Program and Course Structure

School of Engineering Technology

B.Tech - Biotechnology

Program code: SET0201

1.1 Vision, Mission and Core Values of the University

Vision of the University

To serve the society by being a global University of higher learning in pursuit of academic excellence, innovation and nurturing entrepreneurship.

Mission of the University

1. Transformative educational experience
2. Enrichment by educational initiatives that encourage global outlook
3. Develop research, support disruptive innovations and accelerate entrepreneurship
4. Seeking beyond boundaries

Core Values

- Integrity
- Leadership
- Diversity
- Community

Vision of the School

To become a globally acclaimed institution of higher learning in engineering and technology promoting excellence in research, innovation and entrepreneurship to provide sustainable solution to the needs of the society

Mission of the School

1. To impart quality education with strong industry & academic connectivity in the expanding fields of Engineering and Technology in a conducive and enriching learning environment.
2. To produce technocrats equipped with technical & soft skills and experiential learning required to stay current with the modern tools in emerging technologies to fulfill professional responsibilities and uphold ethical values.
3. To inculcate a culture of interdisciplinary research, innovation and entrepreneurship to provide sustainable solutions to meet the growing challenges and societal needs.
4. To foster collaborative learning and to play adaptive leadership role in professional career and pursuit of higher education through effective mentoring and counseling.

Core Values

- Integrity
- Leadership
- Diversity
- Community

Vision of the Department

To serve the society by being a global centre of higher learning in pursuit of academic excellence, innovation and nurturing entrepreneurship to cater to the needs of biotechnology in health, agriculture and environment sectors.

Mission of the Department

M1: To conduct cutting-edge multidisciplinary original research in plant, animal, medical, industrial and environmental biotechnology.

M2: To train and transform students into thinking bioengineers, and scientists who are able to integrate theoretical knowledge with practical applications in diverse areas of Biotechnology

M3: To adapt and update with rapidly changing technologies through self-improvement with continuous learning and education, without compromising with moral and professional ethics.

M4: To provide opportunities for collaborative-learning beyond classrooms, in the broader community- across the diverse spectrum of disciplines**.**

Core Values

- Integrity
- Leadership
- Diversity
- Community

1.3 Program Educational Objectives (PEO)

PEO1: Graduates will be able to integrate the physical, biological and mathematical sciences with engineering principles for the study of biological systems and medical health related problems.

PEO2: Graduates will demonstrate the applications of biotechnology and bioengineering principles through development of industrial designs and processes that are of societal and industrial importance.

PEO3: Graduates will adapt to and update with rapidly changing biotechnologies through self-improvement with continuous learning about the impact of technology and engineering solutions on the society and environment.

PEO4: Graduates will develop communication skills and demonstrate independent thinking, analytical and problem solving skills, self-management and function effectively in team-oriented and open-ended activities in an industrial or academic environment.

PEO5: Graduates will develop leadership skills at levels appropriate to their experience and perform ethically and professionally in business, academia, industry and society.

1.3.2 Map PEOs with School Mission Statements:

PEO Statements	School Mission 1	School Mission 2	School Mission 3	School Mission 4
PEO1:	3	3	2	1
PEO2:	2	2	3	1
PEO3:	3	2	3	1
PEO4:	1	1	2	3
PEO5:	2	2	1	3

1. Slight (Low) 2. Moderate (Medium) 3. Substantial (High)

1.3.2.1 Map PEOs with Department Mission Statements:

PEO Statements	Department Mission 1	Department Mission 2	Department Mission 3	Department Mission 4
PEO1:	**3**	**3**	**2**	**1**
PEO2:	**2**	**3**	**1**	**3**
PEO3:	**1**	**2**	**3**	**3**
PEO4:	**1**	**3**	**3**	**2**
PEO5:	**2**	**3**	**3**	**1**

1. Slight (Low) 2. Moderate (Medium) 3. Substantial (High)

1.3.3 Program Outcomes (PO's)

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 considerations.

