T/SLr	P/R	C
EBME22001	Prerequisite : None	ETL	1	0/0	2/0	2

CONCEPTS AND CONVENTIONS (Not for examination) **3Hrs**

Introduction to drawing, importance and areas of applications – BIS standards – IS: 10711 – 2001 : Technical products Documentation – Size and layout of drawing sheets – IS 9606 – 2001: Technical products Documentation – Lettering – IS 10714 & SP 46 – 2003: Dimensioning of Technical Drawings – IS : 15021 – 2001 : Technical drawings – Projections Methods – drawing Instruments, Lettering Practice – Line Types and dimensioning – Border lines, lines title blocks Construction of polygons – conic sections – Ellipse, Parabola, Hyperbola and cycloids.

UNIT I PROJECTION OF POINTS, LINES AND PLANE SURFACES **12Hrs**

Projection of points and straight lines located in the first quadrant – Determination of true lengths and true inclinations – projection of polygonal surface and circular lamina in simple position only.

UNIT IIPROJECTION OF SOLIDS **9Hrs**

Projection of simple solids like prism, pyramid, cylinder and cone in simple position

Sectioning of above solids in simple vertical position by cutting plane inclined to any one of the reference plane and perpendicular to the other.

UNIT III DEVELOPMMENT OF SURFACES **6Hrs**

Development of lateral surfaces of simple and truncated solids – prisms, pyramids, cylinders, and cones.

UNIT IVISOMETRIC PROJECTION **6Hrs**

Principles of isometric projection – isometric scale – isometric projections of simple solids, like prisms pyramids, cylinders and cones.

UNIT V ORTHOGRAPHICS PROJECTIONS **6 Hrs**

Orthographic projection of simple machine parts – missing views

BUILDING DRAWING **3Hrs**

Building components – front, Top and sectional view of a security shed.

(Basic Auto CAD commands to be taught- not for Examinations)

Total periods: 45

Note: First angle projection to be followed.

TEXT BOOKS

- Bhatt, N.D. and Panchal, V.M. (2014) Engineering Drawing Charotar Publishing House
- Gopalakrishnan, K.R. (2014) Engineering Drawing (Vol.I& II Combined) Subhas Stores, Bangalore.
- Natrajan K.V., “A Text Book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2018.
- Venugopal K. and Prabhu Raja V., “Engineering Graphics", New Age International (P) Limited, 2008.

Subject Code: EBBT22001	Subject Name: CELL BIOLOGY Prerequisite: Nil	TY / LB/ ETL/IE TY	L 3	T / S.Lr 0/0	P/ R 0/0	C 3

C: Credits, L: Lecture, T: Tutorial, SLr: Supervised Learning, P: Problem / Practical
R: Research, Ty/Lb/ETL/IE: Theory /Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVE: To recollect the knowledge on prokaryotic and eukaryotic cells, cell division and cell organelles. To understand transport mechanism across cell membrane.

COURSE OUTCOMES (COs) :Upon completion of this course, the students

CO1	Understand the historical development of cell biology, including the discovery of key cellular structures and the significance of model organisms in research.
CO2	Describe the structure and functions of cell membranes, including the transport mechanisms across membranes and the energetics of transport.
CO3	Explain the organization and functions of endomembrane systems, including the ER, Golgi complex, lysosomes, and peroxisomes, in protein glycosylation, secretion, and cellular transport processes.

Mapping of Course Outcomes with Program Outcomes (POs)

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

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

3/2/1 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: CELL BIOLOGY	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
EBBT22001	Prerequisite: Nil	TY	3	0/0	0/0	3

UNIT I - BRIEF HISTORY OF THE CELL **9 Hrs**

Brief History of the cell, model organisms in research, Cells and organelles, organelles in human diseases, Cell cycle, and cell cycle regulation, apoptosis, ubiquitination, autophagy, stem cells.

UNIT II- CELL MEMBRANES **9Hrs**

Functions of membranes, models of membrane structure, membrane lipids, membrane proteins, transport across membranes – simple diffusion, facilitated diffusion through carrier proteins and channel proteins, active transport. Energetics of transport.

UNIT III- ENDOMEMBRANE SYSTEMS **9 Hrs**

Endomembrane systems and peroxisomes: Structure of E R and glogi complex. Role of E R and golgi complex in protein glycosylation, secretary pathways, protein trafficking, exocytosis, endocytosis, coated vesicles in cellular transport processes. Lysosomes and cellular digestion. Role of plant vacuole and peroxisomes.

UNIT IV –INTRODUCTION TO CELL SIGNALLING **9Hrs**

Electrical and synaptic signalling in neurons, membrane potential, action potential; signal transduction through messengers and receptors. Chemical signals and cellular receptors; G- Protein linked receptors, protein kinase associated receptors, hormonal signaling.

UNIT V - CYTO SKELETON SYSTEMS **9Hrs**

Major structural elements of the cytoskeleton, microtubules, microfilament, intermediate filament, cell-cell recognition and adhesion, cell – cell junction, extracellular matrix of animal cells, and surface of plant cells

Total periods: 45

TEXT BOOKS

- Jeff Hardin, Gregory Paul Bertoni, Lewis J. Kleinsmith, (2011), Becker's World of the
- Cell (8th Ed) Pearson Publ
- Lodish, Harvey etal., " Molecular Cell Biology," 6th Edition. W.H.Freeman, 2008
- Alberts, Bruce etal., "Essentail Cell Biology", 2nd Edition, Garland Science, 2004

REFERENCES

- Alberts, Bruce, "Molecular Biology of Cell", 5th Edition, Garland Science, 2008.
- Cooper,G.M. "The Cell: A Molecular Approach, 4th Edition, ASM Press, 2007
- Thomas D. Pollard " Cell Biology" ELSEVIER 2016
- Bruce Alberts, "Essential Cell Biology" Garland Science 2014
- Julio E. Celis, "Cell Biology: A Laboratory Handbook" Elsevier Academic Press 2006

SUBJECT CODE	Subject Name :**COMMUNICATIVE ENGLISH LAB**	Ty/Lb/ETL/ IE	L	T/SLr	P/R	C
EBCC22I02	Prerequisite :Pass in Plus 2 English	**IE**	**1**	**0/0**	**1/0**	**1**

C: Credits, L: Lecture, T: Tutorial, SLr: Supervised Learning, P: Problem / Practical
R: Research, Ty/Lb/ETL/IE: Theory /Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES

- To engage students in meaningful oral English communication and organized academic and professional reading and writing for a successful career.

COURSE OUTCOMES (Cos)

Students completing this course were able to

CO1	Engage in meaningful oral communication in English with writing as a scaffolding activiTy.
CO2	Have an in-depth understanding of the components of English language and its use in oral communication.
CO3	Strengthen their vocabulary and syntactic knowledge for use in academic and technical communication
CO4	Learn to negotiate meaning in inter-personal and academic communication for a successful career.
CO5	Engage in organized academic and professional writing for life-long learning and research

Mapping of Course Outcome with Program Outcome (POs)

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

COs/PSOs	PSO1	PSO2	PSO3	
CO1	2	1		
CO2	1			
CO3		1	1	
CO4				
CO5	1	1	1	

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engg. Science	Humanities & social Science	Program Core	Program Elective	Open Elective	Practical/ Project	Internships/Technical Skills	Soft Skills
			√						

SUBJECT CODE	Subject Name :**COMMUNICATIVE ENGLISH LAB**	Ty/Lb/ ETL/ IE	L	T/SLr	P/R	C
EBCC22I02	Prerequisite :Pass in Plus 2 English	**IE**	**1**	**0/0**	**1/0**	**1**

UNIT I LISTENING **3Hrs**

Authentic audios and videos

Prescribed Book: English Pronunciation in use – Mark Hancock,

UNIT IISPEAKING **3Hrs**

Individual- Solo: Self introduction, Describing, anchoring, welcome address, vote of thanks,

Pair & Group: Role play- formal -informal, narrating stories, film review, analysing newspaper headings and reports, interpreting Advertisement pamphlets

Group discussion, mock interviews, formal presentation, power point presentation

Prescribed Book: J. C. Richards with J. Hull &S.Proctor, Interchange, Cambridge University Press, 2015.

UNIT III READING **3Hrs**

Extensive, focused reading,

Strategies for effective reading - Reading comprehensions – Note making- summarising- paraphrasing, Review

Suggested reading: Short stories, news paper reports, film reviews

UNIT IV WRITING **3Hrs**

Extensive writing practices – note taking, Cognitive and metacognitive strategies to inculcate a sense of organising ideas into coherent sentences and paragraphs, Formal letters, Business letters. Resume with covering letter

UNIT VNON VERBAL COMMUNICATION/ CHARTS, DIAGRAMS AND TABLE **3Hrs**

Interpretation of charts Flow chart, pie chart, bar diagram, table, tree diagram, etc.,

Total Periods :15

Prescribed Text:

- J. C. Richards with J. Hull &S.Proctor, Interchange, Level 2, Cambridge UniversiTy Press, 2021.
- M. ChandrasenaRajeswaran&R.Pushkala, English - Communication Lab Work book

Reference

- Hancock, Mark, English Pronunciation in Use; Cambridge Univ. Press, 2013
- Dutt, K, Rajeevan, G & Prakash, CLN 2008, *A Course on Communication Skills*, 1st edn, Cambridge UniversiTy Press, Chennai

SUBJECT CODE	SUBJECT NAME: PYTHON PROGRAMMING	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
EBCS22ET2	Prerequisite: EBCS22ET1	ETL	1	0/0	2/0	2

C: Credits, L: Lecture, T: Tutorial, SLr: Supervised Learning, P: Problem / Practical
R: Research, Ty/Lb/ETL/IE: Theory /Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVE : The student should be made to:

- Develop a basic understanding of *programming* and the *Python programming* language
- Write programs in Python to solve real world problems
- See the value of *programming* in a variety of different disciplines, especially as it relates in engineering.

COURSE OUTCOMES (COs) : After Completing the course, the student can be able to

CO1	Remember the syntax and semantics of python programming language
CO2	Understand how functional and operations are to be utilized
CO3	Applythe fundamental programming constructs like variables, conditional logic, looping, and functions to build basic programs
CO4	design object-oriented programs with Python classes
CO5	Apply the knowledge to solve various real world problems

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	2	2	1	1	1	1	0	1	1
CO2	3	2	2	2	2	1	1	1	1	0	1	1
CO3	3	2	2	2	2	1	1	1	1	0	1	1
CO4	3	3	3	2	2	1	2	0	2	0	2	2
CO5	3	3	3	3	2	1	2	0	2	0	2	2

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

3/2/1 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: PYTHON PROGRAMMING	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
EBCS22ET2	Prerequisite: EBCS22ET1	ETL	1	0/0	2/0	2

UNIT I: INTRODUCTION **9 Hrs**

History of Python, Need of Python Programming, Applications Basics of Python Programming Using the REPL(Shell), Running Python Scripts, Variables, Assignment, Keywords, Input-Output, Indentation.

UNIT II: TYPES, OPERATORS AND EXPRESSIONS **9 Hrs**

Types - Integers, Strings, Booleans; Operators- Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Expressions and order of evaluations Control Flow- if, if-elif-else, for, while, break, continue, pass.

UNIT III: FUNCTIONS **9 Hrs**

Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments, Default Arguments, Variable-length arguments, Anonymous Functions, Fruitful Functions (Function Returning Values), Scope of the Variables in a Function - Global and Local Variables.

UNIT IV:LISTS, TUPLES, DICTIONARIES **9 Hrs**

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: selection sort, insertion sort, mergesort, histogram.

UNIT V: OBJECT ORIENTED PROGRAMMING OOP IN PYTHON **9 Hrs**

Classes, 'self variable', Methods, Constructor Method, Inheritance, Overriding Methods, Data hiding.

Total Hours: 45

TEXT BOOKS:

- Python Programming: A Modern Approach, VamsiKurama, Pearson.
- Think Python:How to Think Like a Computer Scientist'', 2nd editionUpdated for Python 3, Shroff/O'Reilly Publishers,Allen B. Downey
- Learning Python, Mark Lutz, Orielly.

REFERENCE BOOKS:

- Core Python Programming, W.Chun, Pearson.
- Introduction to Python, Kenneth A. Lambert, Cengage.

Subject Code: EBCC22I03	Subject Name: ENVIRONMENTAL SCIENCE (AUDIT COURSE)	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: None	IE	1	0/0	1/0	0

C: Credits, L: Lecture, T: Tutorial, SLr: Supervised Learning, P: Problem / Practical R: Research, Ty/Lb/ETL/IE: Theory /Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES:

- To acquire knowledge of the Environment and Ecosystem & Biodiversity
- To acquire knowledge of the different Types of Environmental pollution
- To know more about Natural Resources
- To gain understanding of social issues and the Environment
- To attain familiarity of human population and Environment

COURSE OUTCOMES (COs): (3 – 5)

Students completing the course were able to

CO1	Know about Environment and Ecosystem & BiodiversiTy
CO2	Comprehend air, water, Soil, Marine, Noise, Thermal and Nuclear Pollutions and Solid Waste management and identify the importance of natural resources like forest, water, and food resources
CO3	Discover water conservation and watershed management
CO4	Identify its problems and concerns climate change, global warming, acid rain, ozone layer depletion etc.,
CO5	Explain family welfare programmes and role of information technology in human health and environment

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			2	3	2				1
CO2	1	1				2	3			2		1
CO3	1	1				2	3	2				1
CO4	1	1				2	3	2		2		1
CO5	1	1				2	3			2		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

3/2/1 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: EBCC22I03	Subject Name: ENVIRONMENTAL SCIENCE (AUDIT COURSE)	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: None	IE	1	0/0	1/0	0

UNIT I ENVIRONMENT AND ECOSYSTEM **3 Hrs**

Definition, Scope and Importance of environment – need for public awareness – concept, structure and function of an ecosystem- producers, consumers and decomposers – energy flow in the ecosystem. Biodiversity at national and local levels – India

UNIT II ENVIRONMENT POLLUTION **3 Hrs**

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Nuclear hazards (g) E-Wastes and causes, effects and control measures

UNIT III NATURAL RESOURCES **3 Hrs**

Forest resources: Use and over-exploitation, deforestation. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT **3 Hrs**

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns climate change, global warming, acid rain, ozone layer depletion, nuclear accidents, central and state pollution control boards- Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT **3 Hrs**

Population growth, variation among nations – population explosion, environment and human health – human rights – value education – HIV/AIDS – women and child welfare – role of information technology in environment and human health

(A) AWARENESS ACTIVITIES: **15 Hrs**

i) small group meetings about water management, promotion of recycle use, generation of less waste, avoiding electricity waste
ii) Slogan making event
iii) Poster making event
iv) Cycle rally
v) Lectures from experts

(B) ACTUAL ACTIVITIES:

i) Plantation
ii) Gifting a tree to see its full growth
iii) Cleanliness drive
iv) Drive for segregation of waste
v) To live some big environmentalist for a week or so to understand his work
vi) To work in kitchen garden for mess
vii) To know about the different varieties of plants
viii) Shutting down the fans and ACs of the campus for an hour or so

Total periods: 30

TEXT BOOKS

- Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education (2004).
- Benny Joseph, 'Environmental Science and Engineering', Tata McGrawHill,NewDelhi, (2006).

REFERENCES

- Vairamani, S. and Dr. K. Sankaran. **Elements of Environmental and Health Science.**Karaikudi: KPSV Publications, 5th Edition, July 2013.
- Ifthikarudeen, Etal, **Environmental Studies**, Sooraj Publications,2005.
- R.Murugesan, **Environmental Studies,** Millennium Publishers and Distributors, 2nd Edition, July, 2009.

SEMESTER III

Subject Code: EBBT22002	Subject Name : BIOCHEMISTRY	TY / L/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Chemistry	TY	3	1/0	0/0	4

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

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

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

CO1	Understand the concepts of fundamentals of biochemical processes and biomolecules.
CO2	Relate the major pathways of the biomolecules relevant to clinical conditions.
CO3	Illustrate the biochemical process of biological oxidation.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12
CO1	-	2	-	3	-	-	-	-	-	-	-	-
CO2	-	2	-	3	-	-	-	-	-	-	-	-
CO3	-	2	-	3	-	-	-	-	-	-	-	-

COs / PSOs	PSO1	PSO2	PSO3
CO1	3	-	2
CO2	-	2	2
CO3	-	-	3

H3/2/1 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: EBBT22002	Subject Name : BIOCHEMISTRY	TY / L/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Chemistry	TY	3	1/0	0/0	4

UNIT I -CHEMSTRYAND METABOLISM OF CARBOHYDRATES 12 Hrs

Structure, Classification and metabolism of Carbohydrates, Glycolysis, TCA Cycle, Gluconeogenesis, Glucogenesis, glycogenolysis

UNIT II - BIOLOGICAL OXIDATION 12 Hrs

Energetics-ATP as energy currency, biologic oxidation, structural organization and electron flow of respiratory chain, chemiosmotic theory of oxidative phosphorylation.

UNIT III -CHEMISTRY AND METABOLISM OF PROTEINS AND NUCLEIC ACIDS 12 Hrs

Structure, Classification and metabolism of Amino acids and Proteins and Nucleo Proteins, Degradation of proteins, Oxidative, Non-Oxidative deamination and decarboxylation of amino acids, Urea Cycle. degradation of purine and pyrimidines nucleotides

UNIT IV - CHEMISTRY AND METABOLISM OF LIPIDS 12 Hrs

Classification of lipids, Fatty acid oxidation: β-oxidation of fatty acids, biosynthesis of fatty acids: saturated fatty acids, biosynthesis and degradation of cholesterol

UNIT V - BIOCHEMISTRY OF CLINICAL DISEASES 12 Hrs

Diabetes mellitus, atherosclerosis, fatty liver, and obesity, Diseases of protein metabolism, inborn errors of amino acid metabolism

Total number of periods: 60

TEXT BOOKS

- Nelson, L. D. and M. M Cox, (2002), Lehninger's Principle of Biochemistry: (3rd Ed) Macmillan, Worth Publication Inc.
- Rama Rao A.V.S.S.,(1986) ,Textbook of Biochemistry.(7 th Ed)L. K. and S. Publishers.
- Deb,A.C,(2001),Fundamentals of Biochemistry (7 th Ed) New central book agency Calcutta.

REFERENCE BOOKS

- Voet&Voet,:(1995) Biochemistry (2nd Ed)John Wiley and Sons.
- JeoffreryZubay(1993) Biochemistry: (3rd Ed. Vol.1, 2, 3,), Wm C. Brown Publ.

Subject Code: EBBT22003	Subject Name : MICROBIOLOGY	TY / L/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Biology	TY	3	1/0	0/0	4

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

OBJECTIVE : To understand the basic structure of microorganism such as bacteria, viruses, algae fungi and phage. To have a brief knowledge about the nutrition requirements and growth curve of bacteria and also to understand the various methods to control the Microbes.

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

CO1	Acquire the basic knowledge of bacterial cell structure, Classification systems, Staining methods, the nutritional requirements of bacteria and get equipped with various methods of bacterial growth measurement.
CO2	Describe fungi and virus classification, structure, types and replication cycles.
CO3	Understand the Principles of sterilization and disinfection, various physical andchemical means of sterilization and evaluation of disinfectants. Analyze the antibiotic mode of action and microbial resistance towards antibiotics.

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	3	-	2	2	-	-	-	-
CO2	-	2	2	2	3	-	2	2	-	-	-	-
CO3	-	2	2	2	3	-	2	2	-	-	-	-

COs / PSOs	PSO1	PSO2	PSO3
CO1	2	-	2
CO2	-	-	2
CO3	3	3	3

H3/2/1 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: EBBT22003	Subject Name : MICROBIOLOGY	TY / L/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Biology	TY	3	1/0	0/0	4

UNIT - I:HISTORY OF MICROBIOLOGY **12 Hrs**

History and scope of Microbiology, Pasteur's contribution and Koch's contribution, Classification of microorganisms – general principles and nomenclature – Haeckel's three kingdom concept, Whittaker's five kingdom concept. Principles of Microscopic Techniques, and staining techniques –Simple staining, Gram staining, acid fast and capsule staining.

UNIT II - BACTERIAL GROWTH **12 Hrs**

Bacterial Growth- Growth curve, measuring the bacterial growth, factors effecting bacteria growth-physical and nutritional factors. Prevention of bacterial growth- Physical and chemical control of organisms, different mode of antibiotic action.Microbes in extreme environment – Adaptation mechanism of Halophiles, alkaliphiles, psychrophiles, Piezophile and xerophile.

Unit- III: FUNGI **12 Hrs**

Classification of fungi, Oomycetes-water mould, Chytridiomycetes- anearobic rumen fungi , Zygomycetes-Rhizopus stolonifer, Ascomycetes- Aspergillus and Basidiomycetes-smuts and rusts and lichens.Study of Yeasts – morphology, reproduction and industrial application

Unit-IV: VIRUS **12 Hrs**

Structure (general morphology, nucleic acids, capsid and envelope), characteristics and Classification of viruses based on genetic material, host and capsid material. Bacteriophages and phage study, Multiplication of bacteriophages; lytic cycle, lysogenic cycle.

UNIT V - CONTROL OF MICROORGANISMS **12 Hrs**

Physical and chemical control of microorganisms; host-microbe interactions; anti-bacterial, anti-fungal and anti-viral agents; its mode of action and resistance to antibiotics; clinically important microorganisms.

Total number of periods: 60

TEXT BOOKS

- *Michael J. Pelezar, J.R.E.C.S Chan, Noel R. Erieg,(2005), Microbiology (5 thEd) TATA McGraw Hill,*
- *Anantha Narayan, C.K. JayaramPaniker, (2009), Text Book of Microbiology (7 th Ed) Orient Blackswan,*
- *Prescott L.M., Harley J.P., Klein DA,(1996) Microbiology, (3rd Ed) Wm. C. Brown Publishers,*

REFERENCE BOOKS

- *Jacquelyn and G.Black (2000) Microbiology :Principles and Explorations (7 th Ed) wiley*
- *John Webster Roland Weber.(2007) Introduction to fungi Cambridge UniversiTy Press,*
- *Colin Munn.Marine (2011) Microbiology-Ecology and application (2nd Ed)Kindle publications*

Subject Code: EBBT22004	Subject Name: BIOTHERMODYNAMICS	TY / LB/ ETL/IE	L	T / S.Lr	P/R	C
	Prerequisite: Physics / Chemistry	TY	3	0/0	0/0	3

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

OBJECTIVE :

- To enable the students to learn about basic concepts of classical and statistical thermodynamics.