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 modelling to complex engineering activities with an understanding of the limitations.

PO6: **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess 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 a 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 one's own work, as a member and leader in a team, to manage projects and in 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.

PSO1: Acquire practical knowledge of biotechnological techniques to identify, quantify and characterize biomolecules and bio-organisms, critical for sustaining life processes and also for industrial applications.

PSO2: Ability to unravel metabolic and molecular pathways in living organisms and harnessing or manipulating them for better health, agricultural produce or industrial products.

PSO3: Obtain knowledge and research abilities in tissue engineering, stem cell research and other biotechnological process and bioinformatics for product development.

1.3.4 Mapping of Program Outcome Vs Program Educational Objectives

Mapping	PEO1	PEO2	PEO3	PEO4	PEO5
PO1	3	3	2	1	1
PO2	3	1	1	-	-
PO3	1	3	2	1	1
PO4	3	2	1	1	-
PO5	3	3	2	1	-
PO6	1	1	2	2	3
PO7	1	2	3	-	-
PO8	-	-	-	1	3
PO9	-	-	-	3	2
PO10	-	-	-	3	2
PO11	2	3	1	2	3
PO12	2	1	3	1	2
PSO1	3	3	3	-	-
PSO2	3	3	3	-	-
PSO3	1	1	3	1	1

1. Slight (Low) **2. Moderate (Medium)** **3. Substantial (High)**

1.3.5 The components of the curriculum

Course Component	Curriculum Content (% of total number of credits of the program)	Total number of contact hours	Total number of credits
Basic Sciences	3.75%	6	6
Engineering Sciences	9.06%	22	14.5
Humanities and Social sciences	3.12%	5	5
Technical and communications skills	10%	29	16
Sciences	13.4%	26	21.5
Program Core	27.5%	51	44
Program Electives	13.1%	21	21
Open Electives	6.8%	11	11
Project(s)	13.1%	36	21

1.3.5 Program Outcome Vs Courses Mapping Table

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
Semester 1																
BTY114.1	3	-	1	1	2	2	1	3	2	1	-	3	3	1	1	3
BTY114.2	-	-	1	1	2	3	1	-	2	1	2	2	2	1	1	-
BTY114.3	3	1	1	3	1	2	3	1	3	1	1	2	3	1	2	3
BTY114.4	3	2	2	3	-	-	1	2	3	2	1	2	3	1	2	3
BTY114.5	3	2	2	3	1	2	1	2	3	2	1	3	3	1	2	2
BTY114.6	3	2	2	3	1	1	3	2	3	1	1	2	3	1	2	2
Semester 2																
BTY115.1	1	1	-	3	-	2	-	-	-	-	-	-	-	-	-	-
BTY115.2	-	1	-	2	-	-	-	-	-	3	-	1	-	3	-	-
BTY115.3	3	2	3	2	2	2	-	1	-	-	-	2	3	3	-	2
BTY115.4	3	2	3	2	-	-	-	-	3	-	-	-	3	-	-	
BTY115.5	2	3	2	2	3	3	-	-	-	-	2	2	1	3	-	3
BTY115.6	2	3	2	3	1	3	-	-	-	-	-	2	3	1	-	-
Semester 3																
CHY213.1	2	1	1	1	1	-	-	-	-	-	1	1	2	2	2	1
CHY213.2	2	1	1	1	1	-	-	-	-	-	1	1	2	2	2	1
CHY213.3	2	1	1	1	1	-	-	-	-	-	1	1	2	2	2	1
CHY213.4	2	1	1	1	1	-	-	-	-	-	1	1	2	2	2	1
CHY213.5	2	1	1	1	2	-	-	-	-	-	1	1	3	3	3	1
CHY213.6	3	1	1	1	2	-	-	-	-	-	1	1	3	3	3	1
BTY209.1	3	2	-	1	-	-	-	-	-	-	-	1	3	3	3	3
BTY209.2	3	2	-	2	-	-	-	-	-	-	-	1	3	2	2	2
BTY209.3	3	2	2	2	2	-	-	-	-	-	-	2	2	3	3	2
BTY209.4	3	2	-	2	-	-	-	-	-	-	-	2	3	2	2	2
BTY209.5	3	3	3	2	-	-	-	-	-	-	-	2	2	2	2	3
BTY209.6	-	-	-	1	-	-	-	-	-	-	-	3	2	2	2	2
BTY211.1	3	2	-	1	-	-	-	-	-	-	-	-	-	-	1	-
BTY211.2	3	2	-	2	-	-	-	2	-	-	-	1	2	-	-	-
BTY211.3	3	2	2	2	2	-	3	-	-	2	-	2	2	3	2	2
BTY211.4	3	2	-	2	-	-	-	-	2	-	-	-	-	-	-	
BTY211.5	3	3	3	2	3	3	-	-	-	-	-	2	3	3	-	3