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

CO1	Identify the basic concepts of thermodynamics and its applications.
CO2	Execute the thermodynamic principles in the bio chemical process
CO3	Examine the dimensionless groups and enthalpy calculations for various unit operations.

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	2	-	-	-	-	-	-	-	-
CO2	3	3	3	2	-	-	-	-	-	-	-	-
CO3	3	3	3	2	-	-	-	-	-	-	-	-

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

3/2/1 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: EBBT22004	Subject Name: BIOTHERMODYNAMICS	TY / LB/ ETL/IE	L	T / S.Lr	P/R	C
	Prerequisite: Physics / Chemistry	TY	3	0/0	0/0	3

UNIT I - BASIC CONCEPTS OFTHERMODYNAMICS **9 Hrs**

The Ideal Gas, Review of first and second laws of thermodynamics, PVT behavior of Pure Substances, Application of the Viral Equations, Cubic Equations of State. The Vapor-Compression Cycle, the Choice of Refrigerant, Absorption, Refrigeration and liquefaction: Low temperature cycle: Linde and Claude.

UNIT II - THERMODYNAMICS AND ITS APPLICATIONS **9 Hrs**

The Chemical Potential and Phase Equilibria Fugacity and Fugacity Coefficient: for pure species and solution; The Nature of Equilibrium, the Phase Rule, Duhem's Theorem, Simple model's for Vapour/Liquid Equilibrium, Roult's Law, Henry's law.

UNIT III - BIOCHEMICAL THERMODYNAMICS **9 Hrs**

Energetics of Metabolic Pathways; Energy Coupling (ATP & NADH); Stoichiometry and energetic analysis of Cell Growth and Product Formation - elemental Balances, Degree of reduction concepts; available-electron balances; yield coefficients; Oxygen consumption and heat evolution in aerobic cultures; thermodynamic efficiency of growth.

UNIT IV - SMALL UNITS AND DIMENSIONS **9 Hrs**

Basic physical Laws & concepts of vapour pressure. Buckingham Pi-theorem. Dimensionless groups, Conversion of equations, Solution of simultaneous equations, use of log-log and semi-log graph paper, triangular diagram, Graphical differentiation and graphical integration.

UNIT V - ENERGY BALANCE **9 Hrs**

General energy balance equation for steady and unsteady state processes: Without Chemical Reaction, concept of humidification and psychometric chart. With Chemical Reaction, Enthalpy calculation procedures, Special cases e.g., spray dryer, Distillation Column, Enthalpy change due to reaction: Heat of combustion, Heat of reaction for processes with biomass production.

Total number of periods: 45

TEXT BOOKS

- *Smith &Vanness, Thermodynamics for Chemical Engineers, MGH*
- *Hougen and Watson, Chemical Process Principles (Part one): 2nd ed, John Wiley.*

REFERENCE BOOKS

- *Richardson, J.F., Peacock, D.G.Coulson&Richardson's(1998)Chemical Engineering- Volume (3 ed.), First Indian ed. Asian Books Pvt. Ltd.*
- *David MautnerHimmelblau(1996)Basic Principles and Calculations in Chemical Engineering (6th Ed) Prentice Hall*
- *Michael L. Shuler, FilkertKargi(2001)Bioprocess engineering: Basic concepts (2nd Ed) Prentice Hall*
- *Bhatt & Thakur(2012) Stoichiometry (1 st Ed) Tata McGraw Hill*

Subject Code: EBCS22ID3	Subject Name : OBJECT ORIENTED PROGRAMMING FORBIOTECHNOLOGISTS	TY / LB/ ETL/IE	L	T / S.Lr	P/R	C
	Prerequisite: C Programming	Ty	3	0/0	0/0	3

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

OBJECTIVE : To enable the students to learn about basic concepts in programming for biotechnologists

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

CO1	To give an insight about the basic concepts of OOPS
CO2	Evaluate the features of OOPS with procedural Oriented concepts and analyze these features to a real world object
CO3	Develop program that support Various data types at runtime and ability to handle exceptions

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	-	-	-	-	-	-	-
CO2	-	-	-	2	3	-	-	-	-	-	-	-
CO3	-	-	-	2	3	-	-	-	-	-	-	-

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

3/2/1 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: EBCS22ID3	Subject Name :OBJECT ORIENTED PROGRAMMING FORBIOTECHNOLOGISTS	TY / LB/ ETL/IE	L	T / S.Lr	P/R	C
	Prerequisite: C Programming	Ty	3	0/0	0/0	3

UNIT I - INTRODUCTION **9 Hrs**

Programming methodologies – Comparison – Object Oriented programming concepts-objects-classes-methods and messages-abstraction and encapsulation-inheritance-polymorphism-dynamic binding-message passing – Basics of C++ environment-tokens-keywords-identifiers and constants-data Types-operators

UNIT II - CLASSES **9 Hrs**

Definition – Data members – Function members – Access specifiers – Constructor – Default constructors – Copy constructors – Destructors – Static members – This pointer – Constant members – Free store operators – Control statements

UNIT III - INHERITANCE AND POLYMORPHISM **9Hrs**

Overloading operators – Function overloading – Friend function– Virtual functions – pure virtual function-Abstract classes – Inheritance-single Inheritance-multilevel Inheritance-multiple Inheritance-Hierarchical Inheritance- hybrid Inheritance.

UNIT IV - TEMPLATES **9 Hrs**

Class templates – Function templates – Exception handling –try catch throw paradigm- terminate and unexpected functions – uncaught exceptions

UNIT V - STREAMS **9Hrs**

Streams and formatted I/O- I/O manipulators –file handling- random access – object serialization – namespaces – stdnamespace – ANSI string objects – standard template library

Total number of periods: 45

TEXT BOOKS

- Bala gurusamy.E (2008) Object Oriented Programming with C++, (4th ed.),Tata McGraw Hill
- Gary J. Bronson (2005) Object Oriented Program development using C++,Thomson Learning
- Object Oriented Programming in C++ :Strout Strups

REFERENCES

- Deitel and Deitel (2011) C++ How to Program, (8th ed.), Prentice Hall
- K.R.Venugopal, Rajkumar, T.Ravishankar (2010) Mastering C++,(36thed.),Tata McGrawHill,
- Stanley B.Lippman (2012) The C++ Primer ,(5thed.),Addison Wesley.
- OOP with C++ by M.P. Bhave& S. A. Patekar(Pearson Education)

Subject Code: EBCC22ET1	Subject Name :UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY	TY / LB/ ETL/IE	L	T / S.Lr	P/R	C
	Prerequisite: NIL	ETL	1	0/0	2/0	2

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

OBJECTIVE :Human Values Courses: During the Induction Program, students would get an initial exposure to human values through Universal Human Values – I. This exposure is to be augmented by this compulsory full semester foundation course.

1. Development of a holistic perspective based on self- exploration about themselves (human being), family, society and nature/existence.
2. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
3. Strengthening of self-reflection.

Development of commitment and courage to act

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

CO1	Relate self and surroundings and identify responsibility in life
CO2	Associate human relationship and nature to handle problems and provide sustainable solutions
CO3	Develop critical ability and engage in reflective and independent Thinking

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		2	2		1	1		2
CO2			2	2	2	2	3	1		2		2
CO3			1	1	2	2			1	2		3
CO4			2		2	2	2	3	1	1		3
CO5			1			2	2	2	1	1		3

COs /PSOs	PSO1	PSO2	PSO3
CO1	1	1	3
CO2	1	1	3
CO3	1	1	3

3/2/1 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: EBCC22ET1	Subject Name :UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY	TY / LB/ ETL/IE	L	T / S.Lr	P/R	C
	Prerequisite: NIL	ETL	1	0/0	2/0	2

UNIT 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education **9 Hrs**

Purpose and motivation for the course, recapitulation from Universal Human Values-I. Self-Exploration–what is it? - Its content and process;‘ Natural Acceptance’ and Experiential Validation-as the process for self-exploration. Continuous Happiness and Prosperity- A look at basic Human Aspirations. Right understanding, Relationship and Physical Facility- the basic Requirements for fulfillment of aspirations of every human being with their correct priority. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

UNIT II Understanding Harmony in the Human Being - Harmony in Myself! **9 Hrs**

Understanding human being as a co-existence of the sentient ‘I’ and the material‘Body’.- Understanding the needs of Self (‘I’) and ‘Body’ - happiness and physical facility. - Understanding the Body as an instrument of ‘I’ (I being the doer, seer and enjoyer). - Understanding the characteristics and activities of ‘I’ and harmony in ‘I’ - Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail - Programs to ensure Sanyam and Health. Include practice sessions to discuss the role others have played in making material goods available tome. Identifying from one’s own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

UNIT III Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship **9 Hrs**

Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness; Trust and Respect as the foundational values of relationship - Understanding the meaning of Trust; Difference between intention and competence - Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship - Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals - Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family. Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students’ lives.

UNIT IV Understanding Harmony in the Nature and Existence - Whole existence as Coexistence **9 Hrs**

Understanding the harmony in the Nature - Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature - Understanding Existence as Co-existence of mutually interacting units in all-pervasive space - Holistic perception of harmony at all levels of existence - Include practice sessions to discuss human being as cause

of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

UNIT V Implications of the above Holistic Understanding of Harmony on professional Ethics **9 Hrs**

Natural acceptance of human values - Definitiveness of Ethical Human Conduct - Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order - Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems. - Case studies of Typical holistic technologies, management models and production systems - Strategy for transition from the present state to Universal Human Order: ((a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers, (b)At the level of society: as mutually enriching institutions and organizations - Sum up Include practice Exercises and Case Studies will be taken up in Practice (tutorial)
Sessions e.g. to discuss the conduct as an engineer or scientist etc.

Text Book

- Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books,New Delhi, 2010

Reference Books

- Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
- Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
- The Story of Stuff (Book).
- The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi.
- Small is Beautiful - E. F Schumacher.
- Slow is Beautiful - Cecile Andrews
- Economy of Permanence - J C Kumarappa
- Bharat Mein Angreji Raj - PanditSunderlal
- Rediscovering India - by Dharampal
- Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
- India Wins Freedom - Maulana Abdul Kalam Azad
- Vivekananda - Romain Rolland (English)
- Gandhi - Romain Rolland (English)

Subject Code: EBBT22L01	Subject Name :BIOCHEMISTRY LAB	TY / LB/ ETL/IE	L	T / S.Lr	P/R	C
	Prerequisite: Chemistry	LB	0	0/0	3/0	1

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

OBJECTIVE :

- To learn and understand the principles behind the qualitative and quantitative estimation of biomolecules

COURSE OUTCOMES (COs) : Students will acquire knowledge about

CO1	The students will learn about the chemical structures of carbohydrate, and their structural and metabolic role in cellular system.
CO2	The students will understand about the structure and function of nucleosides and nucleotides and accessory molecules like vitamins, plant and animal harmones, plant secondary metabolite like terpenes.
CO3	The students will learn about structure and function of lipids, circulating lipids and inflammatory lipid mediators 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	2	-	-	-	-	2	1	-	-
CO2	-	-	2	2	-	-	-	-	2	1	-	-
CO3	-	-	2	2	-	-	-	-	2	1	-	-

COs / PSOs	PSO1	PSO2	PSO3
CO1	1	2	2
CO2	2	1	2
CO3	1	1	2

3/2/1 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: EBBT22L01	Subject Name :BIOCHEMISTRY LAB	TY / LB/ ETL/IE	L	T / S.Lr	P/R	C
	Prerequisite: Chemistry	LB	0	0/0	3/0	1

1. Laboratory Safety and Hygiene
2. Standard Operating Procedures, Units and Measurements,
3. Use of Instruments, pH and Buffers
4. Qualitative analysis of Carbohydrates(mono di and Polysaccharides)
5. Qualitative analysis of Proteins (Egg albumin , casein and Gelatin)
6. Qualitative analysis of lipids
7. Estimation of Proteins by Lowry's and Bardford Methods
8. Biological Preparations: Isolation of Caesin, and Starch

TEXT BOOKS:

- Gupta R.C. and Bhargavan S. Practical Biochemistry.
- David T. Phummer. Introduction of Practical Biochemistry (II Edition).
- B.S. Rao and V.Deshpande (2005) Experimental Biochemistry, A student companion IK International Pvt. Ltd. (New Delhi)

REFERENCES:

- Murray R.K., Granner D.K., Mayes P.A. and Rodwell V.W. Harpers Biochemistry, Appleton and Lange ,Stanford ,Conneticut. 2. Thomas M. Devlin. Textbook of Biochemistry with clinical correlations. Wiley LissPublishers

Subject Code: EBBT22L02	Subject Name : MICROBIOLOGY LAB	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	Lb	0	0/0	3/0	1

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

OBJECTIVE : To teach the basic concept involved in the sterilization, isolation and cultivation, identification of microbes

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

CO1	Handle the basic instruments – Autoclave, laminar air flow, incubator, pH meter, colorimeter used for the microbial cultivation.
CO2	Understand the working principle and operation of compound microscope with deep knowledge on the sample preparation and staining techniques.
CO3	Acquire the practical knowledge of various biochemical phenomena of different types of microbes, their applications and interpretation the results.

Mapping of Course Outcomes with Program Outcomes (POs)

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

COs / PSOs	PSO1	PSO2	PSO3
CO1	-	2	2
CO2	3	3	3
CO3	3	3	3

3/2/1 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: EBBT22L02	Subject Name :MICROBIOLOGY LAB	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	Lb	0	0/0	3/0	1

1. Sterilization techniques- Autoclave, Hot air oven, Filter sterilization (lecture/demonstrations).
2. Preparation of culture media (a) broth Type of media (b) Agar (C) Differential media and (D) selective media
3. Culturing of Microorganisms: Pure culture techniques: Streak plate, pour plate
4. Isolation and preservation of bacterial culture.
5. Enumeration of micro-organisms- Serial dilution plating
6. Identification of microorganisms. (a) Staining techniques –Simple staining, Grams staining, Capsule staining, Endospore staining,
7. MotiliTy of bacteria by Hanging drop method.
8. Biochemical test -Gram negative –Indole test, Methyl red test, VogesProskauer test, Cirtate test, Triple sugar iron test
9. Biochemical test -Gram positive – Catalase test, Starch hydrolysis test.
10. Exposing the Sabouraud's agar plate in different location -Fungal identification by LPCD mount.

TEXT BOOKS

- Monica Chessbrough(1999) Laboratory Manual in Microbiology(Vol I & II)Cambridge University Press
- collee, J.G. etal., "Mackie & McCartney Practical Medical Microbiology" 4th Edition,
- Churchill Livingstone, 1996.

REFERENCE BOOKS

1. *Cappucino (1999) Microbiology – A Laboratory Manual Benjamin Cummings*

Subject Code: EBCS22IL2	Subject Name :OBJECT ORIENTED PROGRMMING FOR BIOTECHNOLOGISTS LAB	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite; C Programming	Lb	0	0/0	3/0	1

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

OBJECTIVE : To enable the students to learn about basic concepts in programming for biotechnologists.

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

CO1	Explore the basic concepts of oops
CO2	Apply the OOPS features in Procedural Oriented Programming
CO3	To develop program that support data types at runtime and handle exception

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	-	-	-	-	1	-	-
CO2	-	-	-	2	3	-	-	-	-	1	-	-
CO3	-	-	-	2	3	-	-	-	-	1	-	-

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

3/2/1 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: EBCS22IL2	Subject Name :OBJECT ORIENTED PROGRMMING FOR BIOTECHNOLOGISTS LAB	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite; C Programming	Lb	0	0/0	3/0	1

1. Design C++ classes with static members, methods with default arguments,

2. Develop friend function to do matrix-vector multiplication

3. Implement complex number class with required operator overloading and Type conversion.

4. Implement matrix class with dynamic memory allocation and required methods.

5. Overload the new and delete operators to provide custom dynamic allocation of memory.

6. Implement Matrix class with dynamic memory allocation and necessary methods.

7. Write a C++ program that randomly generates complex numbers

8. Develop a program that implements inheritance

9. Implement string as new data Types

10. Stack with Virtual function

TEXT BOOK

- Gary Cornell, Cay Horstmann, Core Java™ 2, Volume 2, Advanced Features, 7th Edition, Prentice Hall of India

Subject Code: **EBBT22ET1**	**Subject Name : GENETICS**	**TY / LB/ ETL/IE**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: Nil	ETL	2	0/0	2/0	3

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

OBJECTIVE: To impart knowledge about the basics of genetics behavioral pattern of genes. To give a outline about the various genetic disorders.

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

CO1	Understand the fundamental concepts of genetics, including the nature of genetic material, Mendelian laws of inheritance, dominance relationships, and sex determination in plants and animals.
CO2	Describe the structural organization of chromosomes, variations in their number and structure, and the role of chromosomal rearrangements in inheritance. Learn about sex-linked inheritance, inherited diseases, and molecular diseases.
CO3	Develop proficiency in gene mapping techniques, including calculation of map distances, mapping genes through mitotic segregation and recombination, and gene transfer in bacteria. Gain knowledge of population genetics, Hardy-Weinberg equilibrium, factors affecting gene frequencies, and the concept of polymorphism.

Mapping of Course Outcomes with Program Outcomes (POs)

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

COs / PSOs	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	**1**	**2**
CO2	**2**	**1**	**3**
CO3	**1**	**2**	**3**

/2/1 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: **EBBT22ET1**	**Subject Name : GENETICS**	**TY / LB/ ETL/IE**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: Nil	ETL	2	0/0	2/0	3

UNIT I - INTRODUCTION **12 Hrs**

Nature of genetic material, Mendelian laws of inheritance, law of segregation and laws of independent assortment.Dominance and lethal genes-Dominance relationships.

Lab component (1) study of compound microscope (2) problems related to monohybrid and dihybrid cross

UNIT II - CHROMOSOME **12 Hrs**

Structural organization, variation in the number and structure of chromosome- Haploids, missing and Euploid and aneuploid, Deletion, Duplication, Translocation and structural rearrangements.

Lab component (3) Model preparation and explanation for chromosomes variations

UNIT III - SEX CHROMOSOMES AND INHERITED DISEASES **12 Hrs**

Vehicles of heredity, sex determination in plants and animals, Autosomal dominant disorders sex linked inheritance, non-disjunction of X chromosomes, linkage and crossing over, interference, coincidence. Molecular diseases Hemoglobinopathies, disorders of coagulation, colour blindness, hemophilia. Multiple alleles ABO blood groups, Rh group system

Lab component (4) Study on sex linked inheritance in Drosophila

UNIT IV - GENE TRANSFER &MAPPING **12 Hrs**

Mapping techniques-calculation of large map distances, mapping genes by mitotic segregation and recombination, mapping by in-situhybridization. Gene transfer in bacteria-transformation, transduction, conjugation and their mapping

Lab component (5)Making models for gene transfer reactions

UNIT V - POPULATION GENETICS **12 Hrs**

Principles of Hardy Weinberg law-Gene frequency, genoType frequency, Hardy Weinberg equilibrium and application, factors affecting gene frequencies. Polymorphism and characteristic features, inbreeding.

Total Number of Hours: 60

TEXT BOOKS

- Monroe W. Stricberger (1985) Genetics (3th Ed) Macmillan Publishing Company
- Gardner (2006) Principles of Genetics (8th Ed) Wiley edition,
- B.D.Singh (1999) Fundamentals of Genetics (3th Ed) Kalyani Publishers, New Delhi.

REFERENCE BOOKS

- Good enough (1984) Genetics Saunders College Pub.
- Singer and P.Berg (1991) Genes and Genomes UniversiTy Science Books
- Griffith (2000) Genetics W. H. Freeman
- Hugh L. Fletcher, Genetics, Garland Science 2012
- Anna Claybourne, Genetics, Evans Brothers 2006

SEMESTER IV

Subject Code	Subject Name :**Advanced Mathematics for Bio Technology**	Ty/Lb/ETL/IE	L	T/S.Lr	P/R	C
EBMA22012	Prerequisite: First year Engineering Mathematics	Ty	3	1/0	0/0	4

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

The student should be made to:

To be able to understand Algebraic series
To understand the concepts in Matrices
To analyze the Problems in Sequence and series
To be able to understand concepts in Ordinary Differential Equations
To be able to understand the concept of Fucntions of several variables

COURSE OUTCOMES (COs) :

CO1	Understand the basic concepts of algebra and matrices
CO2	Understand the sequences and series
CO3	Understand the sequences ordinary differential equation and several variable

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	2	-	-	-	-	-	-	-	1
CO2	3	3	3	2	-	-	-	-	-	-	-	1
CO3	3	3	3	2	-	-	-	-	-	-	-	1

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

3/2/1 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 **:Advanced Mathematics for Bio Technology**	**Ty/Lb/ETL/IE**	**L**	**T/S.Lr**	**P/R**	**C**
EBMA22012	Prerequisite: First year Engineering Mathematics	Ty	3	1/0	0/0	4

UNIT I ALGEBRA (12hrs)

Partial fractions – Binomial, Exponential, and Logarithmic Series (without proof of theorems)– Problems on Summation, and Approximation. (simple problems)

UNIT II MATRICES II (12 hrs)

Determinant – Simple properties – Symmetric & Skew symmetric matrices – Unitary matrix – Characteristic equation – Eigen values and Eigen vectors of a real matrix – Cayley - Hamilton theorem(without proof).

UNIT III SEQUENCE AND SERIES (12 hrs)

Basic definitions of Sequence and Series–Convergence & Divergence– Ratio test – Comparison test – Cauchy's root test – Raabe's test. (simple problems)

UNIT IV ORDINARY DIFFERENTIAL EQUATIONS (12 hrs)

First order differential equations – Second and higher order linear differential equations with constant coefficients and with RHS of the form: e^{ax}, x^n, Sin ax, Cos ax, $e^{ax}f(x)$, x f(x) where f(x) is Sin bx or Cos bx – Differential equations with variable coefficients (Euler's form).(simple problems)

UNIT V FUNCTIONS OF SEVERAL VARIABLES (12hrs)

Partial derivatives – Total differential – Differentiation of implicit functions – Taylor's expansion – Maxima and Minima by Lagrange's Method of undetermined multipliers – Jacobians.