BTY211.6	3	2	1	-	-	2	-	-	1	-	-	-	2	-	-	1
BTY232.1	2	2	-	1	-	2	-	-	-	-	-	-	-	-	-	-
BTY232.2	3	2	-	2	-	-	-	-	-	3	-	1	-	-	-	-
BTY232.3	3	2	2	2	2	2	-	1	-	-	-	2	2	3	-	2
BTY232.4	2	2	-	2	-	-	-	-	3	-	-	-	-	-	-	
BTY232.5	2	3	3	2	3	3	-	-	-	-	2	2	3	3	-	3
BTY232.6	2	3	2	3	1	3	-	-	-	-	-	2	2	1	-	-
CHY253.1	2	1	1	1	1	-	-	-	-	-	1	1	2	2	2	1
CHY253.2	2	1	1	1	1	-	-	-	-	-	1	1	2	2	2	1
CHY253.3	2	1	1	1	1	-	-	-	-	-	1	1	2	2	2	1
CHY253.4	2	1	1	1	1	-	-	-	-	-	1	1	2	2	2	1
CHY253.5	2	1	1	1	2	-	-	-	-	-	1	1	3	3	3	1
CHY253.6	3	1	1	1	2	-	-	-	-	-	1	1	3	3	3	1
BTP209.1	3	2	-	1	-	-	-	-	-	-	-	1	3	3	3	3
BTP209.2	3	2	-	2	-	-	-	-	-	-	-	1	3	2	2	2
BTP209.3	3	2	2	2	2	-	-	-	-	-	-	2	2	3	3	2
BTP209.4	3	2	-	2	-	-	-	-	-	-	-	2	3	2	2	2
BTP209.5	3	3	3	2	-	-	-	-	-	-	-	2	2	2	2	3
BTP209.6	-	-	-	1	-	-	-	-	-	-	-	3	2	2	2	2
Semester 4																
BTY210.1	3	2	2	2	1				2	2		2	3	2	2	1
BTY210.2	2	2	2	1			1	1	1		1	2	3	2	2	1
BTY210.3	3	3	3	2	2	2	2	1	2		1	2	2	2	2	2
BTY210.4	2	3	2	2	2				2	1		2	3	2	3	2
BTY210.5	2	3	2	2	3	1	1		2	2	2	3	3	2	2	2
BTY210.6	3	2	2	2	1				2	2		2	3	2	2	1
BTY234.1	3	2	-	1	-	-	-	-	-	-	-	-	-	-	1	-
BTY234.2	3	2	-	2	-	-	-	2	-	-	-	1	2	-	-	-
BTY234.3	3	2	2	2	2	-	3	-	-	2	-	2	2	3	2	2
BTY234.4	3	2	-	2	-	-	-	-	2	-	-	-	-	-	-	
BTY234.5	3	3	3	2	3	3	-	-	-	-	-	2	3	3	-	3
BTY234.6	3	2	1	-	-	2	-	-	1	-	-	-	2	-	-	1
BTY235.1	2	2	-	1	-	2	-	-	-	-	-	-	-	-	-	-

BTY235.2	3	2	-	2	-	-	-	-	-	3	-	1	-	-	-	-
BTY235.3	3	2	2	2	2	2	-	1	-	-	-	2	2	3	-	2
BTY235.4	2	2	-	2	-	-	-	-	3	-	-	-	-	-	-	
BTY235.5	2	3	3	2	3	3	-	-	-	-	2	2	3	3	-	3
BTY235.6	2	3	2	3	1	3	-	-	-	-	-	2	2	1	-	-
BTP210.1	3	2	2	2	1				2	2		2	3	2	2	1
BTP210.2	2	2	2	1			1	1	1		1	2	3	2	2	1
BTP210.3	3	3	3	2	2	2	2	1	2		1	2	2	2	2	2
BTP210.4	2	3	2	2	2				2	1		2	3	2	3	2
BTP210.5	2	3	2	2	3	1	1		2	2	2	3	3	2	2	2
BTP210.6	3	2	2	2	1				2	2		2	3	2	2	1
BTP307.1	3	-	-	2	-	1	-	-	3	2	-	3	3	1	2	-
BTP307.2	3	-	-	1	-	-	-	-	2	-	-	2	3	2	3	-
BTP307.3	3	3	3	2	3	-	-	-	2	-	-	2	3	1	2	-
BTP307.4	3	3	2	3	3	-	-	-	3	-	1	2	3	-	2	2
BTP307.5	3	-	3	1	-	2	2	-	3	-	-	3	3	1	3	2
BTP307.6	3	3	3	3	3	3	1	-	3	-	1	3	3	2	2	1
Semester 5																
BTY320.1	3	-	-	1	-	-	-	-	2	-	-	1	3	2	2	-
BTY320.2	3	-	3	1	3	-	-	-	-	-	-	3	3	3	2	-
BTY320.3	3	3	3	2	3	-	-	2	1	-	-	3	3	3	3	-
BTY320.4	3	1	2	2	-	-	-	3	-	-	-	2	3	2	2	2
BTY320.5	3	1	3	1	2	2	-	3	3	-	-	1	3	3	2	3
BTY320.6	3	3	3	3	3	3	-	3	3	-	-	2	3	3	2	2
BTY310.1	3	2	-	1	-	-	-	-	-	-	-	-	-	-	1	-
BTY310.2	3	2	-	2	-	-	-	2	-	-	-	1	2	-	-	-
BTY310.3	3	2	2	2	2	-	3	-	-	2	-	2	2	3	2	2
BTY310.4	3	2	-	2	-	-	-	-	2	-	-	-	-	-	-	
BTY310.5	3	3	3	2	3	3	-	-	-	-	-	2	3	3	-	3
BTY310.6	3	2	2	-	1	3	-	-	-	-	-	2	1	-	-	1
BTY320.1	3	-	-	1	-	-	-	-	2	-	-	1	3	2	2	-
BTY320.2	3	-	3	1	3	-	-	-	-	-	-	3	3	3	2	-
BTY320.3	3	3	3	2	3	-	-	2	1	-	-	3	3	3	3	-