Total no. of hrs: 60

Reference Books:

- Kreyszig E., *Advanced Engineering Mathematics (10th ed.)*, John Wiley & Sons, (2011).
- Grewal B.S., *Higher Engineering Mathematics*, Khanna Publishers, (2012).
- John Bird, *Basic Engineering Mathematics (5th ed.)*, Elsevier Ltd, (2010).
- Vittal P.R., *Vector analysis, Analytical solid geometry, Sequences and series (3rd ed.)*, Margham Publications, (2010).
- Veerarajan T., *Engineering Mathematics (for first year)*, Tata McGraw Hill Publishing Co., (2008).
- P.Kandasamy, K.Thilagavathy and K. Gunavathy, *Engineering Mathematics Vol. I (4th Revised ed.)*,S.Chand& Co., Publishers, New Delhi (2000).
- John Bird, *Higher Engineering Mathematics (5th ed.)*, Elsevier Ltd, (2006).

Subject Code **EBBT22005**	Subject Name **: INSTRUMENTATION METHODS AND ANALYSIS**	**Ty/Lb/ETL/IE**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite: Biochemistry, Electronics	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits Ty/Lb/ETL :Teory/Lab/Embedded Theory and Lab

OBJECTIVES :
To impart adequate knowledge of scientific understanding of the basic concepts in instrumentation used in Biotechnology

COURSE OUTCOMES (COs) :

CO1	To remember the working principle and understand the theoretical knowledge about instruments
CO2	To practice the handling of instruments and its applications
CO3	To develop skills among students about 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	2	-	2	2	-	-	-	-	-	-	-
CO2	3	2	-	2	2	-	-	-	-	-	-	-
CO3	3	2	-	2	2	-	-	-	-	-	-	-

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	
CO1	3	2	3	
CO2	3	2	3	
CO3	3	2	3	

3/2/1 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 **EBBT22005**	Subject Name **: INSTRUMENTATION METHODS AND ANALYSIS**	**Ty/Lb/ETL/IE**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite: Biochemistry, Electronics	Ty	3	0/0	0/0	3

UNIT I: **SPECTROSCOPY - I & THERMAL METHODS** **9Hrs**

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 spectometry, NMR, XRD

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

Introduction to principles and applications of Microscopic methods 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 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 no of Hours: 45

REFERENCES

- Principles of Instrumental Analysis, Skoog DA, Thomspon Brooks and Cole, 5th Edition
- Instrumental Methods of Chemical Analysis, Chatwal GR, Himalaya Publishing House
- Instrumental Methods of Chemical Analysis, Sharma BK, Krishna Prakashan Media Pvt Ltd
- Instrumental methods of analysis by Willard, Merit Dean & Settle, CBS Publishers and Distributers, 6th Edition

Subject Code: EBBT22006	Subject Name : MICROBIAL BIOTECHNOLOGY	Ty/Lb/E TL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Microbiology	TY	3	1/0	0/0	4

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

OBJECTIVE : To make the students aware of the bulk production of commercially important modern Bio products, Industrial Enzymes, Products of plant and animal cell cultures

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

CO1	Acquire the basic knowledge of bacterial cell structure, Classification systems, Staining methods, the nutritional requirements of bacteria and get equipped with various methods of bacterial growth measurement.
CO2	Describe fungi and virus classification, structure, types and replication cycles.
CO3	Understand the Principles of sterilization and disinfection, various physical and chemical means of sterilization and evaluation of disinfectants. Analyze the antibiotic mode of action and microbial resistance towards antibiotics.

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	3	-	2	2	-	-	-	-
CO2	-	2	2	2	3	-	2	2	-	-	-	-
CO3	-	2	2	2	3	-	2	2	-	-	-	-

COs / PSOs	PSO1	PSO2	PSO3
CO1	-	2	2
CO2	3	3	3
CO3	3	3	3

3/2/1 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: EBBT22006	Subject Name : MICROBIAL BIOTECHNOLOGY	Ty/Lb/ETL /IE	L	T / S.Lr	P/ R	C
	Prerequisite: Microbiology	TY	3	1/0	1/0	4

UNIT I - HISTORY AND SCOPE **9 Hrs**

History and scope of microbial biotechnology, Microbial biodiversity and its use, basic functions of CBD. Berge's manual of systemic bacteriology. Mass cultivation and preservation of microorganisms. Mycotechnology, Classification in microbial biomass.

UNIT II - MICROBIAL METABOLITES **9 Hrs**

Production of microbial enzymes and its applications, microbial production of antibiotics, production of single cell proteins – Commercially available forms of single cell protein for food and feed. Strain improvement. Marine microbial metabolites and biopolymer.

UNIT III - ROLE OF MICROBES **9 Hrs**

Role of microorganisms for industrial, agricultural and environmental use. Beer and wine defects in industries. Bio fertilizers and Biopesticides, Large-scale production of microbial inoculants for agriculture - microbial fertilizers, microbial pesticides and Mycorhizae.

UNIT IV - MICROBES IN BIOREMEDIATION AND IN GENERATION OF ENERGY **9 Hrs**

Bioremediation of Xenobiotic and natural compounds - microbes in mining, ore leaching, MEOR, waste - water treatment, biodegradation of non cellulose and cellulosic wastes for environmental conservation. Lignocellulosic waste degradation. Microbes as alternative energy sources by microbial fuel cells and biofuels. Biomass from carbohydrates.

UNIT V - CASE STUDIES AND CURRENT ISSUES **9 Hrs**

Production of primary metabolites, organic acids (citric acid, itaconic acid, acetic acid, gluconic acid), Amino acids (glutamic acid, lysine, aspartic acid, phenylalanine), alcohols (Ethanol, 2,3-butanediol). Case studies on Industrial contamination (Only for discussion)

Total number of periods: 45

TEXT BOOKS:

- Satyanarayana, U. "Biotechnology" Books & Allied (P) Ltd., 2005.
- Kumar, H.D. "A Textbook on Biotechnology" 2nd Edition. Affiliated East West Press Pvt.Ltd., 1998.
- Balasubramanian, D. etal., "Concepts in Biotechnology" Universities Press Pvt.Ltd.,2004.
- Ratledge, Colin and Bjorn Kristiansen "Basic Biotechnology" 2nd Edition Cambridge UniversiTy Press, 2001.
- Dubey, R.C. "A Textbook of Biotechnology" S.Chand& Co. Ltd., 2006.

REFERENCES:

- A.H. Patel " Industrial Microbiology" Macmillan
- Presscott, S.C. and Cecil G. Dunn, "Industrial Microbiology", Agrobios (India), 2005.
- Cruger,Wulf and AnnelieseCrueger, "Biotechnology: A Textbook of Industrial Microbiology", 2nd
- Edition, Panima Publishing, 2000.
- Moo-Young, Murrey, "Comprehensive Biotechnology", 4 Vols. Pergamon Press, (An Imprint of Elsevier) 2004.
- C.F.A Bryce and EL.Mansi, Fermentation microbiology & Biotechnology, 1999.
- K.G.Ramawat&ShailyGoyal, Comprehensive Biotechnology, 2009, S.Chand publications

Subject Code: EBCS22ID4	Subject Name : BIO DATABASE MANAGEMENT SYSTEM	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Basic Computer Science Engineering	Ty	3	0/0	0/0	3

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

OBJECTIVE :

- To get knowledge in database management , SQL and DB transaction

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

CO1	Explore how to utilize a relational database to store data in an electronic way.
CO2	Probably learn how to use SQL to retrieve the data stored in the database.
CO3	Implement the transaction concepts to reads a value from the database or writes a value to the database

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	-	-	-	-	-	-	-
CO2	-	-	-	2	3	-	-	-	-	-	-	-
CO3	-	-	-	2	3	-	-	-	-	-	-	-

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

3/2/1 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: EBCS22ID4	Subject Name : BIO DATA BASE MANGEMENT SYSTEM	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Basic Computer Science Engineering	Ty	3	0/0	0/0	3

UNIT I - PURPOSE OF DATABASE **9 Hrs**

Overall System Structure - Entity Relationship Model - Mapping Constraints - Keys - E-R Diagrams – Relational Model - Structure

UNIT II - STRUCTURED QUERY LANGUAGE **9 Hrs**

Basic Structure - Set Operations - Aggregate Functions - Date, Numeric, and Character Functions - Nested Sub queries -Modification Of Databases - Joined Relations-DDL - Embedded SQL.

UNIT III - RELATIONAL DATABASE DESIGNS **9 Hrs**

Pitfalls - Normalization Using Functional Dependencies - First Normal Form-Second Normal Form-Third Normal Form-Fourth Normal Form and BCNF.

UNIT IV - INDEXING & HASHING **9 Hrs**

File and system structure – overall system structure file transaction – data dictionary – indexing and hashing basic concepts. static and dynamic hash functions Transaction Management

UNIT V - TRANSACTIONS **9 Hrs**

Transaction Concept- Properties of a Transaction- A Simple Transaction Mode- Concurrent Executions- Schedules- Serial and Non Serial Types-Serialization of schedules and views-locks based protocols-time based protocols.

Total number of periods: 45

TEXT BOOK:

- Abraham Silberschatz, H.F.Korth and S.Sudarshan-Database System Concepts McGraw Hill Publication.
- Singh-Database systems: Concepts, Design & applications, Pearson Education.
- G. K. Gupta, Database Management System, Tata McGraw Hill Publication (2011)

REFERENCE BOOK:

- Gerald V.Post - DBMS-Designing and Business Applications - McGraw Hill Publications
- Michael Abbey and Michael.J.Corey-Oracle- A Beginners guide TMH
- Patricia Ward, Database Management Systems, Thomson learning (2006)
- Malay K. Pakhira, Database Management Systems (2013)
- Rajesh Narang, Database Management Systems (2011)

Subject Code: EBEE22ID5	Subject Name :BIOPROCESS INSTRUMENTATION AND CONTROL SYSTEM	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Physics	Ty	3	0/0	0/0	3

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

OBJECTIVE :

- The introduction of need for process control and over all view of self regulation.The overview of control action and pneumatic and electronic controllers with practical form of PID.
- To understand the basic principles of measurements and classification of process instruments and application of sensors

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

CO1	Remember the introduction to process control, mathematical modelling of simple processes, batch and continuous process, controllers, gas analyzers, closed loop systems, instrumentation and bio-sensors
CO2	Understand and apply the concepts in process control, mathematical modelling of simple processes, batch and continuous process, controllers, gas analyzers, closed loop systems, instrumentation and bio-sensors
CO3	Analyze and evaluate the concepts in process control, mathematical modelling of simple processes, batch and continuous process, controllers, gas analyzers, closed loop systems, instrumentation and bio-sensors

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

COs / PSOs	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	3
CO2	3	2	3
CO3	2	3	3

3/2/1 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: EBEE22ID5	Subject Name :BIOPROCESS INSTRUMENTATION AND CONTROL SYSTEM	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Physics	Ty	3	0/0	0/0	3

UNIT I - INTRODUCTION **9 Hrs**

Need for process control – mathematical model of first – order level, pressure and thermal processes – higher order process – interacting and non-interacting systems – continuous and batch process – self-regulation – servo and regulator operation-Heat Exchanger-CSTR.

UNIT II - CONTROL ACTIONS AND CONTROLLERS **9 Hrs**

Basic control actions – characteristics of on-off, proportional, single-speed floating, integral and derivative control modes – P+I, P+D and P+I+D control modes – pneumatic and electronic controllers – Control of pH, dissolved oxygen, dissolved carbon dioxide, temperature of Fermentor

UNIT III - CLOSED LOOP SYSTEMS **9 Hrs**

Closed loop control systems, development of block diagram for feed-back control systems, servo and regulatory problems, transfer function for controllers and final control element, principles of pneumatic and electronic controllers, transient response of closed-loop control systems and their stability

UNIT IV - INSTRUMENTATION **9 Hrs**

Principles of measurements and classification of process instruments, measurement of temperature, pressure, fluid flow level , liquid weight and weight flow rate, viscosity, pH, Concentration, Humidity & Moisture

UNIT V - BIOSENSORS **9 Hrs**

Physical and chemical sensors; Biosensors; On-line sensors for cell properties; off-line, Analytical methods

Total Number of Hours: 45

TEXT BOOKS

- Stephanopoulis, G, Chemical Process Control, Prentice Hall of India, New Delhi, 1990.
- Eckman. D.P., Automatic Process Control, Wiley Eastern Ltd., New Delhi, 1993.
- Despande and R.H.Ash, Computer process control, ISA Publication, USA 1995.

REFERENCES

- Pollard A.Process Control, Heinemann educational books, London, 1971.
- Harriott. P., Process Control, Tata McGraw-Hill Publishing Co., New Delhi, 1991.
- Curtis.D.Johnson, Process control Instrumentation Technolgy,PHI Learning ,2009.
- Ahson, S.I., "Microprocessors with applications in process control", Tata McGraw-Hill Publishing Company Limited, New Delhi, 1984.
- Bequette, B.W., "Process Control Modeling, Design and Simulation", Prentice Hall of India, 2004

Subject Code: EBCC22I04	Subject Name : THE INDIAN CONSTITUTION	TY / LB/	L	T /	P/ R	C
	Prerequisite: NIL	IE	2	0/0	0/0	0

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

OBJECTIVES:

- To provide an overview of the history of the making of Indian Constitution
- To understand the preamble and the basic structures of the Constitution.
- To Know the fundamental rights, duties and the directive principles of state policy
- To understand the functionality of the legislature ,the executive and the judiciary

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

CO1	To provide an overview of the history of the making of Indian Constitution
CO2	To understand the preamble and the basic structures of the Constitution.
CO3	To Know the fundamental rights, duties and the directive principles of state policy

Mapping of Course Outcomes with Program Outcomes (POs)

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

COs / PSOs	PSO1	PSO2	PSO3				
CO1	1	1	2				
CO2	1	1	2				
CO3	1	1	2				

3/2/1 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: EBCC22I04	Subject Name : The Indian Constitution	TY / LB/	L	T / S.Lr	P/ R	C
	Prerequisite: NIL	IE	2	0/0	0/0	0

UNIT 1 **3Hrs**

The History of the Making of Indian Constitution, Preamble and the Basic Structures

UNIT 2 **3Hrs**

Fundamental Rights and Duties , Directive Principles of State Policy

UNIT 3 **3Hrs**

Legislature, Executive and Judiciary

UNIT 4 **3Hrs**

Emergency Powers

UNIT 5 **3Hrs**

Special Provisions for Jammu and Kashmir, Nagaland and Other Regions, Amendments

Total no Hrs: 15 Hrs

TEXT BOOKS:

- D D Basu, Introductiontothe Constitutionof India,20th Edn.,LexisnexisButterworths, 2012.

REFERENCE BOOKS:

- Rajeev Bhargava (ed), Ethics and Politics of the Indian Constitution, Oxford UniversiTy Press, NewDelhi, 2008.
- GranvilleAustin,TheIndianConstitution:CornerstoneofaNation,OxfordUniversiTyPress, Oxford, 1966.
- Zoya Hassan, E. Sridharan and R. Sudarshan (eds), India's Living Constitution: Ideas, Practices, Controversies,Permanent Black, NewDelhi, 2002.
- SubhashC.Kashyap,OurConstitution,National BookTrust, NewDelhi, 2011.

Subject Code: EBCC22I05	Subject Name : THE INDIAN TRADITIONAL 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 SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES:

- To understand the Pre- colonial and Colonial Period, Indian Traditional Knowledge System
- To understandtheTraditional Medicine, Traditional Production and Construction Technology
- To Know the History of Physics and Chemistry, Traditional Art and Architecture and Vastu Shashtra, Astronomy and Astrology

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

CO1	To understand the Pre- colonial and Colonial Period, Indian Traditional Knowledge System
CO2	To understandtheTraditional Medicine, Traditional Production and Construction Technology
CO3	To understand the Origin of Mathematics, Aviation Technology in Ancient India, Crafts and Trade in Ancient India

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	2	-	2	-	-	-	2	-	1
CO2	-	3	3	2	-	2	-	-	-	2	-	1
CO3	-	3	3	2	-	2	-	-	-	2	-	1

COs / PSOs	PSO1	PSO2	PSO3
CO1	1	1	2
CO2	1	1	2
CO3	1	1	2

3/2/1 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: EBCC22I05	Subject Name : THE INDIAN TRADITIONAL KNOWLEDGE	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: NIL	IE	2	0/0	0/0	0

UNIT I **3 Hrs**

Historical Background: TKS During the Pre- colonial and Colonial Period, Indian Traditional Knowledge System

UNIT II **3 Hrs**

Traditional Medicine, Traditional Production and Construction Technology

UNIT III **3 Hrs**

History of Physics and Chemistry, Traditional Art and Architecture and Vastu Shashtra, Astronomy and Astrology

UNIT IV **3 Hrs**

Origin of Mathematics, Aviation Technology in Ancient India, Crafts and Trade in Ancient India

UNIT V **3 Hrs**

TKS and the Contemporary World, TKS and the Indian Union, TKS and IT Revolution

Total no Hrs: 15 Hrs

TEXT BOOKS:

- Amit Jha (2009) , Traditional knowledge system in india, 1st Edition, Delhi UniversiTy (North Campus)
- Dr.A.K.Ghosh (2011), Traditional Knowledge of Household Products

Subject Code: EBCS22IL4	Subject Name :BIO DATABASE MANAGEMENT SYSTEMS LAB	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Basic Computer Science Engineering Lab	Lb	0	0/0	3/0	1

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

OBJECTIVE :

- To get knowledge in SQL of storage, retrieval from the appropriate database

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

CO1	To understand the concept of Data retrieval from a Database with help of SQL
CO2	Storing of data in a electronic format by making use of Relational database
CO3	Apply the transaction concepts to reads a value from the database or writes a value to the database

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	-	-	-	-	1	-	-
CO2	-	-	-	2	3	-	-	-	-	1	-	-
CO3	-	-	-	2	3	-	-	-	-	1	-	-

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

3/2/1 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: EBCS22IL4	Subject Name :BIO DATABASE MANAGEMENT SYSTEMS LAB	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Basic Computer Science Engineering Lab	Lb	0	0/0	3/0	1

I. PROGRAM TO LEARN SQL COMMANDS

1. Execution of DDL Commands
2. Execution of DML Commands
3. Insert Command
4. Select, From and Where Clause
5. Set Operation [Union, Intersection, Except]
6. Nested Queries
7. Join Operation
8. Modification of the Database

REFERENCE BOOKS

- Dr. Rajiv Chopra (2014) Database Management System (DBMS), Fourth Edition, S.Chand & Company Pvt. Ltd.,
- Bhavesh Pandya, Safa Hamdare,Asim Kumar Sen (2015),Data base Management Sytstem, Vikas Publishing House Pvt.Ltd.
- Ramez Elmasri, Shamkant B.Navathe (2008), Fundamentals of database systems, Fifth Edition, Dorling Kindersley (India) Pvt.Ltd

Subject Code: EBBT22L03	Subject Name : INSTRUMENTAL METHODS OF ANALYSIS LAB	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Biochemistry Lab	Lb	0	0/0	3/0	1

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

OBJECTIVE:

- To understand the standard operating procedures of various instruments.
- To analyze the different biomolecules present in the biological system using the analytical techniques.

COURSE OUTCOMES (COs) : To train the students

CO1	To understand practical knowledge about various instruments
CO2	To acquire experience in the purification by performing chromatographic technique
CO3	To analyse several biomolecule using spectrophotometer and colorimeter

Mapping of Course Outcomes with Program Outcomes (POs)

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

COs / PSOs	PSO1	PSO2	PSO3
CO1	2	1	1
CO2	2	1	1
CO3	2	1	1

3/2/1 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: EBBT22L03	Subject Name : INSTRUMENTAL METHODS OF ANALYSIS LAB	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Biochemistry Lab	Lb	0	0/0	3/0	1

1. Qualitative analysis: `
Normal & abnormal urine

2. Titrimetric analysis:
Estimation of titrable acidity and ammonia content of urine.

3. Colorimetric analysis:
Estimation of blood urea by Dam method.

4 .Spectrophometric analysis:
Estimation of protein by Bradford method.

5. Centrifugation technique:
Separation of serum and Plasma from blood

7. Chromatographic technique
Separation of amino acids by paper chromatography
Separation of lipids by TLC.

TEXT BOOKS:

- *Gupta R.C. and Bhargavan S. Practical Biochemistry.*
- *David T. Phummer. Introduction of Practical Biochemistry (II Edition).*
- *B.S. Rao and V.Deshpande (2005) Experimental Biochemistry, A student companion IK International Pvt. Ltd. (New Delhi)*

REFERENCES:

- Murray R.K., Granner D.K., Mayes P.A. and Rodwell V.W. Harpers Biochemistry, Appleton and Lange ,StanfordConneticut.
- Thomas M. Devlin. Textbook of Biochemistry with clinical correlations. Wiley Liss Publishers Harold Varley (1967) Practical biochemistry (4th Ed) Heinemann Medical,

Subject Code: EBBT22L04	Subject Name :MICROBIAL BIOTECHNOLOGY LAB	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Microbiology Lab	Lb	0	0/0	3/0	1

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

OBJECTIVE: To understand the basic microbial systems and to know how does it help in the biodegradation and biotransformation process.