BTY320.4	3	1	2	2	-	-	-	3	-	-	-	2	3	2	2	2
BTY320.5	3	1	3	1	2	2	-	3	3	-	-	1	3	3	2	3
BTY320.6	3	3	3	3	3	3	-	3	3	-	-	2	3	3	2	2
BTP310.1	3	3	-	2	-	2	-	-	2	3	-	3	2	2	3	-
BTP310.2	3	-	-	1	-	-	-	-	2	-	-	2	3	2	2	-
BTP310.3	3	2	3	2	3	-	-	-	2	-	-	3	3	1	2	-
BTP310.4	3	3	2	3	3	-	-	-	3	2	1	2	2	-	2	3
BTP310.5	3	-	3	1	-	2	2	-	3	-	-	3	3	1	3	2
BTP310.6	3	3	3	3	3	3	1	-	3	-	1	3	3	2	2	1
BTY321.1	2	2	-	1	-	2	-	-	-	-	-	-	-	-	-	-
BTY321.2	3	2	-	2	-	-	-	-	-	3	-	1	-	-	-	-
BTY321.3	3	2	2	2	2	2	-	1	-	-	-	2	2	3	-	2
BTY321.4	2	2	-	2	-	-	-	-	3	-	-	-	-	-	-	
BTY321.5	2	3	3	2	3	3	-	-	-	-	2	2	3	3	-	3
BTY321.6	2	3	2	3	1	3	-	-	-	-	-	2	2	1	-	-
Semester 6																
BTY318.1	3	-	-	1	-	-	-	-	3	-	-	3	3	1	2	-
BTY318.2	3	-	-	1	-	-	-	-	3	-	-	3	3	1	3	-
BTY318.3	3	3	3	2	3	-	-	-	2	-	-	2	3	-	2	-
BTY318.4	3	3	3	2	3	-	-	-	-	-	1	2	3	-	2	2
BTY318.5	3	-	3	1	-	2	2	-	3	-	-	3	3	1	3	2
BTY318.6	3	3	3	3	3	3	1	-	3	-	1	2	3	1	2	1
BTY319.1	3	2	-	1	-	-	-	-	-	-	-	-	-	-	1	-
BTY319.2	3	2	-	2	-	-	-	-	-	-	-	1	2	-	-	-
BTY319.3	3	2	2	2	2	-	-	-	-	-	-	2	2	3	2	2
BTY319.4	3	2	-	2	-	-	-	-	-	-	-	-	-	-	-	
BTY319.5	3	3	3	2	3	-	-	-	-	-	-	2	3	3	-	3
BTY319.6	2	1	3	2	-	-	-	-	-	-	-	2	1	2	1	-
BTP306.1	3	-	-	1	-	-	-	-	3	-	-	3	3	1	2	-
BTP306.2	3	-	-	1	-	-	-	-	3	-	-	3	3	1	3	-
BTP306.3	3	3	3	2	3	-	-	-	2	-	-	2	3	-	2	-
BTP306.4	3	3	3	2	3	-	-	-	-	-	1	2	3	-	2	2
BTP306.5	3	-	3	1	-	2	2	-	3	-	-	3	3	1	3	2

BTP306.6	3	3	3	3	3	3	1	-	3	-	1	2	3	1	2	1
Semester 7																
BTY416.1	3	2	-	1	-	-	-	-	-	-	-	-	-	-	1	-
BTY416.2	3	2	-	2	-	-	-	2	-	-	-	1	2	-	-	-
BTY416.3	3	2	2	2	2	-	3	-	-	2	-	2	2	3	2	2
BTY416.4	3	2	-	2	-	-	-	-	2	-	-	-	-	-	-	
BTY416.5	3	3	3	2	3	3	-	-	-	-	-	2	3	3	-	3
BTY416.6	3	2	1	-	-	2	-	-	1	-	-	-	2	-	-	1
BTP309.1	3	2	-	1	-	2	-	1	3	-	-	2	3	2	2	3
BTP309.2	3	2	-	2	-	2	-	-	3	-	-	2	3	3	2	3
BTP309.3	3	2	2	2	-	1	-	1	3	-	-	2	3	3	2	2
BTP309.4	3	2	-	2	-	3	-	-	3	-	-	2	3	3	2	1
BTP309.5	3	3	3	2	-	3	-	-	3	-	-	2	3	3	2	1
BTP309.6	3	2	-	2	-	3	-	1	3	-	-	2	3	2	2	1

School of Engineering and Technology
B.Tech-Biotechnology
Batch: 2019-2023
TERM: I