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

CO1	Understand about microbial biodiversity and its uses, familiarize on mass cultivation and preservation of micro-organisms.
CO2	Explore and analyze the different types of microbial metabolites production on industrial scale.
CO3	Evaluate the importance of microbes in industrial, agricultural and environmental sectors

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	3	-	2	2	-	-	-	-
CO2	-	2	2	2	3	-	2	2	-	-	-	-
CO3	-	2	2	2	3	-	2	2	-	-	-	-

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

3/2/1 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: EBBT22L04	Subject Name :MICROBIAL BIOTECHNOLOGY LAB	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Microbiology Lab	Lb	0	0/0	3/0	1

1. Pure culture techniques
   a. Selective screening mediums for industrially important microbes
2. Isolation of fungi from soil sample and identification through slide culture technique.
3. Determination of growth curve of the given organism
4. Screening of amylase producing microorganism
5. Lyophilization of given industrially important microorganism
6. Determination of TDP (Thermal death point) and TDT (Thermal death time)

REFERENCE BOOKS

1. Cappucino (1999) Microbiology - A laboratory Manual Benjamin Cummings

2. *T.Sundarrajan(2005) Microbiology laboratory Manual (4th Ed) A. SundarrajPerungudi.*

Subject Code: EBEE22IL2	Subject Name : Bioprocess Control Systems Lab	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Physics	Lb	0	0/0	3/0	1

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

OBJECTIVE :

- To understand the fundamentals of process control, Types of processes, characteristics of different Types of controllers for controlling a process

COURSE OUTCOMES (COs) : End of the semester students will able to

CO1	Remember and recall the introduction to various types of controllers for temperature process pressure process and level process
CO2	Understand and apply the concepts for various types of controllers for temperature process pressure process and level process
CO3	Analyze and evaluate and experiment the concepts in controllers for temperature process pressure process and level process

Mapping of Course Outcomes with Program Outcomes (POs)

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

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

3/2/1 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: EBEE22IL2	Subject Name : Bioprocess Control Systems Lab	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Physics	Lb	0	0/0	3/0	1

1. Response of ON-OFF controller

2. Response of P+I+D controller

3. Closed loop response of Flow Control Loop

4. Closed loop response of Level Control Loop

5. Closed loop response of Temperature Control Loop

REFERENCE BOOK

- Despande and R.H.Ash, Computer process control, ISA Publication, USA 1995

Subject Code: EBBT22I01	Subject Name :TECHNICAL SKILL-I	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: : All core papers	IE	0	0/0	2/0	1

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

OBJECTIVE:

Students are expected to understand the technical knowledge in the core domains of biotechnology such as Biochemistry, Microbiology and Chemical Engineering

COURSE OUTCOMES (COs) : The student will be exposed

CO1	To get knowledge about the biotechnology skill through value added courses
CO2	Ability to understand the biotechnological contemporary issues
CO3	To enrich the thinking of students towards biotechnological problem solving skill

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	-	2	1	-	-	-	-	-	1	2	-	-
CO2	-	2	1	-	-	-	-	-	1	2	-	-
CO3	-	2	1	-	-	-	-	-	1	2	-	-

COs / PSOs	PSO1	PSO2	PSO3
CO1	2	1	2
CO2	2	1	2
CO3	2	1	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: EBBT22I01	Subject Name :TECHNICAL SKILL-I	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: : All core papers	IE	0	0/0	2/0	1

Students should acquire skill in the domain/inter disciplinary area from government/private training centers/industries /University for a minimum period of 15 calendar days. The training can be through off line, online or mixed mode. Students are supposed to prepare Technical skill report at the end of the training and submit the report along with the certificate in proof of the training, during the viva voce examination conducted by the examiners duly appointed by the head of the department.

Total Periods: 30

Subject Code: EBCC22I06	Subject Name : SOFT SKILLS I - EMPLOYABILITY SKILLS	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
	Prerequisite: Pass Marks in Plus 2 English	Lb	0	0/1	2/0	1

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

To equip the advanced level engineering students with skills essential for work place and global environment to which they will move on from the university, once they complete the course.

COURSE OUTCOMES (COs)

CO1	Develop the skills to get employed and have a self esteem and a sense of self worth to be a good team member
CO2	Develop empathy to think from other's point of view and evolve as global citizens with insights into social and professional ethics
CO3	Develop lifelong learning skills to adapt in the multicultural context of workplaces.

Mapping of Course Outcomes with Program Outcomes (POs)

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

COs PSOs	PSO1	PSO2	PSO3
CO1	2	2	3
CO2	2	2	3
CO3	2	2	3

3/2/1 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: EBCC22I06	Subject Name : SOFT SKILLS I - EMPLOYABILITY SKILLS	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
	Prerequisite: Pass Marks in Plus 2 English	Lb	0	0/1	2/0	1

Unit -I (LSRW)

Conversational skills: Essential skills to sustain conversation- non-verbal communication – body language - gestures, gambits- paralanguage-Role plays – Skeleton dialogues- Dialogue writing- telephone etiquette- pragmatics in communication – speech styles for effective communication

Unit -II

Self-esteem skills-empathy-public relations-positivity-reliability-professionalism

Unit -III

Leadership skills – importance of interaction in group management- analytical skill-conflict management- problem solving

Unit -IV

Intercultural communication skills- familiarising global culture-Cultural sensitivity- Cultural intelligence: Low and High context, e mail and inter cultural communication

Unit -V

Job and career- three types- Govt.-private and public sector – competitive exams -Group discussion &Interview skills

Suggested reading

1. S.P. Dhanavel, English and Soft Skills, Vol.2 Orient Blackswan Pvt. Ltd. 2010
2. P.D. Chaturvedi and M. Chaturvedi, Communication Skills , Pearson, 2012

SEMESTER - V

Subject Code: EBBT22007	Subject Name :MOLECULAR BIOLOGY AND RECOMBINANT DNA TECHNOLOGY	TY / LB/ ETL/IE	L	T / S.L r	P/ R	C
	Prerequisite: Biochemistry & Microbiology	Ty	3	1/0	0/0	4

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

OBJECTIVE: To Understand the mechanism of replication, transcription and translation. To deeply learn the molecules involved in synthesis of DNA, RNA and proteins.

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

CO1	Discuss on the basic concepts and principles of nucleic acids from the perspective of engineers
CO2	Illustrate the mechanism and role of the nucleic acids in, replication, gene expression and gene regulation in prokaryotic and eukaryotic organisms .
CO3	Applying molecular biology knowledge in to Recombinant technology , DNA sequences and polymerase chain reactions

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	2	-	-	-	-	-	-	-	-	-
CO2	1	3	2	-	-	-	-	-	-	-	-	-
CO3	1	3	2	-	-	-	-	-	-	-	-	-

COs / PSOs	PSO1	PSO2	PSO3
CO1	1	2	2
CO2	2	1	1
CO3	2	1	2

3/2/1 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: EBBT22007	Subject Name :MOLECULAR BIOLOGY AND RECOMBINANT DNA TECHNOLOGY	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Biochemistry & Microbiology	Ty	3	1/0	0/0	4

UNIT I - STRUCTURE, REPLICATION AND REPAIR MECHANISM 12 Hrs

DNA Structure, RNA structure, Replication process of prokaryotic and eukaryotic, Replication errors-Mutagens-their repair mechanism. Recombination mechanism in prokaryotes and eukaryotes, transposition- transposase – replicative transposition, non-replicative transposition.

UNIT II - TRANSCRIPTION AND TRANSLATION 12 Hrs

Types of RNA polymerases, prokaryotic and eukaryotic transcription- splicing and editing, mRNAtransport, inhibitors of transcription, Role of mRNA and tRNA in translation process, structure of ribosome, mechanism of Prokaryotic and Eukaryotic translation process, Wobble hypothesis, Deviations from the universal genetic code

UNIT III - GENE REGULATION 12 Hrs

Prokaryotes – activators and repressors, DNA looping, cooperative binding, anti-terminations, eg. Lac operon, phage lambda regulation of lytic and lysogenic lifecycle; Eukaryotes – Homeo-domain proteins, Zn containing DNA binding domains, leucine zipper motifs, helix – loop helix proteins, nucleosome modifiers, eg. Human interferon gene, gene silencing, histone modifications, RNAi, siRNA, microRNAs

UNIT IV - ENZYMES IN RECOMBINANT TECHNOLOGY AND CLONING VECTORS 12 Hrs

Restriction Endonucleases, DNA manipulating enzymes, conversion of blunt end to Cohesive end, Hybridization techniques: Southern, Northern and colony hybridization, Plasmid Vectors : PBR 322, PUC19 vectors, Bacteriophage vectors : Insertion and replacement vectors, Cosmids, M13 Vectors,. Expression vectors, yeast vectors, artificial chromosome vectors: YAC and BAC, Methods for introducing DNA into cells, application of recombinant DNA technology (Insulin,vaccines)

UNIT V - CONSTRUCTION OF LIBRARIES AND DNA SEQUENCING 12 Hrs

Construction of Genomic and cDNA Libraries, Screening of libraries - gene probes, with antibodies. labeling of DNA probes: Nick translation, Random priming, Radioactive and non-radioactive probes, Principles of DNA Sequencing and its Types, PCR, Types of PCR:Real time PCR, Reverse transcriptase PCR, nested PCR, Applications of PCR

Total Number of Hours: 60

TEXT BOOK

- Watson et al (2004) Molecular Biology of the Gene, (5th Ed).,Pearson Education.
- David freifelder (1987) Molecular biology Jones & Bartlett Publishers,
- Karp, Gerald “Cell and Molecular Biology: Concepts and Experiments” 4th Edition, John Wiley, 2005.

REFERENCE BOOKS

- Baltimore (2000) Molecular biology (4th Ed): W. H. Freeman New York\
- Lodish (2000) Molecular cell biology (4th Ed): W. H. Freeman New York
- Bernard R. Glick, Molecular Biotechnology: Principles and Applications of Recombinant DNA, ASM Press (2010)

Subject Code: EBBT22008	Subject Name: IMMUNOLOGY	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Biochemistry & Microbiology	Ty	3	1/0	0/0	4

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

OBJECTIVE:

- To understand the role of immune system, to gain knowledge on different lymphoid organs and Types of immunity 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 to

CO1	Describe the immune system and their structure and classification
CO2	Explain various methods to access immune function , their function and interpretation of the results
CO3	Describe how immune cells, organs and processes function to protect human body against infective agents and cancer 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	2	1	-	-	-	-	-	-
CO2	-	-	2	3	2	1	-	-	-	-	-	-
CO3	-	-	2	3	2	1	-	-	-	-	-	-

COs / PSOs	PSO1	PSO2	PSO3
CO1	2	2	2
CO2	1	1	1
CO3	1	1	1

3/2/1 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: EBBT22008	Subject Name :IMMUNOLOGY	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Biochemistry & Microbiology	Ty	3	1/0	0/0	4

UNIT I - INTRODUCTION **12 Hrs**

Components of innate and acquired immunity; Organs and cells of the immune system - primary and secondary lymphoid organs; antigens: chemical and molecular nature; haptens; adjuvants; Types of immune responses; theory of clonal selection.

UNIT II - CELLULAR RESPONSES **12 Hrs**

Development, maturation, activation and differentiation of T-cells and B-cells; T-Cell receptors; Functional T-cell subsets; Immunoglobulins: basic structure, classes, subclasses and functions; Generation of antibody diversity; antigen-antibody reactions; antigen presenting cells: Major Histocompatibility Complex; Antigen processing and presentation: regulation of T-cell and B-cell responses; Monoclonal antibodies: Principle and Applications.

UNIT III - INFECTION AND IMMUNITY **12 Hrs**

Injury and inflammation; Immune responses to infections: Immune response to infectious agents: Viruses, bacteria, fungi and parasites; Cytokines secreted by Th1 and Th2 subsets; Complement. Immune dysfunction and its consequence: Allergy and Asthma; Hypersensitivity (Type I to IV); AIDS and Immunodeficiency; Immunization; Vaccines and Types: Common vaccines for humans.

UNIT IV - TRANSPLANTATION AND TUMORIMMUNOLOGY **12 Hrs**

Different Types of transplants; Mechanism of graft rejection; Tumor Immunology: Tumor antigens, Immune response to tumors and tumor evasion; Autoimmunity, Autoimmune disorders and diagnosis.

UNIT V - IMMUNOLOGICAL TECHNIQUES **12 Hrs**

Precipitation, agglutination and complement mediated immune reactions; Blood grouping; Advanced immunological techniques - RIA, ELISA, ELISPOT assay, Immunohistochemistry, Immuno fluorescence, Flow cytometry.

Total Number of Hours: 60

TEXT BOOKS

- Kuby J, (2003). Immunology, (5th Ed), WH Freeman & Co., New York.,
- Janeway CA, Travers P, Walport M, and Shlomchik M. (2001) Immunobiology, (6th Ed), Garland Science.,
- Animated pictures &Videos : www.roitt.com

REFERENCE BOOKS

- Roitt's (2011) Essential of Immunology,(12th Ed),Wiley-Blackwell.
- Werner Luttmann “Immunology” Elsevier publication 2006
- Thao Doan “ Immunology” Lippincott Williams & Wilkins 2013
- David male “Immunology” Elsevier publication 2006
- R. J. Turner “Immunology: A Comparative Approach” 2008

Subject Code: EBBT22009	Subject Name : PHARMACEUTICAL TECHNOLOGY	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Biochemistry	Ty	3	0/0	0/0	3

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

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

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

CO1	Understand the fundamentals of the pharmaceutical industry, including regulatory aspects, routes of drug administration, and the different types of therapeutic agents.
CO2	Demonstrate knowledge of pharmacokinetics and pharmacodynamics, including the absorption, distribution, metabolism, and excretion of drugs, as well as the mechanisms of drug action and the process of new drug discovery.
CO3	Gain an understanding of the principles of drug manufacture, including tablet and capsule preparation, formulation techniques, quality management, and the analytical methods used in drug manufacturing.

Mapping of Course Outcomes with Program Outcomes (POs)

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

COs / PSOs	PSO1	PSO2	PSO3
CO1	2	1	3
CO2	1	3	2
CO3	3	2	1

3/2/1 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: EBBT22009	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 I - INTRODUCTION **9 Hrs**

Introduction to Pharmaceutical Industry, Regulatory aspects, Routes of Administration of Drugs and Types of therapeutic agents.

UNITIIPHARMACOKINETICSAND PHARMACODYNAMICS **9 Hrs**

Basic aspects of Pharmacokinetics. Absorption, Distribution, Biotransformation and Excretion. Factors affecting pharmacokinetics. Basic aspects of Pharmacodynamics. Mechanism of drug action Steps involved in new drug discovery. Preclinical and clinical trials**.**

UNIT III - PRINCIPLES OF DRUG MANUFACTURE **9 Hrs**

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

UNIT IV - BIOPHARMACEUTICALS **9 Hrs**

Various categories of therapeutics like laxatives, analgesics, contraceptives, hormones and Antibiotics

UNIT V - PHARMACEUTICAL PATENTS **9 Hrs**

Introduction about the Patents related to Pharmaceutical Natural Products

Total no of Hours: 45

TEXT BOOKS

- Experimental pharmaceutical technology by Eugene L Parrott
- Pharmaceutical Technology: Table ting Technology Edited by James I. Wells
- Encyclopedia of Pharmaceutical Technology, Second Edition, 2004 Update Supplement by James Swarbrick

REFERENCES

- Gareth Thomas. Medicinal Chemistry. An introduction. John Wiley. 2000.
- Katzung B.G. Basic and Clinical Pharmacology, Prentice Hall of Intl. 1995.
- Current Research in Pharmaceutical Technology Edited by Sabine Globig, William Hunter Jr.
- Drugs & Pharmaceutical Technology Handbook By NIIR Board
- Pharmaceutical Technology: Concepts and applications By S. Bharath.

Subject Code: EBOL22I01	Subject Name : ONLINE COURSE (NPTEL/ SWAYAM/ Any MOOC approved by AICTE/ UGC)	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: All papers	ID	1	0/0	1/0	1

ONLINE COURSE

Students should register for the online course with a minimum course duration of 4 weeks through the online portals such as NPTEL/SWAYAM/Any MOOC in the beginning of the semester. A mentor will be assigned by the department for monitoring the students.

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.

Subject Code: EBBT22L05	Subject Name : MOLECULAR BIOLOGY AND RECOMBINANT DNA TECHNOLOGY LAB	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Biochemistry Lab & Microbiology Lab	Lb	0	0/0	3/0	1

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

OBJECTIVE:

- To apply the knowledge gained in Recombinant DNA technology and Molecular biology subjects regarding DNA, RNA and gene manipulation

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

CO1	To understand the basic molecular techniques such as Plasmid isolation, Transformation techniques
CO2	To apply molecular techniques for students to attain knowledge in nucleic acids , hybridization and enzyme digestion
CO3	To analyze the outcomes of various molecular biology techniques based on nucleic acid restriction , digestion and hybridization

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	2	-	-	-	-	-	-	-	-	-
CO2	1	3	2	-	-	-	-	-	-	-	-	-
CO3	1	3	2	-	-	-	-	-	-	-	-	-

COs / PSOs	PSO1	PSO2	PSO3
CO1	1	2	2
CO2	2	1	1
CO3	2	1	2

3/2/1 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: EBBT22L05	Subject Name : MOLECULAR BIOLOGY AND RECOMBINANT DNA TECHNOLOGY LAB	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Biochemistry Lab & Microbiology Lab	Lb	0	0/0	3/0	1

1. Isolation of Plasmid DNA
2. Competent Cell preparation and transformation
3. Quantization of DNA by agarose gel electrophoresis and spectroscopy
4. Isolation of Plant cell and / or genomic DNA
5. Restriction Enzyme Digestion
6. Principles of Colony hybridization
7. PCR
8. Principles of RNA isolation and northern hybridization

REFERENCE BOOKS:

❖ Sam brook, Frisch and Maniatis, Vol I, II and III (1989) Molecular Cloning (2nd Ed) Cold Spring Harbor Laboratory,

Subject Code: EBBT22L06	Subject Name : IMMUNOLOGY LAB	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Biochemistry Lab & Microbiology Lab	Lb	0	0/0	3/0	1

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

OBJECTIVE: To enable the students to understand the specificities of antibodies and mechanism of antibody diversiTy To give laboratory training in different immunological and immunotechnological techniques.

COURSE OUTCOMES (COs) : End of the course,

CO1	Recognise the morphology and functions of various immune cells corresponding to their immunological response
CO2	Use experimental techniques to address changes in immunological reactions in immune system
CO3	Develop an ability to summarize , integrate and organize information and relate it to disease outcomes

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	2	1	-	-	-	-	-	-
CO2	-	-	2	3	2	1	-	-	-	-	-	-
CO3	-	-	3	3	2	1	-	-	-	-	-	-

COs / PSOs	PSO1	PSO2	PSO3
CO1	1	2	2
CO2	1	2	2
CO3	2	2	2

3/2/1 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: EBBT22L06	Subject Name : IMMUNOLOGY LAB	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Biochemistry Lab & Microbiology Lab	Lb	0	0/0	3/0	1

1. Identification of cells in a blood smear
2. Identification of blood group
3. Immuno diffusion SRID
4. Immunoelectrophoresis Serum, CIE
5. Testing for Typhoid antigens by Widal test
6. Enzyme Linked ImmunoSorbent Assay (ELISA)
7. Isolation of monocytes from blood

(Experiments will be conducted using kits)

REFERENCE BOOKS

- . Kuby J, (2003). Immunology, (5th Ed), WH Freeman & Co., New York.,

Subject Code: EBBT22I02	Subject Name :TECHNICAL SKILL-II	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: : All core papers	IE	0	0/0	2/0	1

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

OBJECTIVE:

Students are expected to understand the technical knowledge in the core domains of biotechnology such as Biochemistry, Microbiology and Chemical Engineering

COURSE OUTCOMES (COs) : The student will be exposed

CO1	To get knowledge about the biotechnology skill through value added courses
CO2	Ability to understand the biotechnological contemporary issues
CO3	To enrich the thinking of students towards biotechnological problem solving skill

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	-	2	2	-	-	-	-	-	1	2	-	-
CO2	-	2	2	-	-	-	-	-	1	2	-	-
CO3	-	2	2	-	-	-	-	-	1	2	-	-

COs / PSOs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	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: EBBT22I02	Subject Name :TECHNICAL SKILL-II	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: : All core papers	IE	0	0/0	2/0	1

Students should acquire skill in the domain/inter disciplinary area from government/private training centers/industries /University for a minimum period of 15 calendar days. The training can be through off line, online or mixed mode. Students are supposed to prepare Technical skill report at the end of the training and submit the report along with the certificate in proof of the training, during the viva voce examination conducted by the examiners duly appointed by the head of the department.

Total Periods: 30

Subject Code: EBBT22ET2	Subject Name : ENZYME TECHNOLOGY	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Biochemistry	ETL	2	0/0	2/0	3

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

OBJECTIVE :

- To enable the students to learn enzyme reactions and its characteristics along with the production and purificationprocess:To know the industrial applications of enzymes.

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

CO1	To understand and access the regulations and kinetics of enzyme.
CO2	Apply the knowledge about in the purification and characterization from natural sources
CO3	Ability to construct biosensors by understanding the concept of enzyme immobilization.

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	-	-	-	-	-	-	-	-
CO2	2	2	2	2	-	-	-	-	-	-	-	-
CO3	2	2	2	2	-	-	-	-	-	-	-	-

COs / PSOs	PSO1	PSO2	PSO3
CO1	-	2	-
CO2	3	-	-
CO3	3	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: EBBT22ET2	Subject Name : ENZYME TECHNOLOGY	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Biochemistry	ETL	2	0/0	2/0	3

UNIT I - INTRODUCTION TO ENZYMES **12 Hrs**

Classification of enzymes – Mechanisms of enzyme action – Concept of active site and enzyme substrate complex formation – Specificity of enzyme action –Principles of catalysis – Collision theory and transition state theory – Role of entropy in Catalysis.

Lab component (1)Preparation of phosphate buffer solution.

UNIT II - KINETICS OF ENZYME ACTION **12 Hrs**

Enzyme kinetics (steady state), determination of Km value and studying kinetics using Michalis menton, Lineweaver Burke plot parameters. Enzyme inhibition - competitive, Non competitive, Uncompetitive (Concepts with example).

Lab component (2) Effect of temperature on amylase action

UNIT III - ENZYME REGULATION **12 Hrs**

General Mechanisms of enzyme regulation, Allosteric enzymes, Symmetric and sequential modes for action of allosteric enzymes. Reversible and irreversible covalent modification of enzymes, cascade systems.

Lab component (3)Breaking of sucrose by yeast

UNIT IV - PURIFICATION AND CHARACTERIZATION OF ENZYMES FROM NATURAL SOURCES 12 Hrs

Production and purification of crude enzyme extracts from plant, animal and microbial sources – Methods of characterization of enzymes. Clinical and industrial applications of Enzymes.

Lab component (4) Isolation of amylase from saliva .

UNIT V - ENZYME IMMOBILIZATION AND BIOSENSORS **12 Hrs**

Physical and chemical techniques for enzyme immobilization – Adsorption, matrix entrapment, encapsulation, cross-linking, covalent binding with suitable examples – Advantages and disadvantages – Design of enzyme electrodes and their application as biosensors in industry, healthcare and environment .

Lab component (5) Preparation of sodium alginate Microsphere for amylase immobilization.

Total number of periods: 60

TEXT BOOKS

- Nicholas C. Price and Lewis Stevens, (1989), Fundamentals of Enzymology Oxford Univ.Press.
- M. Dixon, E. C. Webb, CJR Thorne and K. F. Tipton(1979) Enzymes**:**, Longmans,
- Trevor Palmer. (1999) Understanding Enzymes**:** Kindle publisher.

SEMESTER -VI

Subject Code: EBBT22010	Subject Name :BIOPROCESS ENGINEERING	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite Thermodynamics	TY	3	1/0	0/0	4

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

OBJECTIVE :: To develop bioengineering skills by explain the different aspects of bioreactors for the production of biochemical product using integrated biochemical processes.

COURSE OUTCOMES (COs) : Upon completion of this course, the students

CO1	Classify the various industrial fermentation process and types of bioreactors.
CO2	Demonstrate the medium requirement, formulation and optimization for fermentation and sterilization kinetics.
CO3	Examine the gas-liquid mass transfer coefficients and the industrial applications of bio process engineering

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	2	2	2	-	-	-	-	-	-	-
CO2	3	3	2	2	2	-	-	-	-	-	-	-
CO3	3	3	2	2	2	-	-	-	-	-	-	-

COs / PSOs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	1	2	3

3/2/1 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: EBBT22010	Subject Name :BIOPROCESS ENGINEERING	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite- Thermodynamics	TY	3	1/0	0/0	4

UNIT I - OVERVIEW OF BIOPROCESS ENGINEERING 12 Hrs

Engineering perspective of fermentation processes – role of bioprocess engineers. Media for industrial fermentation.Medium optimization techniques. Design Of Novel Bioreactors- packed bed bioreactors, Bubble-column bioreactors, fluidized bed bioreactors, trickle bed bioreactors, airlift loop bioreactors, Batch, fed-batch and continuous reactors.

UNIT II - MICROBIAL GROWTH KINETICS 12 Hrs

Microbial growth kinetics: Growth pattern and kinetics in batch, continuous and fed batch cultures. Kinetic modeling of cell growth: prediction of specific growth rate using unstructured and un-segregated models-Monod equation, Models with growth inhibitors (substrate inhibition, product inhibition and inhibition by toxic compounds.

UNIT III - STERILIZATION KINETICS 12 Hrs

Sterilization kinetics: Medium sterilization, the design of batch and continuous sterilization process, sterilization of fermenter, feeds, liquid wastes and filter sterilization.

UNIT IV - MASS TRANSFER 12 Hrs

Gas liquid mass transfer- theories of diffusion -volumetric oxygen transfer coefficient correlations – oxygen transfer mechanism- Measurement KLa merits and demerits of each method. Scale up and scale down of bioprocess systems: operating boundaries for aerated and agitated fermentor.

UNIT V - APPLICATION OF BIOPROCESS ENGINEERING IN INDUSTRIES 12 Hrs

Food Industry - (Lactic Acid Production, baker's yeast), Pharmaceutical Industry (Penicillin Production, streptomycin), enzyme industry (amylases, protease) and production of vitamins (Vit $B_{2,}$ VitB_{12})

Total No Hours: 60

TEXT BOOKS

- Michael L. Shuler, FilkertKargi(2001)*Bioprocess engineering*: *Basic concepts*(2ndEd)Prentice Hall
- Peter F. Stanbury, Stephen J. Hall & A. Whitaker (1995) ,*Principles of Fermentation Technology*, (2nd Ed) Butterworth-Heinemann.
- A.H.Patel in Industrial microbiology.

REFERENCE BOOKS

- Pauline. M. Doran,(1995) *Bioprocess engineering principles*, Academic press..
- James. E.Bailey, David.F. Ollis (2002) *Biochemical engineering fundamentals*, (2nd Ed), McGraw Hill, Prentice Hall of India.
- MukeshDoble, Sathyanarayana and Gummadi N (2007), *Biochemical Engineering*, Prentice Hall of India Mukhopadhyay S.N (2008) *Advanced Process Biotechnology*, (1st Ed) Viva Books.
- Bioprocess Engineering Principles By Pauline M. Doran

Subject Code: EBBT22011	Subject Name :BIOINFORMATICS	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite Biochemistry,Molecular Biology	TY	3	0/0	0/ 0	3

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

OBJECTIVE :: To learn nucleotide, protein and genome databases and know about the file formats

COURSE OUTCOMES (COs) : Upon completion of this course, the students

CO1	Understand the basic concepts, methods and tools used in bioinformatics
CO2	Understand the structure function relationship and database queries.
CO3	Ability to apply application of bioinformatics and biological data bases to solve problem in real research.

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	-	-	-	-	-	-	-
CO2	-	2	-	-	3	-	-	-	-	-	-	-
CO3	-	2	-	-	3	-	-	-	-	-	-	-

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

3/2/1 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: EBBT22011	Subject Name :BIOINFORMATICS	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite Biochemistry,Molecular Biology	TY	3	0/0	0/0	3

UNIT I - BIOLOGICAL DATABASES AND DATA RETRIEVAL 9 Hrs

Nucleotide databases (Genbank, EMBL, DDBJ), Sequence submission Methods and tools (Sequin, Sakura, Bankit), Sequence retrieval systems (Entrez& SRS), Sequence File Formats and Conversion tools, Protein (Swiss-Prot, Tr-EMBL, PIR_PSD, Expasy), Genome (NCBI, EBI, TIGR, SANGER), Derived Databases (Prosite, PRODOM, Pfam, PRINTS), Metabolic Pathway DB (KEGG, EMP),

UNIT II - PAIRWISE SEQUENCE ALIGNMENT 9 Hrs

Similarity, Identity and Homology, Global Alignment, Local Alignment, Visual Alignment, Dynamic Programming, Heuristic approach, Database Search methods & tool, PAM & BLOSUM Matrices and Gap penalty, Assessing the Significance of Sequence Alignments

UNIT III - MULTIPLE SEQUENCE ALIGNMENT 9 Hrs

Significance of MSA, Various approaches for MSA (Progressive & Iterative), Profile analysis, Block analysis, Pattern searching, Motif analysis. Statistical methods for aiding alignment –, Gibbs Sampling, Hidden Markov Models, Algorithm of HMM-based approaches, Bali Base-Scoring of MSA, PSI/PHI-BLAST

UNIT IV: GENE PREDICTION AND PROTEIN PREDICTION 9 Hrs

Aryotes, Gene prediction methods, Neural Networks, Pattern Discrimination methods, Signal sites Predictions (Promoter, Splice, UTR, CpG-islands), Evaluation of Gene Prediction methods, Prediction methods using DNA sequences - Michael Zhan's Exon Finder, Gene scan

UNIT V - PHYLOGENETIC ANALYSIS & SOFTWARES IN BIOINFORMATICS 9 Hrs

Methods of Construction of Phylogenetic trees- Maximum Parsimony Method, Maximum likelihood method and Distance Methods Emboss - Cn3D viewer- Rasmol,Swisspdb viewer, Pymol, Jmol. Modeling, Docking -Auto dock

Total Number of Hours: 45

TEXT BOOKS

- A. Lesk (2002) Introduction to Bioinformatics (3rd Ed), Oxford University Press
- Bioinformatics: An Introduction By Jeremy Ramsden
- Bioinformatics: A Practical Approach Edited by Shui Qing Ye

REFERENCE BOOKS

- D.E. Krane and M.L Raymer (2003)Fundamental concepts of Bioinformatics Pearson Education ISBN 81- 297-0044-1
- A.D. Baxevaniset. al., (2005) Current Protocols in Bioinformatics Wiley Publishers
- Carlos Setubal, Joao Meidanis ,(1997) Introduction to Computational Molecular Biology PWS Pub

Subject Code: EBBT22012	Subject Name :PROTEIN CHEMISTRY	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Biochemistry & Microbial Technology	Ty	3	0/0	0/0	3

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

OBJECTIVE: To recapitulate the knowledge on protein structure and its properties. To learn different methods in characterizing proteins and protein structure determination. To learn protein structure prediction and modeling and mechanism of protein folding and misfolding.

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

CO1	Understand the structure and classification of proteins, including the classification of amino acids, primary, secondary, tertiary, and quaternary protein structures, protein stability, and denaturation.
CO2	Gain knowledge of various methods used to characterize proteins in solution, such as absorbance, fluorescence, circular dichroism, X-ray crystallography, nuclear magnetic resonance spectroscopy, mass spectrometry, and protein sequencing.
CO3	Familiarize with protein motifs, including helix-turn-helix motifs, beta structures, folding and flexibility, and their role in signal transduction, membrane proteins, and fibrous proteins. Also, explore protein engineering, including protein folding, prediction and design, protein structure prediction and modeling, and the role of protein interactions in diseases.

Mapping of Course Outcomes with Program Outcomes (POs)

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

COs / PSOs	PSO1	PSO2	PSO3
CO1	2	1	3
CO2	1	3	2
CO3	3	2	1

H/M/L indicates Strength of Correlation H- High, M- Medium, L-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: EBBT22012	Subject Name :PROTEIN CHEMISTRY	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Biochemistry & Microbial Technology	Ty	3	0/0	0/0	3

UNIT I - PROTEIN STRUCTURE AND CLASSIFICATION **9 Hrs**

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 PROTEINS IN SOLUTION **9 Hrs**

Methods of Characterizing Proteins in solution, Absorbance and fluorescence of proteins, Fluoresence resonance energy transfer, circular dichroism, Protein structure determination – X-ray crystallogaphy, Nuclear magnetic resonance spectroscopy, Low temperature electron microscopy, Mass spectrometry, Protein Sequencing, Catalysis by enzymes- serine proteases; protein conformational changes, control of protein activity.

UNIT III - MOTIFS **9 Hrs**

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

UNIT IV - PROTEIN ENGINEERING **9 Hrs**

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.

UNIT V - PROTEIN INTERACTIONS AND PROTEINS IN DISEASE **9 Hrs**

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:

- Arthur M. Lesk, (2004) Introduction to Protein Science: Architecture, Function and Genomics. Oxford UniversiTy Press

REFERENCE BOOK

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

Subject Code: EBBT22L07	Subject Name : BIOPROCESS ENGINEERING LAB	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Microbial Technology Lab	Lb	0	0/0	3/0	1

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

OBJECTIVE:

- To gain knowledge on the up streaming process experiment. To know the selection, preparation and operation of bioreactors. To analyze how to interpret the data collected from the bioreactor.

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

CO1	Understand the thermal death kinetics and residence time distribution of cells.
CO2	Execute the various techniques for fermentation and immobilization process.
CO3	Evaluate the design of sterilization process and cell size determination by various methods.

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	2	2	-	-	-	-	-	-	-
CO2	3	3	3	2	2	-	-	-	-	-	-	-
CO3	3	3	3	2	2	-	-	-	-	-	-	-

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

3/2/1 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: EBBT22L07	Subject Name : BIOPROCESS ENGINEERING LAB	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Microbial Technology Lab	Lb	0	0/0	3/0	1

1. Thermal death kinetics
2. Batch sterilization design
3. Residence time distribution
4. SSF
5. Bacterial cell size determination by dye adsorption technique
6. Immobilization technique
7. Amylase production

REFERENCE BOOK

- Ponmurugan Experimental Procedures In Bioprocess Technology & Downstream Processing (1st Ed)
- Bioprocess Engineering: Kinetics, Sustainability, and Reactor Design By Shijie Liu
- Chemical and Bioprocess Engineering: Fundamental Concepts By Ricardo Simpson, Sudhir K. Sastry

Subject Code: EBBT22L08	Subject Name : BIOINFORMATICS LAB	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Molecular Biology & Protein Science	Lb	0	0/0	3/0	1

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

OBJECTIVE : understand different biological databases. To carry out sequence and phylogenetic analysis.

COURSE OUTCOMES (COs) : After completing this course students will be able to

CO1	Demonstrate the retrieval of sequence data
CO2	Perform experiments related to locating chromosome and gene expression data.
CO3	Demonstrate the data retrieval system of PubMed. Perform the ORF finding and retrieval of gene information computational tools for expression analysis.

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	-	-	-	-	-	-	-
CO2	-	2	-	-	3	-	-	-	-	-	-	-
CO3	-	2	-	-	3	-	-	-	-	-	-	-

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

3/2/1 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: EBBT22L08	Subject Name : BIOINFORMATICS LAB	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Molecular Biology & Protein Science	Lb	0	0/0	3/0	1

1. Demonstration of Entrez and SRS
2. Exploring nucleotide database GenBank
3. Exploring Protein Database Uniprot
3. Database Searches with BLASTP and PSI BLAST
4. Protein secondary structure prediction
5. Pairwise Sequence Alignment -EMBOSS
6. Multiple sequence alignment – CLUSTAL OMEGA
7. Primer BLAST
8. Phylogenetic analysis
9. Simple Sequence Formats- Sequin(demo)

REFERENCE BOOK

- Bioinformatics and Functional Genomics by Jonathan Pevsner
- Bioinformatics Data Skills: Reproducible and Robust Research with Open by Vince Buffalo
- Introduction to Bioinformatics Using Action Labs by Jean-Louis Ryan Rossi, Stephen Sheel

Subject Code: EBCC22I07	Subject Name: SOFT SKILL II - QUALITATIVE AND QUANTITATIVE TECHNIQUES	Ty/Lb/ETL/IE	L	T/S.Lr	P/R	C
	Prerequisite: Higher Secondary Mathematics	IE	0	0/0	2/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P: Project R : Research C: Credits,TY/LB/ETL:Theory / Lab / Embedded Theory andLab

OBJECTIVES

- To understand the Basic concepts in Logical Reasoning
- To understand the Basic concepts in Arithmetical Reasoning
- To understand the Basic concepts in Data Interpretation

COURSE OUTCOMES (Cos)

Students completing this course were able to

CO1	Understand the basic concepts of Logical Statements and Arguments
CO2	Understand the concept of Logical conclusions
CO3	Understand the Basic concepts in Number system

Mapping of Course Outcome with Program Outcome (POs)

Cos/POs	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	3	3	-	-
CO2	-	-	-	-	-	-	-	-	3	3	-	-
CO3	-	-	-	-	-	-	-	-	3	3	-	-

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

3/2/1 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: EBCC22SS2	Subject Name: SOFT SKILL II - QUALITATIVE AND QUANTITATIVE TECHNIQUES	Ty/Lb/ETL/IE	L	T/S.Lr	P/R	C
	Prerequisite: Higher Secondary Mathematics	IE	0	0/0	2/0	1

UNIT 1 Logical Reasoning I
Logical Statements –Arguments – Assumptions – Courses of Action.

UNIT 2 Logical Reasoning II
Logical conclusions – Deriving conclusions from passages – Theme detection.

UNIT 3 Arithmetical Reasoning I
Number system – H.C.F & L.C.M – Problem on ages – Percentage – Profit & Loss – Ratio & Proportion – Partnership.

UNIT 4 Arithmetical Reasoning II
Time & Work – Time & Distance – Clocks – Permutations & Combinations – Heights & Distances – Odd man out and Series.

UNIT 5 Data Interpretation
Tabulation – Bar graphs – Pie graphs – Line graphs.

Reference Book:

- R.S.Agarwal, A modern approach to Logical Reasoning, S.Chand& Co., (2017).
- R.S.Agarwal, A modern approach to Verbal and Non verbal Reasoning, S.Chand& Co., (2017).
- R.S.Agarwal, Quantitative Aptitude for Competitive Examinations, S.Chand& Co., (2017).
- A.K.Gupta, Logical and Analytical Reasoning, Ramesh Publishing House, (2014).
- B.S.Sijwali, Indusijwali, A new approach to Reasoning (Verbal and Non verbal), Arihant Publishers,(2014).

Subject Code: EBBT22I03	Subject Name :TECHNICAL SKILL-III	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: : All core papers	IE	0	0/0	2/0	1

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

OBJECTIVE:

Students are expected to understand the technical knowledge in the core domains of biotechnology such as Biochemistry, Microbiology and Chemical Engineering

COURSE OUTCOMES (COs) : The student will be exposed

CO1	To get knowledge about the biotechnology skill through value added courses
CO2	Ability to understand the biotechnological contemporary issues
CO3	To enrich the thinking of students towards biotechnological problem solving skill

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	-	2	2	-	-	-	-	-	1	2	-	-
CO2	-	2	2	-	-	-	-	-	1	2	-	-
CO3	-	2	2	-	-	-	-	-	1	2	-	-

COs / PSOs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	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: EBBT22I03	Subject Name :TECHNICAL SKILL-III	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: : All core papers	IE	0	0/0	2/0	1

Students should acquire skill in the domain/inter disciplinary area from government/private training centers/industries /University for a minimum period of 15 calendar days. The training can be through off line, online or mixed mode. Students are supposed to prepare Technical skill report at the end of the training and submit the report along with the certificate in proof of the training, during the viva voce examination conducted by the examiners duly appointed by the head of the department.

Total Periods: 30

Subject Code: EBBT22I04	Subject Name :MINI PROJECT/ INTERNSHIP	TY / LB/ ETL/IE	L	T	P/ R	C
	Prerequisite: All core papers	IE	0	0/0	3/0	1

T/L 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: EBBT22I04	Subject Name :MINI PROJECT/ INTERNSHIP	TY / LB/ ETL/IE	L	T	P/ R	C
	Prerequisite: All core papers	IE	0	0/0	3/0	1

MINI PROJECT:

Students will have an opportunity to expose their knowledge and talent to make an innovative project. Students are supposed to do innovative projects useful to industries/society in the area of relevant Engineering, inter and multi-disciplinary areas, under the guidance of a staff member. They have to prepare a project report and submit to the department.

At the end of the semester Viva-Voce examination will be conducted by the internal Examiner duly appointed by the Head of the department and the students will be evaluated.

INTERNSHIP

Students are supposed to undergo internship in related Industries for a minimum period of 30 days 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.

SEMESTER -VII

Subject Code: EBBT22013	Subject Name :DOWNSTREAM PROCESSING	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Bioprocess Engineering	TY	3	1/0	0/0	4

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

OBJECTIVE:

- To understand the basic fundamentals of downstream processing for biochemical product recovery.
- To understand the basic principle of characterization of biomolecules and various cell disruption process.
- To model biochemical product recovery, including small molecule purification

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

CO1	To understand the basic fundamentals of downstream processing for biochemical product recovery.
CO2	To understand the basic principle of characterization of biomolecules and various cell disruption process.
CO3	To model biochemical product recovery, including small molecule purification

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	2	2	-	-	-	-	-	-	-
CO2	3	3	3	2	2	-	-	-	-	-	-	-
CO3	3	3	3	2	2	-	-	-	-	-	-	-

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

3/2/1 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: EBBT22013	Subject Name :DOWNSTREAM PROCESSING	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Bioprocess Engineering	TY	3	1/0	0/0	4

UNIT I - INTRODUCTION **12 Hrs**

Introduction to downstream processing principles characteristics of biomolecules and bioprocesses. Cell disruption for product release – mechanical, enzymatic and chemical methods. Pretreatment and stabilization of bio products.

UNIT II - PHYSICAL METHODS OF SEPERATION **12 Hrs**

Unit operations for solid-liquid separation - filtration and centrifugation.

UNIT III - ISOLATION OF PRODUCTS **12 Hrs**

Adsorption, liquid-liquid extraction, aqueous two-phase extraction, membrane separation – ultra filtration and reverse osmosis, dialysis, precipitation of proteins by different methods.

UNIT IV - FINAL PRODUCT FORMULATION AND FINISHING OPERATIONS **12 Hrs**

Crystallization, drying and lyophilization in final product formulation.

UNIT V - INDUSTRIAL HYGIENE **12 Hrs**

Government regulations, Identification, Evaluation, Control. Designs to prevent fires and explosions: Inerting, Explosion proof equipment and instruments, Ventilations, Sprinkler systems.

Total no of Periods: 60

TEXT BOOK

- P.A. Belter, E.L. CusslerAnd Wei-Houhu (1988).Bioseparations – Downstream Processing
- For Biotechnology, Wiley Interscience Pun.D.A. Crowl& J.F. Louvar (1990).Chemical Process SafeTy (Fundamentals with applications), Prentice Hall
- Downstream Processing of Proteins: Methods and Protocol edited by Mohamed A. Desai(2000)

REFERENCE BOOKS

- R.O. Jenkins, (Ed.) (1992).Product Recovery In Bioprocess Technology – Biotechnology Open Learning Series, Butterworth-Heinemann
- J.C. Janson And L. Ryden, (Ed.)(1989).Protein Purification – Principles, High Resolution Methods And Applications, VCH Pub.
- R.K. Scopes (1989) Protein Purification – Principles And Practice, (3rd Ed) Narosa Pub
- Handbook of Downstream Processing By E. Goldberg
- Downstream Process Technology: A New Horizon In Biotechnology (2010)By Krishna Kant Prasad, Nooralabettu Krishna Prasad

Subject Code: EBBT22014	Subject Name :ANIMAL 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 SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and 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 product recovery.

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

CO1	Understand the design, layout, and equipment required for a cell culture laboratory, including sterile handling areas, incubators, refrigerators, centrifuges, and microscopes.
CO2	Demonstrate knowledge of cell culture media and reagents, including their composition, physicochemical properties, sterilization techniques, and selection criteria for different cell types.
CO3	Describe different types of cell cultures, such as primary cultures, continuous cell lines, suspension cultures, and organ cultures, and understand their behavior, maintenance, and applications in cloning, transfection, production of vaccines, and drug testing.