S. No.	Paper ID	Course Code	Course	Teaching Load			Credits	Pre-Requisite/Co Requisite	Type of course 1. CC 2. AECC 3. SEC 4. DSE
				L	T	P			
THEORY SUBJECTS									
1.		BTY114	Introduction to Biotechnology Engineering	0	0	2	1		CC
2.		CSE113	Programming for Problem Solving	3	0	0	3		AECC
3.		EVS112	Environmental Studies	3	0	0	3		AECC
4.		MTH114	Maths I	3	1	0	4		AECC
5.		ARP101	Communicative English	1	0	2	2		SEC
6.		PHY121	Thermodynamics	2	1	0	3		AECC
7.		EEE112	Principles of Electrical and Electronics Engineering	2	1	0	3		AECC
PRACTICAL									
8.		CSP113	Programming for Problem Solving Lab	0	0	2	1		SEC
9.		EEP112	Principles of Electrical and Electronics Engineering Lab	0	0	2	1		SEC
10.		MEP106	Computer Aided Design & Drafting	0	0	3	1.5		SEC
11.		PHY162	Physics Lab 2	0	0	2	1		SEC
TOTAL CREDITS							**23.5**		

School of Engineering and Technology
B.Tech- Biotechnology
Batch: 2019-2023
TERM: II

S. No.	Paper ID	Course Code	Course	Teaching Load			Credits	Pre-Requisite/Co Requisite	Type of Course
				L	T	P			
THEORY SUBJECTS									
1.		CHY110	Physical Chemistry	3	0	0	3		AECC
2.		CSE114	Application based Programming in Python	3	0	0	3		AECC
3.		FEN102/ FEN104	Functional English Beginners 2/ Functional English Intermediate 2	1	0	0	1		SEC
4.		HMM111	Value Ethics	2	0	0	2		SEC
5.		PHY122	Fluids	2	1	0	3		AECC
6.		MTH215	Biostatistics	3	1	0	4		AECC
PRACTICAL									
7.		BTY115	Design/Creativity based course	0	0	2	1		CC
8.		CHY152	Physical Chemistry Lab	0	0	2	1		SEC
9.		CSP114	Application based Programming in Python Lab	0	0	2	1		SEC
10.		ENP103	Functional English Lab II	0	0	2	1		SEC
11.		MEP105	Mechanical Workshop	0	0	3	1.5		SEC
12.		PHY161	Physics Lab	0	0	2	1		SEC
Summer Internship (0-0-2)1 for II term to be evaluated in III term									
TOTAL CREDITS							**22.5**		

School of Engineering and Technology
B.Tech- Biotechnology
Batch: 2019-2023
TERM: III

S. No.	Paper ID	Course Code	Course	Teaching Load			Credits	Pre-Requisite/Co Requisite	Type of Course
				L	T	P			
THEORY SUBJECTS									
1.		HMM305	Management for Engineers	3	0	0	3		AECC
2.		CHY113	Organic Chemistry	3	0	0	3		AECC
3.		BTY211	Genetics	3	1	0	4		CC
4.		BTY209	Cell Biology	3	0	0	3		CC
5.		BTY232	Immunology	3	0	0	3		CC
PRACTICAL									
6.		ARP203	Aptitude Reasoning and Business Communication Skills-Basic	0	0	4	2		SEC
7.		CHY261	Organic Chemistry Lab	0	0	2	1		SEC
8.		BTP209	Cell Biology Lab	0	0	2	1		CC
9.		BTP251	Project Based Learning (PBL) -1	0	0	2	1		SEC
10.		BTP294	Summer Internship	0	0	2	1		SEC
TOTAL CREDITS							**22**		

School of Engineering and Technology
B.Tech- Biotechnology
Batch: 2019-2023
TERM: IV