Mapping of Course Outcomes with Program Outcomes (POs)

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

COs / PSOs	PSO1	PSO2	PSO3
CO1	2	1	3
CO2	1	3	2
CO3	3	2	1

3/2/1 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: EBBT22014	Subject Name :ANIMAL 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 - CELL CULTURE LABORATORY DESIGN & EQUIPMENTS 9 Hrs

Cell culture lab Layout; Sterile handling area; Incubation; Hot room; Air circulation; Service bench; Laminar flow; Sterilizer; Incubator; CO2 incubator; Refrigerators and freezers; Centrifuge; Inverted stage microscope; Magnetic stirrer; Liquid nitrogen freezers; Slow cooling system for cell freezing; Washing, packing and sterilization of different materials used in animal cell culture; Aseptic concepts; Maintenance of sterility; Cell culture vessels.

UNIT II - MEDIA AND REAGENTS 9 Hrs

Types of cell culture media; Ingredients of media; Physiochemical properties; CO2 and bicarbonates; Buffering; Oxygen; Osmolarity; Temperature; Surface tension and foaming; Balance salt solutions; Antibiotics growth supplements; Fetal bovine serum; Serum free media; Trypsin solution; Selection of medium and serum; Conditioned media; Other cell culture reagents; Preparation and sterilization of cell culture media, serum and other reagents.

UNIT III - DIFFERENT TYPES OF CELL CULTURES 9 Hrs

History of animal cell culture; Different tissue culture techniques; Types of primary culture; Chicken embryo fibroblast culture; Chicken liver and kidney culture; Secondary culture; Trypsinization; Cell separation; Continuous cell lines; Suspension culture; Organ culture etc.; Behavior of cells in culture conditions: division, growth pattern, metabolism of estimation of cell number; Development of cell lines; Characterization and maintenance of cell lines, stem cells; Cryopreservation; Common cell culture contaminants.

UNIT IV - APPLICATIONS 9 Hrs

Cell cloning and selection; Transfection and transformation of cells; Commercial scale production of animal cells, stem cells and their application; Application of animal cell culture for in vitro testing of drugs; Testing of toxicity of environmental pollutants in cell culture; Application of cell culture technology in production of human and animal viral vaccines and pharmaceutical proteins.

UNIT V - SCALE-UP 9 Hrs

Cell culture reactors; Scale-up in suspension; Scale and complexity; Mixing and aeration; Rotating chambers; Perfused suspension cultures; Fluidized bed reactors for suspension culture; Scale-up in monolayers; Multisurface propagators; Multiarray disks, spirals and tubes; Roller culture; Microcarriers; Perfused monolayer cultures; Membrane perfusion; Hollow fiber perfusion; Matrix perfusion; Microencapsulation; Growth monitoring

Total no of Hours: 45

TEXT BOOK

- FreshneyRI(2005) Culture of Animal Cells, (5th Ed) Wiley-Liss.
- Plant And Animal Tissue Culture By Dr.Seema J Patel
- Animal tissue Culture by Anil M Manae(2015)

REFERENCE BOOKS

- John R.W. Masters (2000) Animal Cell Culture: Practical Approach (3rdEd) Oxford.
- Culture of Animal Cells: A Manual of Basic Technique and Specialized ...By R. Ian Freshney(2016)

Subject Code: EBBT22015	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

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

OBJECTIVE : To learn role of food additives in food processing and preservation. To know the role of bacteria, yeast and mould in food processing and role of fermentation of food. To be aware of food borne diseases caused and food poisoning.

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

CO1	Apply the concepts of biotechnology to the science of food
CO2	Interpret the principles of biotechnology in processing and preservation of food
CO3	Understand the microbial products used as additives as food

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	-	-	-	-
CO2	-	2	2	2	2	-	-	2	-	-	-	-
CO3	-	2	1	2	2	-	-	2	-	-	-	-

COs / PSOs	PSO1	PSO2	PSO3
CO1	3	-	3
CO2	2	-	-
CO3	3	2	3

3/2/1 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: EBBT22015	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 - HISTORICAL BACKGROUND **9 Hrs**

Historical background: 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, seafoods, Fermented and fermented dairy products and miscellaneous food products.

UNIT II - STARTER CULTURES **9 Hrs**

Starter cultures: 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 AND FLAVOUR ENHANCERS **9 Hrs**

Nutritional boosts and flavour enhancers: Emerging processing and preservation technologies milk and dairy products. Microbiological examination of surfaces, Air sampling, Metabolically injured organisms, Enumeration and detection of food – borne organisms. Bioassay and releated methods.

UNIT IV - FOOD PRESERVATION **9 Hrs**

Food preservation: 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 **9 Hrs**

Storage stability food preservation with low temperatures, Food preservation with high temperatures, Preservation of food by drying, Indicator and food- borne pathogens, Other proven and food- borne pathogens. Food standards and Specifications: Compulsory and voluntary trade and Company standards. Consumer Protection Act (1986), AgMark, BIS, US, Canadian, EU, ISO and Codex Food Standards, Export Quality Control and Inspection act (1963),

Total no of Periods: 45

TEXT BOOKS

- Michael J. Pelezar, J.R.E.C.S Chan, Noel R. Erieg,(2005), Microbiology (5thEd) TATA McGraw Hill.
- Anthony Pometto, Food Biotechnology, Second Edition, Taylor and Fancis (2005)
- Y. H. Hui, Food Biotechnology: Microorganisms, (1995)

REFERENCE BOOKS

- James M. Jay (1993). Modern Food Microbiology (4th Ed). CBS Publishers Delhi.
- W. C. Frazier & D.C. Westhoffs, (1993). "Food Microbiology" (4th Ed) TMH
- Julie Eckinger, Food Biotechnology in Ethical Perspective (2007)
- S.C. Bhatia, Food Biotechnology (2016)
- Sarah Elderidge, Food Biotechnology: Current Issues and Perspectives (2003)

Subject Code: EBBT22016	Subject Name : BIOFUELS	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Microbiology/Microbial Technology	Ty	3	0/0	0/0	3

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

OBJECTIVE :

- To give an introduction to biogas technology .To Understand the basics behind the bio ethanol and biodiesel production. To give basic idea for the production of green energy from biomass

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

CO1	Biogas produced by different components.
CO2	The concept and basic knowledge about bioethanol and biodiesel production.
CO3	Understand the production of green energy.

Mapping of Course Outcomes with Program Outcomes (POs)

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

COs / PSOs	PSO1	PSO2	PSO3
CO1	2	1	3
CO2	1	3	2
CO3	3	2	1

3/2/1 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: EBBT22016	Subject Name : BIOFUELS	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Microbiology/Microbial Technology	Ty	3	0/0	0/0	3

UNIT I - BIOGAS TECHNOLOGY-I **9 Hrs**

Biogas Technology -I Worldwide perspective of anaerobic digestion, Review of anaerobic digesters, Microbiology of biogas production, Methods to enhance the biogas production, Design parameters affecting the success and failure of biogas plants, Structural behavior and stress conditions in fixed dome biogas plant, Performance of different Types of gas holders.

UNIT II - BIOGAS TECHNOLOGY-II **9 Hrs**

Biogas Technology-II Alternate constructions material for biogas plant construction, Various techniques for increasing gas production in cold region. Effect of heating , insulation and stirring on gas production, Design optimization for biogas production, Alternate feedstock for biogas production. Effect of pesticides on anaerobic digestion, Effect of herbicide on anaerobic digestion,

UNIT III - BIO-ETHANOL AND BIO-DIESEL TECHNOLOGY **9 Hrs**

Bio-Ethanol and Bio-Diesel Technology**:** Production of Fuel Ethanol by Fermentation of Sugars. Gasohol as a Substitute for Leaded Petrol. - Trans-Esterification of Oils to Produce Bio-Diesel.

UNIT IV - GREEN TECHNOLOGY – MICROBIAL FUEL CELL: **9 Hrs**

Green Technology – Microbial Fuel Cell**:** Types of Biological fuel cells – Working Principle - Applications of biological Fuel cells.

UNITV - ENERGY FROM BIOMASS **9 Hrs**

Introduction – Biomass conversion Technologies – Photosynthesis – Biogas generation – Factors affecting Biodigestion – Pyrolysis – Alcohol fuels - Design and operation of Fixed and Fluidized Bed Gasifiers. Combustion of Biomass and Cogeneration Systems: Combustion of Woody Biomass

Total no of Hours: 45

TEXT BOOKS

- G.D.Rai (2011), Non-Conventional Energy Sources , Khanna Publishers.
- B.H.Khan,(2006) Non-conventional Energy Sources , The McGraw Hill Companies.
- Ahindra Nag, Biofuels Refining and Performance, The McGraw Hill Companies (2008*)*

REFERENCE BOOKS

- Halwagi,(1984) Biogas Technology - Transfer and Diffusion. MNES Publication.
- Chawla, O.P, (1986)Advances in Biogas technology. Publications and Information Division, Indian Council of Agricultural Research.
- David M. Mousdale, Biofuels: Biotechnology, Chemistry, and Sustainable Development (2008)
- Paula Johanson, Biofuels: Sustainable Energy in the 21st Century (2010)
- Geoffrey M. Horn, Biofuels, Chelsea house publishers (2010)

Subject Code: EBBT22L09	Subject Name :DOWNSTREAM PROCESSING LAB	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Bioprocess Engineering	Lb	0	0/0	3/0	1

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

OBJECTIVE : To provide basic training in Down stream processing for the product recovery and purification of target biological products through simple experimentations

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

CO1	To understand the separation of whole cells and other insoluble ingredient's from the culture broth
CO2	Developing skills to isolate intracellular products by cell disruption techniques
CO3	To analyze suitable method for product recovery based on purity requirement

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	2	2	-	-	-	-	-	-	-
CO2	3	3	3	2	2	-	-	-	-	-	-	-
CO3	3	3	3	2	2	-	-	-	-	-	-	-

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

3/2/1 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: EBBT22L09	Subject Name :DOWNSTREAM PROCESSING LAB	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Bioprocess Engineering	Lb	0	0/0	3/0	1

1. Solid liquid separation – centrifugation, microfiltration
2. Cell disruption techniques – ultrasonication,
3. Precipitation – ammonium sulphate precipitation
4. Ultra filtration separation
5. Aqueous two phase extraction of biological
6. High resolution purification – affinity chromatography
7. High resolution purification – ion exchange chromatography
8. Product polishing – gel filtration chromatography
9. Product polishing – spray drying, freeze drying

REFERENCE BOOKS

- Ponmurugan Experimental Procedures In Bioprocess Technology & Downstream Processing(1st Ed) Anjanaa Publishing
- Downstream Processing of Proteins: Methods and Protocols edited by Mohamed A. Desai
- Principles of Downstream Techniques in Biological and Chemical Processes edited by Mukesh Doble
- Downstream Process Technology: A New Horizon In Biotechnology (2012)By Krishna Kant Prasad, Nooralabettu Krishna Prasad

Subject Code: EBBT22L10	Subject Name :ANIMAL TISSUE CULTURE LAB	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Cell Biology	Lb	0	0/0	3/0	1

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

OBJECTIVE :

- To be aware of tissue culture laboratory practices and maintaining sterility in lab To learn the composition and preparation of plant and animal tissue culture medium To apply the concepts learned in biochemistry and microbiology for understanding the role of medium in animal cell culture

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

CO1	Basic requirements of animal tissue culture
CO2	Different types of Cryopreservation
CO3	Mutagenecity screening and cell viability assays

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	2	2	-	-	-	-	-	-
CO2	-	-	3	3	2	2	-	-	-	-	-	-
CO3	-	-	3	3	2	1	-	-	-	-	-	-

COs / PSOs	PSO1	PSO2	PSO3
CO1	2	3	2
CO2	2	1	3
CO3	2	2	3

3/2/1 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: EBBT22L10	Subject Name :ANIMAL TISSUE CULTURE LAB	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Cell Biology	Lb	0	0/0	3/0	1

1. Preparation of media, sterilization by filtration.
2. Preparation of single cell suspension from chick embryo, rat liver, human cord blood.
3. Cell counting using haemocytometer, cell viability using Trypan blue and MTT assay.
4. Fibroblast tissue culture, Mutant cell line culture, serial passage and cryopreservation.
5. Cytotoxicity and Cell proliferation kinetics.
6. Mutagenecity in cell lines& screening method: Drug induced, UV treatment,
7. Isolation of DNA from animal cell culture

REFERENCE BOOKS

- Ian Freshney (2010) Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications, (6th Ed) Wiley-Blackwell.
- Culture of Animal Cells: A Manual of Basic Technique and Specialized By R. Ian Freshney(2016)
- Tissue Culture in Science and SocieTy: The Public Life of a Biologic by By D. Wilson
- Plant and Animal tissue culture by Dr.Seema J Patel

Subject Code: EBBT22I05	Subject Name : PROJECT PHASE-I	TY / LB/ ETL/IL	L	T	P/ R	C
	Prerequisite: All core papers	IE	0	0/0	3/3	2

T/L 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	Enable the students to understand and define aims and objectives of the problem statement
CO2	Familiarize them to frame the methodology for problem statement
CO3	Understand the basic concepts of operation process and 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	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3

COs / PSOs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	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: EBBT22I05	Subject Name : PROJECT PHASE-I	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: All core papers	IE	0	0/0	3/3	2

Students are expected to do the Project in a group of 3 to 4 students. They 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.

Subject Code: EBFL22IXX	Subject Name : FOREIGN LANGUAGE	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: All core papers	IE	1	0/0	1/0	1

Foreign language is introduced in the curriculum to make the students globally employable. Students should select and register for any one of the foreign languages from the given list. At the end of the course students should be able to read, write and converse the language in the basic level. At the end of the semester the assessment will be done through internal examination by the examiner duly appointed by the head of the department.

S.NO	COURSE CODE	COURSE NAME
1	EBFL22I01/HBFL22I01	FRENCH
2	EBFL22I02/ HBFL22I02	GERMAN
3	EBFL22I03/ HBFL22I03	JAPANESH
4	EBFL22I04/ HBFL22I04	ARABIC
5	EBFL22I05/ HBFL22I05	CHINESE
6	EBFL22I06/HBFL22I06	RUSSIAN
7	EBFL22I07/HBFL22I07	SPANISH

SEMESTER -VIII

Subject Code: EBCC22ID3	Subject Name : TOTAL QUALITY MANAGEMENT	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: All core papers	**Lb**	**3**	**0/0**	**0/0**	**3**

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

OBJECTIVE: The student will learn:

- To acquaint the students with the basic concept of Total Quality (TQ)
- To understand the customers' expectations and plan TQM accordingly
- To give understand International Quality Certification Systems – ISO 9000 and other standards
- To understand concepts related to quality of services in contemporary environment.

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

CO1	Understand the Quality Policies (Level 2)
CO2	Understand the Concepts of Total Quality Management (Level 2)
CO3	Apply Total Quality Management tools in Industry (Level 3)

Mapping of Course Outcomes with Program Outcomes (POs)

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

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			
				✓								

Subject Code: EBCC22ID3	Subject Name : TOTAL QUALITY MANAGEMENT	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: All core papers	Lb	3	0/0	0/0	3
T/L Theory/Lab L: Lecture T:Tutorial P :Practical/ Project R : Research C:Credits						

UNIT– I QUALITY POLICY, PLANNING AND MANAGEMENT 9 hours

Evolution of quality as a strategy- Definitions of quality, Quality Philosophies of Deming, Crosby and Miller, Service Vs product Quality, Customer focus, Quality and Business performance leadership for quality management, Quality planning, Designing for Quality and Manufacturing for Quality, Vision, Mission statements and Quality policy.

UNIT – II BASIC CONCEPTS F TOTAL QUALITY MANAGEMENT 9 hours

Total Quality management- TQM models, human and system Components, Continuous Improvement Strategies, Deming wheel, Internal External Customer concept, Customer satisfaction Index, Customer retention, Team work and team building, Empowerment, TQM culture, Quality Circle, 5S principle, Top Management commitment.

UNIT – III QUALITY MANAGEMENT TOOLS 9 hours

Quality management tools - Principles and applications of quality Function deployment, Failure Mode and Effect Analysis (FMEA), Taguichi Techniques, Basic tools- Statistical techniques and graphical tools and diagrams.

UNIT - IV VARIOUS CONCEPTS OF QC TECHNIQUES 9 hours

Modern QC techniques - Japanese Production Related Techniques: Just in time (JIT) – Quality circles – Total productive maintenance (TPM) – Kaizen – Kanban – 5S concepts – Toyota production systems – JIDOKA – ANDON etc. Concepts on quality management systems (QMS – ISO 9000 – 2000) – Environmental Management Systems (EMS – ISO – 14000)

UNIT- V MODERN TREND AND CONCEPTS IN MANUFACTURING MANAGEMENT 9 **hours**

Modern Trend and Concept in Manufacturing Management: Business processes reengineering (BPR) – Lean / flexible – manufacturing systems – Six sigma concepts. Quality Leadership-Quality Awards –Quality Tools-Quality Function Deployment.

Total No of Periods: 45

References Books:

1. Jill A. Swift, Joel E.Ross and Vincent K.Omachonu, Peinciples of Total Quality, St.Lucie Press, US, 1998.
2. Samuel K.Ho, TQM, An integrated approach, kogan page India Pvt Ltd, 2002
3. Dale H.N Besterfield et al, Total Quality management, Pearson Education Asia, 2001
4. RoseJ.E. Total Quality ManagementKogan page India Pvt Ltd, 1993.
5. Mullar Max,' Essentials of Materail Management,Amacom.

Subject Code: EBBT22L11	Subject Name : PROJECT PHASE-II	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: All core papers	Lb	0	0/0	12/12	8

T/L 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	Enable the students to understand and define aims and objectives of the problem statement
CO2	Familiarize them to frame the methodology for problem statement
CO3	Understand the basic concepts of operation process and 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	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3

COs / PSOs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	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: EBBT22L11	Subject Name : PROJECT PHASE-II	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: All core papers	Lb	0	0/0	12/12	8

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 of the 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 examiners duly 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.

ELECTIVE-I

Subject Code: EBBT22E01	Subject Name :PLANT BIOTECHNOLOGY	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Molecular biology & Biochemistry	T	3	0/0	0/0	3

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

OBJECTIVE :

To provide an overview about the plant genome and its various important functions such as nitrogen fixation disease resistance varieties. The objective also includes plant viral vectors and plant tissue culture.

COURSE OUTCOMES (COs) : Upon completion of this course, the students

CO1	To understand the genome organization in plants and its regulation.
CO2	To apply the different methods for the development of transgenic plant/crop improvement.
CO3	To illustrate the mechanism and role of plant tissue cultuire for mass multiplications.

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	-	-	-	-	-	-	-
CO2	-	3	3	3	3	-	-	-	-	-	-	-
CO3	-	3	3	3	3	-	-	-	-	-	-	-

COs / PSOs	PSO1	PSO2	PSO3
CO1	2	2	2
CO2	1	1	1
CO3	2	2	2

3/2/1 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: EBBT22E01	Subject Name :PLANT BIOTECHNOLOGY	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Molecular biology & Biochemistry	**T**	3	0/0	0/0	3

UNIT I - PLANT GENOME **9 Hrs**

Gene structure, expression, and regulation in plants - an overview of nuclear and organelle gene structure, function, and expression, with emphasis on aspects that are unique to plant genes. Development of *Arabidopsis* as a model for molecular genetic studies in plant biology, an introduction to systems approaches.

UNIT II - GENETIC TRANSFORMATION **9 Hrs**

Direct gene Transfer Techniques, Agrobacterium mediated gene transfer- Biology and molecular basis of Agrobacterium mediated plant transformation and its application, Plant vectors, Ri and Ti Plasmids, Opines and their significance. Viral vectors : Gemini virus, cauliflower mosaic virus and their uses. Reverse Genetics.

UNIT III - PLANT DISEASE RESISTANCE **9 Hrs**

Types of pathogen and their mode of action, Plant defence system, Constitutive and inducible defence, Genetic basis of plant pathogen interaction, R genes and R gene mediated resistance, Biochemistry and Molecular biology of defence reactions, Systemic acquired resistance, Role of Salicylic, Jasmonic acid and ethylene in plant defence. Plant Stress Response : Abiotic and biotic stress, Pathogen stress, Osmotic adjustment and its role in drought and salinity tolerance, ABA in stress tolerance, Strategies for genetic engineering of stress tolerance

UNIT IV - USE OF KNOCKOUT MUTANT PLANTS **9 Hrs**

Use of knockout mutant plants in understanding the significance of plant hormones, genetically modified plants - Golden rice, vitamin E enhancement, Bt. Cotton, pesticide resistance, cytoplasmic male sterility. Plant genetic resources, Crop gene bank, Plant breeders right and farmers right, patenting of biological materials.

UNIT V - PLANT TISSUE CULTURE **9 Hrs**

Plasticity and Totipotency, The culture environment, Plant Cell culture media, Plant growth regulators and function, Culture Types- Callus, Cell-suspension culture, Protoplast culture, Root culture, Shoot tip and Meristem culture, Embryo culture, Microspore culture, Somaclonal variation, Somatic Embryogenesis, Polyploidy, Androgenesis, Artificial Seed, Germplasm Conservation and Cryopreservation.

Total no of Hours: 45

TEXT BOOKS

❖ Westhoff et al.(1998). Molecular Plant Development: From gene to plant. Oxford UniversiTy Press, Oxford. Selected parts available for purchase at the UBC Bookstore.

REFERENCE BOOK

❖ Buchanan et al.(2000). Biochemistry & Molecular Biology of Plants.American SocieTy of Plant Physiologists, Rockville MD

❖ Heldt HW. (1997) Plant BiochemisTy and Molecular Biology. Oxford UniversiTy Press

Subject Code: EBBT22E02	Subject Name :ENVIRONMENT IMPACT ASSESSMENT	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Solid and hazard waste management	Ty	3	0/0	0/0	3

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

OBJECTIVE:

- **To** understand the Concepts and methodologies of environmental impact assessment .To study the impact of assessment procedures. To know the documentation process of environmental impact assessment.

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

CO1	Understand the evolution, concepts, methodologies, and key components of Environmental Impact Assessment (EIA) and its associated processes such as screening, scoping, baseline studies, mitigation, and the use of matrices and checklists.
CO2	Apply legislative and environmental clearance procedures in India for conducting both rapid and comprehensive EIA, and utilize prediction tools to assess the potential environmental impacts of proposed projects.
CO3	Assess the impacts of various factors, including air, water, soil, noise, biological aspects, socio-cultural environment, and incorporate public participation, resettlement, and rehabilitation considerations in the EIA process.