S. No.	Paper ID	Course Code	Course	Teaching Load			Credits	Pre-Requisite/Co Requisite	Type of Course
				L	T	P			
THEORY SUBJECTS									
1.		BTY210	Instrumentation and Bio-analytical Techniques	3	0	0	3		CC
2.		BTY234	Molecular Biology	3	1	0	4		CC
3.		BTY235	Biochemistry	3	0	0	3		CC
4.		PE1	Program Elective - 1	3	0	0	3		DSE
5.		OE1	Open Elective - 1	2	0	0	2		AECC
PRACTICAL									
6.		BTP210	Instrumentation and Bioanalytical Techniques Lab	0	0	2	1		CC
7.		BTP307	Molecular Biology Lab	0	0	2	1		CC
8.		BTP252	Project Based Learning (PBL) -2	0	0	2	1		SEC
9.		ARP204	Aptitude Reasoning and Business Communication Skills-Intermediate	0	0	4	2		SEC
Summer Internship (0-0-2)1 for IV term to be evaluated in V term									
TOTAL CREDITS							**20**		

School of Engineering and Technology
B.Tech- Biotechnology
Batch: 2019-2023
TERM: V

S. No.	Paper ID	Course Code	Course	Teaching Load			Credits	Pre-Requisite/Co Requisite	Type of Course
				L	T	P			
THEORY SUBJECTS									
1.		BTY320	Microbiology	3	0	0	3		CC
2.		BTY310	Recombinant DNA Technology	3	1	0	4		CC
3.		BTY321	Bioinformatics	2	0	0	2		CC
4.		PE2	Program Elective-2	3	0	0	3		DSE
5.		OE2	Open Elective – 2	3	0	0	3		AECC
PRACTICAL									
6.		BTP214	Microbiology Lab	0	0	2	1		CC
7.		BTP310	Recombinant DNA Technology Lab	0	0	2	1		CC
8.		BTP311	Technical Skill Enhancement Course-1	0	0	2	1	Bioinformatics	SEC
9.		BTP351	Project Based Learning (PBL) -3	0	0	2	1		SEC
10.		ARP301	Quantitative Aptitude Behavioral and Interpersonal Skills	0	0	4	2		SEC
11.		BTP394	Summer Internship	-	-	-	1		SEC
12.		CCU101	Community Connect	0	0	4	2		SEC
Total Credits							**24**		

School of Engineering and Technology
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Batch: 2019-2023
TERM: VI

S. No.	Paper ID	Course Code	Course	Teaching Load			Credits	Pre-Requisite/Co Requisite	Type of Course
				L	T	P			
THEORY SUBJECTS									
1.		BTY318	Bioprocess Engineering	3	0	0	3		CC
2.		BTY319	Signal Transduction	3	0	0	3		CC
3.		PE3	Program Elective-3	3	0	0	3		DSE
4.		PE4	Program Elective-4	3	0	0	3		DSE
5.		OE3	Open Elective – 3	3	0	0	3		AECC
PRACTICAL									
6.		BTP306	Bioprocess Engineering Lab	0	0	2	1		CC
7.		BTP352	Project Based Learning (PBL) -4	0	0	2	1		SEC
8.		BTP312	Technical Skill Enhancement Course-2(Proteomics Lab)	0	0	2	1		SEC
9.		ARP302	Higher Order Mathematics and Advanced People Skills	0	0	4	2		SEC
Summer Internship (0-0-2)1 for VI term to be evaluated in VII term									
TOTAL CREDITS							**20**		

School of Engineering and Technology
B.Tech- Biotechnology
Batch: 2019-2023
TERM: VII

S. No.	Paper ID	Course Code	Course	Teaching Load			Credits	Pre-Requisite/Co Requisite	Type of Course
				L	T	P			
THEORY SUBJECTS									
1.		BTY415	Basic Plant Biotechnology	3	1	0	4		CC
2.		BTY416	Animal Biotechnology	3	0	0	3		CC
3.		PE5	Program Elective-5 (IPR)	3	0	0	3		DSE
4.		PE6	Program Elective-6 (Techniques in Biology)	3	0	0	3		DSE
5.		OE4	Open Elective – 4	3	0	0	3		AECC
PRACTICAL									
6.		BTP309	Basic Plant Biotechnology Lab	0	0	2	1		CC
7.		BTP495	Major Project- 1	-	-	-	3		SEC
9.		BTP494	Summer Internship	-	-	-	1		SEC
11.		SC22	Comprehensive Examination	-	-	-	0		CC
TOTAL CREDITS							**21**		