Mapping of Course Outcomes with Program Outcomes (POs)

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

COs / PSOs	PSO1	PSO2	PSO3
CO1	2	2	2
CO2	1	1	1
CO3	2	2	2

3/2/1 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: EBBT22E02	Subject Name :ENVIRONMENT IMPACT ASSESSMENT	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Solid and hazard waste management	Ty	3	0/0	0/0	3

UNIT I - EVOLUTION OF EIA **9 Hrs**

Evolution of EIA – Concepts – Methodologies – Screening – Scoping – Base line studies - Mitigation – Matrices – Check list.

UNIT II -RAPID AND COMPREHENSIVE EIA **9 Hrs**

Rapid and Comprehensive EIA – Legislative and Environmental clearance procedures in India – Prediction tools for EIA.

UNIT III - ASSESSMENT OF IMPACTS **9 Hrs**

Assessment of impacts – Air – Water – Soil – Noise – Biological. Socio cultural environment – Public participation – resettlement and rehabilitation.

UNIT IV - DOCUMENTATION OF EIA **9 Hrs**

Documentation of EIA – Environmental Management plan – Post project monitoring – Environmental Audit – Life cycle assessment – EMS

UNIT V - CASE STUDIES **9 Hrs**

Case studies in EIA

Total no of Periods: 45

TEXT BOOKS

- Canter R.L.(1997) Environmental Impact Assessment, Mc Graw Hill International Edition,
- Richard K.Morgan. Environmental Impact Assessment : A Methodological Approach
- John Glasson, Introduction to Environmental Impact Assessment (2013)

REFERENCE BOOKS

- *John G. Rau and David C. Wooten (Ed)(1980), Environmental Impact Analysis Handbook, (1st Ed)McGraw Hill Book Company.*
- *Richard K. Morgan, Environmental Impact Assessment: A Methodological Approach (1999)*
- *Peter Wathern, Environmental Impact Assessment: Theory and Practice (2013)*
- *John Glasson, Introduction to Environmental Impact Assessment (2013)*
- *David P. Lawrence, Environmental Impact Assessment (2003)*

Subject Code: EBBT22E03	Subject Name : STEM CELLS AND DEVELOPMENTAL BIOLOGY	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 SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and 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	Understand the principles of developmental biology, including the genetic core of development, differential gene expression, cell commitment, differentiation, induction of cell fate, and cell-cell communication in development.
CO2	Gain knowledge of early embryonic development in various organisms, including invertebrates, Drosophila, amphibians, fish, birds, and mammals, with a focus on axis specification and formation.
CO3	Familiarize with the concept of stem cells, including their definition, classification, properties, and application of embryonic stem cells. Explore the development of differentiated tissues from embryonic germ layers, the function of placenta, amniotic fluid, and umbilical cord, and the hierarchy and properties of hematopoietic stem cells (HSCs).

Mapping of Course Outcomes with Program Outcomes (POs)

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

COs / PSOs	PSO1	PSO2	PSO3
CO1	2	1	3
CO2	1	3	2
CO3	3	2	1

3/2/1 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: EBBT22E03	Subject Name : STEM CELLS AND DEVELOPMENTAL BIOLOGY	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Cell Biology	Ty	3	0/0	0/0	3

UNIT I - PRINCIPLES OF DEVELOPMENTAL BIOLOGY **9 Hrs**

Developmental biology: The anatomical tradition/Life cycles and the evolution of developmental patterns; principles of experimental embryology; The genetic core of development; The paradigm of differential gene expression, cell commitment, differentiation & induction of cell fate; concept of morphogen, cell-cell communication in development.

UNIT II - EARLY EMBRYONIC DEVELOPMENT **9 Hrs**

Fertilization: Beginning a new organism. Early development in selected invertebrates; the genetics of axis specification in Drosophila; Early development and axis formation in amphibians; the early development of vertebrates: fish, birds and mammals.

UNIT III - INTRODUCTION TO STEM CELLS **9 Hrs**

Development of differentiated tissues from embryonic germ layers, Function of placenta, amniotic fluid and umbilical cord; Stem cells : Definition, Classification and Properties; Properties and application of Embryonic stem cells; Hematopoiesis – Hierarchy, Properties of Hematopoietic Stem Cells (HSCs) and Types.

UNIT IV - STEM CELL PROCESSING AND TRANSPLANTATION **9 Hrs**

Sources of stem cells; Cell Types for transplantation: Bone marrow, Peripheral stem cells, cord blood stem cells; Types of transplants; Methods of obtaining bone marrow and peripheral blood for transplant, Stem cell processing and storage; HLA matching; Advantages and drawbacks of autologous and allogeneic transplants.

UNIT V - STEM CELLS AND THERAPY **9 Hrs**

Overview of embryonic and adult stem cells for therapy; Normal stem cells vs Cancer stem cells, Clinical uses of hematopoietic stem cells in leukemia and inherited blood disorders; Use of stem cells in diabetes, myocardial infarction, Parkinson's disease.

Total no of Hours: 45

TEXT BOOK

- Scott F Gilbert (2000) ,A companion to Developmental Biology,(9th Ed), Sunderland (MA): Sinauer Associates;
- Robert Lonza (2009) Essentials of Stem Cell Biology, (2nd Ed) Academic Press.
- KrishnaraoAppasani, Stem Cells & Regenerative Medicine (2010)

REFERENCE BOOK

- Anthony Atala, Robert Lonza, James A.Thomson, Robert Nerem (2011) Principles of Regenerative
- Medicine, (2nd Ed) , Academic Press.
- StemBook Cambridge (MA): 2008.Harvard Stem Cell Institute;
- Lewis Wolpert, Developmental Biology: A Very Short Introduction (2011)
- Robert Lanza, Essentials of Stem Cell Biology (2013)
- Hossein Baharvand, Trends in Stem Cell Biology and Technology (2009

ELECTIVE-II

Subject Code: EBBT22E04	Subject Name : CANCER BIOLOGY	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Cell Biology / Molecular Biology	Ty	3	0/0	0/0	3

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

OBJECTIVESTo 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) : After studying this course the student would be able to

CO1	Understand the fundamental principles of cancer biology, including cell cycle regulation, mutations, tumor suppressor genes, and the role of diet in cancer development.
CO2	Gain knowledge of the principles of carcinogenesis, including chemical and physical factors, metabolism, and radiation-induced carcinogenesis.
CO3	Familiarize with the principles of molecular cell biology of cancer, including signal targets, oncogenes, growth factors, and the role of telomerases in cancer development.

Mapping of Course Outcomes with Program Outcomes (POs)

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

COs / PSOs	PSO1	PSO2	PSO3
CO1	2	1	3
CO2	1	3	2
CO3	3	2	1

3/2/1 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: EBBT22E04	Subject Name : CANCER BIOLOGY	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Cell Biology / Molecular Biology	Ty	3	0/0	0/0	3

UNIT I - 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.
- Roger J. B. King, Cancer Biology, Prentice Hall (2000)
- Maika G. Mitchell, Cell Biology: Translational Impact in Cancer Biology and Bioinformatics, Academic Press (2016)

Subject Code: EBBT22E05	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 SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

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

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

CO1	Understand medicinal plants, their secondary metabolites, and extraction techniques for obtaining phytopharmaceuticals.
CO2	Apply chromatography and spectroscopy methods for plant drug analysis and standardization of herbal drugs.
CO3	Develop skills in identifying and characterizing phytochemical compounds, and adhere to WHO guidelines for quality standardized herbal formulations.

Mapping of Course Outcomes with Program Outcomes (POs)

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

COs / PSOs	PSO1	PSO2	PSO3
CO1	2	1	3
CO2	1	3	2
CO3	3	2	1

3/2/1 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: EBBT22E05	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

UNIT I - INTRODUCTION TO MEDICINAL PLANTS **9 Hrs**

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

UNIT II - EXTRACTION **9 Hrs**

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

UNIT III - EXTRACTION **9 Hrs**

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

UNIT IV - PLANT DRUG ANALYSIS **9 Hrs**

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

UNIT V - STANDARDIZATION OF HERBAL DRUGS **9 Hrs**

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 no of Periods: 45

TEXT BOOK

- S.S. Agarwal, M.Paridhavi (2007) Herbal Drug Technology (1st Ed), UniversiTy press (India) private limited
- N. Raaman, Phytochemical Techniques, New India Publishing Agency (2006)
- Colleen Carkeet, Phytochemicals: Health Promotion and Therapeutic Potential, (2012*)*

REFERENCE BOOK

- A.P.Purohit, C.K.Kokate ,S.B.Gokhale (2001) Pharmacognosy(32nd Edition) NiraliPrakshanpune.
- TreaseGE , Evans WC Pharmacognosy(14th Edition) W.B.Sondars& Co Ltd London.
- Kelsey R. Downum, Phytochemical Potential of Tropical Plants, Springer (2013)
- Amlan K. Patra, Dietary Phytochemicals and Microbes, Springer (2012)
- David R Gang, Phytochemicals, Plant Growth, and the Environment, Springer (2012)

Subject Code: BBT22E06	Subject Name : SOLID AND HAZARDOUS WASTE MANAGEMENT	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Microbiology/Chemical Reaction Engineering	Ty	3	0/0	0/0	3

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

OBJECTIVE : To study the Types and source of solid and hazardous waste and its generation rates. To study the handling and segregation and processing of wastes

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

CO1	Understand the types and sources of solid and hazardous wastes, and the need for effective waste management, including legislation pertaining to municipal solid wastes, hazardous wastes, and biomedical wastes.
CO2	Gain knowledge of waste generation rates, waste composition, hazardous characteristics, waste sampling, and the importance of source reduction, recycling, and reuse in waste management.
CO3	Familiarize with the handling and segregation of wastes at the source, storage and collection of municipal solid wastes, transfer and transport requirements, labeling and handling of hazardous wastes, and the analysis of collection systems in waste management.

Mapping of Course Outcomes with Program Outcomes (POs)

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

COs / PSOs	PSO1	PSO2	PSO3
CO1	2	1	3
CO2	1	3	2
CO3	3	2	1

3/2/1 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: BBT22E06	Subject Name : SOLID AND HAZARDOUS WASTE MANAGEMENT	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Microbiology/Chemical Reaction Engineering	Ty	3	0/0	0/0	3

UNIT I - TYPES AND SOURCES **9 Hrs**

Types and Sources of solid and hazardous wastes - Need for solid and hazardous waste management - Legislations on management and handling of municipal solid wastes, hazardous wastes, and biomedical wastes.

UNIT II - WASTE GENERATION **9 Hrs**

Waste generation rates – Composition - Hazardous Characteristics – TCLP tests – waste sampling- Source reduction of wastes – Recycling and reuse.

UNIT III - HANDLING AND SEGREGATION **9 Hrs**

Handling and segregation of wastes at source – storage and collection of municipal solid wastes – Analysis of Collection systems - Need for transfer and transport – Transfer stations - labeling and handling of hazardous wastes.

UNIT IV - WASTE PROCESSING **9 Hrs**

Waste processing – processing technologies – biological and chemical conversion technologies – Composting - thermal conversion technologies - energy recovery – incineration – solidification and stabilization of hazardous wastes - treatment of biomedical wastes.

UNIT V - DISPOSAL IN LANDFILLS **9 Hrs**

Disposal in landfills - site selection - design and operation of sanitary landfills- secure landfills and landfill bioreactors – leachate and landfill gas management – landfill closure and environmental monitoring – landfill remediation. Elements of integrated waste management.

Total no of Hours: 45

TEXT BOOKS

- George Tchobanoglous, Hilary Theisen and Samuel A, Vigil, (1993) Integrated Solid Waste Management, McGraw- Hill, New York.
- M.N. Rao, Solid and Hazardous Waste Management: Science and Engineering, Elsevier (2016)
- P. M. Cherry, Solid and Hazardous Waste Management, CBS Publishers & Distributors, (2016)

REFERENCE BOOK

- CPHEEO, (2000) Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organization, Government of India, New Delhi.
- Edward J. Martin, Hazardous Waste Management Engineering, Kluver publications (1987)
- Cliff Vanguilder, Hazardous Waste Management: An Introduction, Mercury Learning and Information, (2012)
- Gaynor W. Dawson, Hazardous Waste Management, John Wiley & Sons (1986)
- George Tchobanoglous, Handbook of Solid Waste Management, McGraw Hill Professional, 2002

ELECTIVE-III

Subject Code: EBBT22E07	Subject Name :BIOMATERIALS AND TISSUE ENGINEERING	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: CellBiology/Tissue culture	Ty	3	0/0	0/0	3

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

OBJECTIVES: To introduce polymers as biomaterial Types and their applications .To study about the tissue engineering process of cells and tissues and the regulatory issues regarding tissue engineering and its standardization

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

CO1	Understand the different types of biomaterials, including natural and synthetic polymers, their processing techniques, and their applications in tissue engineering and regenerative medicine.
CO2	Demonstrate knowledge of the properties and characteristics of natural biopolymers and synthetic polymers used in biomaterials, including their chemical modification, scaffold fabrication, and interaction with cells and tissues.
CO3	Gain an understanding of the engineering principles involved in the design and construction of functional cell constructs, tissue engineering scaffolds, and bioartificial devices, as well as the regulatory and safety considerations in the field 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	-	-	-	-	-
CO2	-	2	-	-	2	-	-	-	-	-	-	-
CO3	1	-	-	-		-	-	-	1	-	-	-

COs / PSOs	PSO1	PSO2	PSO3
CO1	2	1	3
CO2	1	3	2
CO3	3	2	1

3/2/1 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: EBBT22E07	Subject Name :BIOMATERIALS AND TISSUE ENGINEERING	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Cell Biology/Tissue culture	Ty	3	0/0	0/0	3

UNIT I - INTRODUCTION **9 Hrs**

Introduction: Biomaterial Types-Natural-Artificial biomaterial-Processing-Skin grafts-Organo-Typic culture-Cell polymer bioreactor-Functional cell mammalian cell constructs.

UNIT II - NATURAL BIOPOLYMERS **9 Hrs**

Natural biopolymers: Introduction: Collagen, Chitosan, Sodium alginate, Hyaluronic acid, Fibrinogen-Stabilization Chemical modification-Copolymers-Scaffolds-Porous matrices-Tubules-Cell surface interaction.

UNIT III - SYNTHETIC POLYMERS **9 Hrs**

Synthetic polymers-Introduction: Aliphatic carbonate based polymers-Dioxepanone based polymers-Polyanhydrides-Poly amino acids-Hydrogels-Polymer scaffolds-Processing microencapsulation-Injectable polymers.

UNIT IV - ENGINEERING CELLS AND TISSUES **9 Hrs**

Engineering cells and tissues: Introduction-Reconstruction-Vascular grafts-Synthetic valves-Replacement-Bioartificial device-Engineering of tissues- Regenerative matrix-implants-Bi-layered skin constructs.

UNIT V - REGULATORY ISSUE AND STANDARDIZATION **9 Hrs**

Regulatory issue and standardization-Safety consideration-Effectiveness consideration-Regulatory activities of FDA-Standardization through the ASTM-future prospects-Ethics and responsibility.

Total no of Hours: 45

REFERENCE BOOK

❖ Anthony Atala, Robert P. Lanza (2001) Methods of tissue engineering .Academic press

Subject Code: EBBT22E08	Subject Name :HUMAN CYTOGENETICS	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Genetics/Biochemistry	Ty	3	0/0	0/0	3

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

OBJECTIVES:

- To understand the fundamentals of Human cytogenetics and malfunctions of genes in different genetic disorders. To study the different analytical techniques used for studying genetic disorders.

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

CO1	Understand and explain the various inheritance patterns in humans, including Mendelian inheritance, dominant, recessive, lethal, sex-linked, sex-influenced, multifactorial, and mitochondrial inheritance. Gain knowledge of genetic diseases affecting the heart, lungs, kidneys, brain, and sex organs.
CO2	Demonstrate proficiency in the chromosome basis of inheritance, including understanding autosomal, sex, and microchromosomal anomalies. Acquire skills in cytogenetic techniques and the nomenclature of banded chromosomes, including ISCN (International System for Human Cytogenomic Nomenclature) standards.
CO3	Develop expertise in banding techniques for chromosome analysis, such as Q-Banding, G-Banding, R-Banding, Acridine orange R-Banding, C-Banding, DAPI, C-Banding, NOR (nucleolar organizing region) banding. Interpret and classify unbanded chromosomes, understand karyotype interpretation, and apply HRB (high-resolution banding) nomenclature.

Mapping of Course Outcomes with Program Outcomes (POs)

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

COs / PSOs	PSO1	PSO2	PSO3
CO1	2	1	3
CO2	1	3	2
CO3	3	2	1

3/2/1 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: EBBT22E08	Subject Name :HUMAN CYTOGENETICS	TY / LB/ ETL/IE	L	T / S.L	P/ R	C
	Prerequisite: Genetics/Biochemistry	Ty	3	0/0	0/0	3

UNIT I - INHERITANCE PATTERN IN MAN **9 Hrs**

Mendelian inheritance, dominant, recessive, lethal, sex linked, sex influenced, multifactorial and mitochondrial inheritance. Genetic Diseases of heart, lungs, Kidney, brain and sex organs.

UNIT II - CHROMOSOME BASIS OF INHERITANCE: **9 Hrs**

Autosomal, sex and micro chromosomal anomalies, cytogenetic techniques and nomenclature of banded chromosomes, ISCN 1980, 1990.

UNIT III - BANDING TECHNIQUE: **9 Hrs**

Differential staining: Q-Banding, G- banding, R-banding, Acridine orange R-banding, C banding, DAPI, C-banding, NOR banding. HRB, chromosome Fragile sites, PCC (premature chromosome condensation), Karyotype interpretation classification of unbanded chromosomes, Nomenclature of banded mitotic chromosomes, HRB nomenclature.

UNIT IV - PREPARATION OF PROBES AND ITS CLASSIFICATION **9 Hrs**

Chromosome analysis by flowcytometry Instrument - Chromosome preparation/ flowsorting and library construction, restriction digestion, amplification techniques, labeling techniques, haptens, fluorochromes, counterstaining and hybridization protocol. Microdissection probe construction.IN- SITU HYBRIDIZATION: **I**sotopic and nonisotopic in situ hybridization (ISH, DISH, FISH, PRINS)

UNIT V- APPLICATION OF FISH: **9 Hrs**

Microdissection, species matching, human gene mapping, dosimetry, interphase cytogenetics, cancer studies clinical disorders etc. Chromosome in clinical medicine: classical chromosome syndromes, cytogenetics of spontaneous abortion, CA in prenatal diagnosis, CA in normal in mental retardations. Genomic imprinting and RFLP.

Total no of Hours: 45

TEXT BOOKS

- Human chromosome principle and techniques, Second edition, by Ram S.Verma and Arvind Babu,MacGrwall-Hill (1995)
- Human Cytogenetics, Volume I constitutional analysis – a practical Approach, editor D. E. Rooney and B.H. Czepulkowski, IRL Press (1992)
- Human cytogenetics, Volume IIMalignancy& Acquired Abnormalities

REFERENCE BOOKS:

- In situ hybridization- Apractical approach, second edition, Editor D.G.Wilkson, Oxford universiTy Press (1999)
- Principles and Practice of Medical Genetics Volume I and II, Editors, Emery and Rimoin, Churchill Liningstone(1991)
- Medical Genetics, Jorde et al,Mosby Publisher (1997)
- Scientific AmericanMolecular Oncology, Editor J.Michael Bishop and Robert A

Subject Code: EBBT22E09	Subject Name : ENVIRONMENTAL TOXICOLOGY	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Biochemistry/Microbiology/Solid hazardous waste water Management	Ty	3	0/0	0/0	3

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

OBJECTIVES:

- To know the toxic chemicals present in the environment and their mode of entry .To understand the presence of carcinogens insecticides present in the environment.

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

CO1	Understand the presence of toxic chemicals in the environment, their sources, and their effects on air, water, and biochemical processes. Gain knowledge of specific toxic chemicals such as arsenic, cadmium, lead, mercury, carbon monoxide, ozone, and pesticides.
CO2	Comprehend the modes of entry for toxic substances into the environment and the process of biotransformation and detoxification of xenobiotics. Explore the mechanisms of how toxic chemicals enter and interact with biological systems.
CO3	Develop an understanding of carcinogens present in the air, their chemical carcinogenicity, and the mechanisms by which they cause cancer. Learn about the environmental testing of carcinogens and their impact on human health.

Mapping of Course Outcomes with Program Outcomes (POs)

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

COs / PSOs	PSO1	PSO2	PSO3
CO1	2	1	3
CO2	1	3	2
CO3	3	2	1

3/2/1 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: EBBT22E09	Subject Name : ENVIRONMENTAL TOXICOLOGY	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Biochemistry/Microbiology/Solid hazardous waste water Management	Ty	3	0/0	0/0	3

UNIT I - TOXIC CHEMICALS IN THE ENVIRONMENT **9 Hrs**

Toxic chemicals in the environment - air, water & their effects, Pesticides in water, Biochemicals aspects of arsenic, cadmium, lead mercury, carbon monoxide, ozone and PAN pesticide.

UNIT II - MODE OF ENTRY **9 Hrs**

Mode of entry of toxic substance, biotransformation of xenobiotics detoxification

UNIT III - CARCINOGENS IN AIR **9 Hrs**

Carcinogens in air, chemical carcinogenicity, mechanism of carcinogenicity, Environmental carcinogenicity testing.

UNIT IV - INSECTICIDES **9 Hrs**

Insecticides, MIC effects, Concept of major, trace and Rare Earth Element (REE)- possible effects of imbalance of some trace elements

UNIT V - BIOGEOCHEMICAL FACTORS **9 Hrs**

Biogeochemical factors in environmental health. Epidemiological issues goiter, fluorosis, arsenic poisoning.

Total no of Hours: 45

TEXT BOOKS

- G. S Sodhi (2009) Fundamental Concepts of Environmental chemistry, (3rd Ed) Alpha Science International.
- Stanley E. Manhan (2009) Principals of Environmental chemistry,(9th Ed) CRC press.
- Ming-Ho Yu, Environmental Toxicology: Biological and Health Effects of Pollutants, CRC Press (2000)

REFERENCE BOOKS

- R.B. Philip (2005) Environmental hazards & human health, Lewis publishers, Boca Raton.
- Raymond Niesink, MannfredA.Hollinger& Jon De Vries ,(1996) Toxicology - Principles & applications. CRC Press.
- Chatterjee (2009) Parasitology, (13th Ed) CBS
- K. Perk (2013) Preventive & Social medicines,(22nd Ed) BanarsidasBhanot Jabalpur publishers
- David A. Wright, Environmental Toxicology, Cmabridge UniversiTy press (2002)

Subject Code: EBBT22E10	Subject Name : MARINE BIOTECHNOLOGY	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Microbiology	Ty	3	0/0	0/0	3

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

OBJECTIVE: To Understand the basic concepts of marine environment. To give an idea about different Types of microbes in marine environment. To gain knowledge in application of marine metabolites.

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

CO1	Understand the diversity and characteristics of marine flora and fauna, including phytoplankton, seaweeds, sea grasses, zooplankton, major marine invertebrates, vertebrates, and marine mammals.
CO2	Identify and classify marine microbes, including their types, methods of culturing, identification, and preservation.
CO3	Explore the role of marine microbes in nutrient cycling, such as microbial nitrogen fixation, carbon, phosphorus, and sulfur cycles, degradation of organic matter, microbial leaching, and biofouling.

Mapping of Course Outcomes with Program Outcomes (POs)

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

COs / PSOs	PSO1	PSO2	PSO3
CO1	2	1	3
CO2	1	3	2
CO3	3	2	1

3/2/1 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: EBBT22E10	Subject Name : MARINE BIOTECHNOLOGY	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Microbiology	Ty	3	0/0	0/0	3

UNIT 1 - INTRODUCTION **9 Hrs**

Introduction to marine environment; Marine Flora – Phytoplankton, seaweeds, sea grasses and mangroves-their characteristics and identification; Biology

UNIT II - MARINE FAUNA **9 Hrs**

Marine fauna-zooplankton; major marine invertebrates; vertebrates and marine mammals-Characteristics and identification, Biology

UNIT III - MARINE MICROBES **9 Hrs**

Marine microbes –Types, classification, methods of culturing and identification; methods of preservation.

UNIT IV – MARINE MINERAL CYCLE **9 Hrs**

Microbial Nitrogen fixation, their role in carbon, phosphorous and sulphur cycle,, degradation of organic matter; Microbial leaching and Biofouling

UNIT V - MARINE PHARMACOLOGY **9 Hrs**

Marine pharmacology – Microbial metabolites; Metabolites from marine flora and fauna

Total no of Hours: 45

TEXT BOOK

❖ Bhakuni, D.S., Rawat, D.S. 2005. Bioactive Marine Natural Products. Springer,

ELECTIVE-IV

Subject Code: EBBT22E11	Subject Name: AGRICULTURAL BIOTECHNOLOGY	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Plant Biotechnology/RDNA/Genetics	Ty	3	0/0	0/0	3

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

OBJECTIVESTo understand the basic concept on Molecular breeding used in crop and farm animal. To known the basic details of molecular and biochemical plant disease resistance and its GE

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

CO1	Understanding the concept and application of molecular markers in crop and animal improvement.
CO2	Applying genetic engineering techniques for developing disease-resistant plants and improving abiotic stress tolerance.
CO3	Exploring the use of transgenic animals for enhancing farming practices and producing valuable products.

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	2	-	-	-	-	-	-	-	-	-
CO2	-	-	-	3	3	2	-	-	-	-	-	-
CO3	-	-	-	-	-	-	3	3	1	-	-	-

COs / PSOs	PSO1	PSO2	PSO3
CO1	2	1	3
CO2	1	3	2
CO3	3	2	1

3/2/1 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: EBBT22E11	Subject Name: AGRICULTURAL BIOTECHNOLOGY	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Plant Biotechnology/RDNA/Genetics	Ty	3	0/0	0/0	3

UNIT I - MOLECULAR BREEDING **9 Hrs**

Concept & methodology of different Types of molecular markers, Role of molecular markers in crop and farm animal improvement, conservation of biodiversity, Marker assisted selection, QTL mapping.

UNIT II - CHLOROPLAST GENETIC ENGINEERING **9 Hrs**

Methodology application in herbicide resistance, production of biopharmaceuticals, edible vaccines, foreign gene expression, Limitations

UNIT III - MOLECULAR AND BIOCHEMICAL BASIS OF PLANT DISEASE RESISTANCE **9 Hrs**

Signelling pathways, Protein kinase, virus induced gene silencing, Molecular basis of plant resistance to various abiotic stresses like drought, salinity, heavy metals, High temperature, etc

UNIT IV - GENETIC ENGINEERING OF PLANTS **9 Hrs**

Production of transgenic plant for fungal ,bacterial and viral disease resistance; Herbicide resistance, Drought and other abiotic stress resistance; Quality parameters: Modification of nitrogen fixing capabilities, gene pyramiding.

UNIT V - TRANSGENIC ANIMALS FOR BETTER FARMING, WHOLE GENOME CLONING, MOLECULAR FARMING **9 Hrs**

Use of plants and animals for production of neutraceuticals, edible vaccines & other desired products

Total no of Hours: 45

TEXT BOOKS

- Agriculture Biotechnology by Ariealtman. Marcel Dekker, inc. (2001)
- Plants, Genes & Crop Biotechnology (2003) 2nd Edition by Chrispeels, M.J &Sadava D.E American SocieTy of Plant Biologists, Jones and Bartlett Publishers,USA
- Biochemistry and Molecular biology of Plants:Edited by Buchanan B.B., Gruissem W and Jones RL(2000) American society of plant biologists, USA.

REFERENCE BOOKS:

- Tom Zinnen, Biotechnology and Food: Leader and Participant Guide, Daine Publishing (1994)
- Sarah Elderidge, Food Biotechnology: Current Issues and Perspectives (2003)
- Israel Goldberg, Biotechnology and Food Ingredients, (1991)
- R. D. King, Food Biotechnology—1 (1987)
- Dietrich W. Knorr, Food Biotechnology (1986)

Subject Code: EBBT22E12	Subject Name : MOLECULAR PATHOGENESIS	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Microbiology/ Cell Biology / Molecular Biology	Ty	3	0/0	0/0	3

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

OBJECTIVES: To understand the fundamentals of pathogenesis at molecular level, mode of entry of pathogens into host, its defense mechanisms, therapeutic approaches etc

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

CO1	Understand the historical perspective and key discoveries in the field of microbiology, including the contributions of Louis Pasteur and Robert Koch, the discovery of microbial toxins, and the development of vaccines and antibiotics.
CO2	Explain the host defense mechanisms against pathogens, including physical barriers, immune responses, inflammation, and the role of antimicrobial compounds. Also, describe the strategies employed by pathogens to overcome host defenses.
CO3	Gain knowledge of molecular pathogenesis through specific examples, including the virulence factors and mechanisms of pathogenicity of various pathogens such as Vibrio cholerae, E. coli, Shigella, Plasmodium, and Influenza virus.

Mapping of Course Outcomes with Program Outcomes (POs)

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

COs / PSOs	PSO1	PSO2	PSO3
CO1	2	1	3
CO2	1	3	2
CO3	3	2	1

3/2/1 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: EBBT22E12	Subject Name : MOLECULAR PATHOGENESIS	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Microbiology/ Cell Biology / Molecular Biology	Ty	3	0/0	0/0	3

UNIT I – OVERVIEW5 Hrs

Historical perspective - discovery of microscope, Louis Pasteur's contributions, Robert Koch's postulates, early discoveries of microbial toxins, toxic assays, vaccines, antibiotics, Various pathogen Types and modes of entry.

UNIT II - HOST-DEFENSE AGAINST PATHOGENS AND PATHOGENIC STRATEGIES 8 Hrs

Host defense: skin, mucosa, cilia, secretions, physical movements, limitation of free iron, antimicrobial compounds, mechanism of killing by humoral and cellular defense mechanisms, complements, inflammation process, general disease symptoms, Pathogenic adaptations to overcome the above defenses.

UNIT III - MOLECULAR PATHOGENESIS (WITH SPECIFIC EXAMPLES) 16 Hrs

Virulence, virulence factors, Vibrio Cholerae: Cholera toxin, co-regulated pili, filamentous phage, survival E.coli pathogens, Shigella: Entry and its cycle, Plasmodium entry and Life cycle, Antimalarials based on transport processes. Influenza virus: Intracellular stages, Neuraminidase & Haemagglutinin in entry, M1 & M2 proteins in assembly and disassembly, action of amantidine.

UNIT IV - EXPERIMENTAL STUDIES ON HOST-PATHOGEN INTERACTIONS 8 Hrs

Virulence assays: adherence, invasion, cytopathic, cytotoxic effects. Criteria & tests in identifying virulence factors, attenuated mutants, molecular characterization of virulence factors

UNIT V - MODERN APPROACHES TO CONTROL PATHOGENS 8 Hrs

Classical approaches based on serotyping. Modern diagnosis immuno & DNA-based techniques. New therapeutic strategies: Vaccines - DNA, subunit and cocktail vaccines.

Total no of Hours: 45

REFERENCES

- Iglewski B.H and Clark V.L " Molecular basis of Bacterial Pathogenesis ", Academic Press, 1990.
- Peter Williams, Julian Ketley& George Salmond, "Methods in Microbiology : Bacterial Pathogenesis, Vol. 27", Academic Press, 1998.
- Recent reviews in Infect. Immun., Mol. Microbiol., Biochem. J., EMBO etc
- Nester, Anderson, Roberts, Pearsall, Nester, "Microbiology: A Human Perspective", Mc Graw Hill, 3rd Edition, 2001.
- Eduardo A. Groisman, Principles of Bacterial Pathogenesis, Academic Press, 2001.

Subject Code: EBBT22E13	Subject Name: LEGAL ASPECTS OF BIOTECHNOLOGY	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Plant biotechnology,Basic pharmaceutical science	TTY	3	0/0	0/0	3

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

OBJECTIVES:

- To gain knowledge about the importance of IPR ,To learn the process involved in patenting and claims To understand the requirements of disclosure and patent litigation. They have to also gain knowledge in biosafeTy and bioethics requirements

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

CO1	Evaluate legal aspects of biotechnology and biosafety case studies
CO2	Apply the course conduct while working on biological agents
CO3	To understand the various biosafety and bioethics principle

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	3	-	-	2	1
CO2	-	-	-	-	-	2	2	3	-	-	2	1
CO3	-	-	-	-	-	2	2	3	-	-	2	1

COs / PSOs	PSO1	PSO2	PSO3
CO1	2	2	2
CO2	1	1	1
CO3	1	1	1

3/2/1 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: EBBT22E13	Subject Name: LEGAL ASPECTS OF BIOTECHNOLOGY	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Plant biotechnology,Basic pharmaceutical science	TY	3	0/0	0/0	3

UNIT I - INTRODUCTION TO INTELLECTUAL PROPERTY 9 Hrs

Types of IP: Patents, Trademarks, Copyright & Related Rights, Industrial Design Protection of GMOs, IP as a factor relevance to Biotechnology and few Case Studies;

UNIT II - AMENDMENTS AND AGREEMENT 9 Hrs

History of GATT & TRIPS Agreement; Madrid Agreement; Hague, Agreement; WIPO Treaties; Budapest TreaTy; PCT; Indian Patent, Act 1970 & recent amendments.

UNIT-III - FORMS 9 Hrs

National and PCT filing procedure ; Time frame and cost; Status of the patent applications filed; Budapest while patenting – disclosure / non –disclosure; Financial assistance for patenting- introduction to existing schemes, patent licensing and agreement, patent infringement – meaning, scope, litigation, Case studies.

UNIT IV - BIOSAFETY 9 Hrs

Introduction; Historical Back Ground; Introduction to Biological Safety Cabinets; Primary Containment for Biohazards; Biosafety Levels; Biosafety Levels of Specific Microorganisms; Recommended Biosafety Levels for Infectious Agents and Infected Animals.

UNITV - BIOETHICS 9 Hrs

Human genome project and its ethical issues.Gene testing, prenatal diagnosis, genetic manipulations, germline therapy, genetic studies on ethnic races.

Total no of Periods: 45

TEXTS/REFERENCES

- BAREACT, (2007) Indian Patent Act 1970 Acts & Rules, Universal Law Publishing Co. Pvt. Ltd.,
- Kankanala C.(2007) Genetic Patent Law & Strategy, (1st Ed), Manupatra Information Solution Pvt. Ltd.,

IMPORTANT LINKS:

- *http://www.w3.org/IPR/*
- *http://www.wipo.int/portal/index.html.en*
- *http://www.ipr.co.uk/IP_conventions/patent_cooperation_treaTy.html*
- *www.patentoffice.nic.in*

ELECTIVE -V

Subject Code: EBBT22E14	Subject Name: HUMAN GENOMICS	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite –Genetics	TY	3	0/0	0/0	3

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

OBJECTIVES:

- To have an insights about the gene sequencing techniques and interpret the data in the form of scripting languages to express the results in the field of clinical genetics

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

CO1	Understand the concepts of sequencing technologies
CO2	Deep insights about genome and transcriptome sequencing
CO3	Knowledge about data analysis and scripting languages.

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	-	-	-	-	-	-	-	-
CO2	-	2	2	2	-	-	-	-	-	-	-	-
CO3	-	2	2	2	-	-	-	-	-	-	-	-

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

3/2/1 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: EBBT22E14	Subject Name: HUMAN GENOMICS	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite –Genetics	TY	3	0/0	0/0	3

UNIT I: INTRODUCTION TO SEQUENCING TECHNOLOGIES 9 Hrs

Principle and workflow of sanger sequencing, sequencing by synthesis method (Illumina), ion semiconductor sequencing, single molecule sequencing (PacBio and Nanopore), optical mapping (Bionano Genomics), high throughput chromosome confirmation capture technologies (Chicago and Hi-C- Dovetail Genomics), and linked read sequencing and sing cell RNA sequencing (10X Genomics).

UNIT II: GENOME AND TRANSCRIPTOME SEQUENCING 9 Hrs

Introduction to human reference genome, whole genome versus exome sequencing, shortread versus long read sequencing, human genome re-sequencing, whole exome sequencing, targeted sequencing, amplicon sequencing, bisulphite sequencing, and Chip-Seq. Designing sequencing strategy considering the objective of the study, Type and throughput of sequencing, cost, and time needed for sequencing.

UNIT III: DATA ANALYSIS AND SCRIPTING LANGUAGES 9 Hrs

Principle and tools for quality assessment of sequence data, reference mapping of genome/exome data, variant calling, and annotation. Principle and tools for mapping of RNAseq data, generating count tables, calculation of RPKM (Reads Per Kilobase Million reads) FPKM (Fragments Per Kilobase Million reads), and TPM (Transcripts Per Kilobase Million reads).

UNIT IV: SEQUENCE ANALYSIS 9 Hrs

Biological replicates and tools for the identification and analysis of differentially expressed genes (DEGs), pairwise and time course DEG analysis. Annotation, gene ontology, and enrichment analysis of DEGs. Heatmaps, clustering and co-expression networks from DEGs. Principal component analysis.

UNIT V: CLINICAL APPLICATION OF GENOMICS 9 Hrs

Genomics approach to identify disease causing gene mutations, differential gene expression, and gene fusion. Diagnosis of diseases using whole genome sequencing, exome sequencing, targeted sequencing. NGS based pre-implantation genetic screening and non-invasive prenatal testing (NIPT). Introduction to ClinVar, ClinGen, COSMIC, dbSNP, 1000 Genomes Project, Exome Sequencing Project, OMIM, and ExA browser.

Total no of Hours: 45

TEXTS/REFERENCES

- The Human Genome - A User's Guide (3rd Edition), 2011 by Julia E. Richards and R. Scott Hawley
- Human molecular genetics (5th Edition), 2018 by Tom Strachan and Andrew P Read

Subject Code: EBBT22E15	Subject Name: NANOTECHNOLOGY	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite:Cell biology and Material science	TY	3	0/0	0/0	3

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

OBJECTIVES:

- The students will have a elaborate knowledge about different nanomaterials used in health science

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

CO1	Understand the Basics of Cell biology, Protein and DNA based Nanostructures
CO2	Deep insights about Nanobiomaterials And Biocompatibility
CO3	Uunderstand the Structural & Functional Principles Of Bionanotechnology and nano bioanalytics

Mapping of Course Outcomes with Program Outcomes (POs)

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

COs / PSOs	PSO1	PSO2	PSO3
CO1	2	1	3
CO2	1	3	2
CO3	3	2	1

3/2/1 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: EBBT22E15	Subject Name: NANOTECHNOLOGY	TY / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite:Cell biology and Material science	TY	3	0/0	0/0	3

UNIT I: BASICS OF CELL BIOLOGY 9 Hrs

Basic structure of mammalian cell membrane, Cell Cycle, Different Types of Cell receptors, Cell lines-Cancerous and Normal cell line, Primary and secondary cell line, Endocytosis and Exocytosis, Reticulo endothelial system (RES), Proteins structure-primary, secondary, tertiary and quaternary structure, Enzymes structure w.r.t metal part, prosthetic group (Metalloenzymes). Antigen-Antibody based assays-Elisa.

UNIT II: NANOBIOMATERIALS AND BIOCOMPATIBILITY 9 Hrs

Surface and Bulk Properties of Bio materials – Nanobiomaterials –NanoCeramics – Nanopolymers – Nano Silica – Hydroxy apatite – Carbon Based nanomaterials Surface modification – Textured and Porous Materials – Surface immobilized biomolecules – Cell-biomaterial interactions – immune response – In Vitro and In Vivo assessment of tissue compatibility.

UNIT III: STRUCTURAL & FUNCTIONAL PRINCIPLES OF BIONANOTECHNOLOGY 9 Hrs

Lipid Bilayers – liposomes – neosomes-Phytosomes, Polysacharides – Peptides –Nucleic acids – DNA scaffolds – Enzymes- Biomolecular motors: linear, rotary mortors – Immunotoxins – Membrane transporters and pumps – Antibodies – monoclonal Antibodies – immunoconjugates – limitations of natural biomolecules

UNIT IV: PROTEIN AND DNA BASED NANOSTRUCTURES 9 Hrs

Nanocircuitry – S-layer proteins: structure, chemistry and assembly – lipid chips – S – Layers as Templates – engineered nanopores – DNA–Protein Nanostructures DNA-based Metallic Nanowires and Networks, DNA–Gold-Nanoparticle Conjugates

UNIT V: Nanobio-Analytics 9 Hrs

Luminescent Quantum Dots for Biological Labeling – Nanoparticle Molecular Labels – Surface Biology: Analysis of Biomolecular Structure by Atomic Force Microscopy and Molecular Pulling – Force Spectroscopy – Biofunctionalized Nanoparticles for Surface – Enhanced Raman Scattering and Surface Plasmon Resonance – Bioconjugated Silica Nanoparticles for Bioanalytical Applications

Total no of Hours: 45

TEXT BOOKS

- Molecular Cell Biology,HarveyLodish, Published by W.H. Freeman & Company
- Biomaterials: A Nano Approach,S Ramakrishna, M Ramalingam, T.S. Sampath Kumar, Winston O. Soboyejo,Published by CRC Press
- Bionanotechnology: Lessons from Nature, D S. Goodsell, by John Wiley & Sons, Inc.
- Nanobiotechnology: Concepts, Applications and Perspectives,(edited by C. M. Niemeyer and C. A. Mirkin),
- Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim,
- Nanobiotechnology: Concepts, Applications and Perspectives,Edited by Christof M. Niemeyer and Chad A. Mirkin, Wiley-VCH, 2004,ISBN 3527306587, 9783527306589

Subject Code: EBBT22E16	SUBJECT NAME : BIOREMEDIATION OF INDUSTRIAL EFFLUENTS	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Bioprocess technology/environment biotechnology	Ty	3	0/0	0/0	3

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

OBJECTIVES: To understand the various methods for effluent treatment. To understand the basic in designing bioreactor. To gain knowledge about the industrial effluent treatment.

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

CO1	Understand the fundamentals of bioremediation, including the introduction to effluent treatment and a comparison of chemical, physical, and biochemical methods. Gain knowledge about the microbial flora of soil and the growth and interactions among soil microorganisms.
CO2	Familiarize with the types of bioreactors used for industrial applications, specifically for aerobic and anaerobic treatment strategies.
CO3	Develop mathematical design approaches for bioreactors, including basic reactor designs, gas transport processes, and the activated sludge process.

Mapping of Course Outcomes with Program Outcomes (POs)

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

COs / PSOs	PSO1	PSO2	PSO3
CO1	2	1	3
CO2	1	3	2
CO3	3	2	1

3/2/1 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: EBBT22E16	SUBJECT NAME : BIOREMEDIATION OF INDUSTRIAL EFFLUENTS	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Bioprocess technology/environment biotechnology	Ty	3	0/0	0/0	3

UNIT I - FUNDAMENTALS OF BIOREMEDIATION **8 Hrs**

Introduction to effluent treatment, Comparison of chemical, physical and biochemical methods, Microbial flora of soil. Growth, interactions among soil microorganisms

UNIT II - BIOREACTORS FOR INDUSTRIAL APPLICATIONS **7 Hrs**

Type of reactors for aerobic and anaerobic treatment strategies

UNIT III - MATHEMATICAL DESIGN APPROACHES **7 Hrs**

Basic reactor designs, gas transport process, activated sludge process

UNIT IV - TREATMENT OF INDUSTRIAL LIQUID EFFLUENTS **15 Hrs**

Dairy, pulp, dye, leather, pharmaceuticals etc. Comparison of various liquid wastes

UNIT V - TREATMENT OF SOLID AND GASEOUS EFFLUENTS **8 Hrs**

Various techniques, reactors, organisms

Total no of Hours: 45

TEXT BOOKS

- Environmental Biotechnology, Principles and applications, Bruce E.Rittman and Perry L.MacCarty,McGrawHill, NewYork, 2001.DobleMukesh, & Anil Kumar, Biotreatment of industrial effluents, Elsevier, New York, Feb,