School of Engineering and Technology
B.Tech- Biotechnology
Batch: 2019-2023
TERM: VIII

S. No.	Paper ID	Course Code	Course	Teaching Load			Credits	Pre-Requisite/Co Requisite	Type of Course
				L	T	P			
PRACTICAL									
1.			Major Project – 2	-	-	-	08		SEC
TOTAL CREDITS							**08**		

Syllabus

BTY114: Introduction to Biotechnology Engineering

School: SET		**Batch : 2019-20**	
Program: B. Tech.		**Current Academic Year: 2019-20**	
Branch: Biotechnology		**Semester: 1**	
1	Course Code	BTY114	
2	Course Title	Introduction to Biotechnology Engineering	
3	Credits	2	
4	Contact Hours (L-T-P)	2-0-0	
	Course Status	Compulsory	
5	Course Objective	To provide a foundation in biotechnology with engineering of living systems and to apply various tools of traditional engineering fields such as mechanical, material, electrical and chemical to understand and solve biomedical and biological problems and harness potential of living systems for the benefit of human mankind.	
6	Course Outcomes	After the successful completion of this course students will be able to: CO1: Recognize the scope, concepts, and terminology of biotechnology CO2: Analyze current events and advances in biotechnology CO3: Identify interdisciplinary nature of Biotechnology CO4: Describe techniques involving the manipulation of DNA CO5: Discover applications of biotechnology in various fields CO6: Recall basic and applied biotechnology and its applications for human benefit	
7	Course Description	The 'Introduction to Biotechnology Engineering' involves study of biotechnology, its history, evolution and applications during course of human history. It encompasses detailed procedure of biotechnological techniques like recombinant DNA technology. It also involves the use of biotechnology for mankind, creation of transgenic plants and animals.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Biotechnology**	
	A	History and origin of Biotechnology	CO1; CO6
	B	Traditional and Modern Biotechnology	
	C	Important events in history of biotechnology	
	Unit 2	**Scope of Biotechnology**	
	A	Areas of Biotechnology	CO2; CO6
	B	Medicine and health care	
	C	Agriculture and industrial biotechnology	
	Unit 3	**Biotechnology as interdisciplinary science**	
	A	Introduction to Bioinformatics and Computational	CO3; CO6

		Biology			
	B	Role of Biotechnology in maintaining sustainable environment			
	C	Basics of Convergence of biotechnology and electronics			
	Unit 4	**Basics of Gene Technology**			
	A	DNA as blue print of life			CO5
	B	Introduction to rDNA Technology			
	C	Transgenesis and Cisgenesis			
	Unit 5	**Applications**			
	A	Introduction to Stem cells			CO6
	B	Tissue engineering			CO5
	C	Gene therapy			CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	Smith J. E., **Biotechnology**, 3rd Edition, Cambridge University Press (2006)			
	Other References	1. **Molecular biology of the Gene (4th Edition).** J .D. Watson, N. H. Hopkins, J. W. Roberts,J.A. Steitz and A.M. 2. Ravi, Indu, Baunthiyal, Mamta, Saxena, Jyoti. **Advances in Biotechnology,** Springer 2014.			

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
BTY114.1	3	-	1	1	2	2	1	3	2	1	-	3	3	1	1
BTY114.2	-	-	1	1	2	3	1	-	2	1	2	2	2	1	1
BTY114.3	3	1	1	3	1	2	3	1	3	1	1	2	3	1	2
BTY114.4	3	2	2	3	-	-	1	2	3	2	1	2	3	1	2
BTY114.5	3	2	2	3	1	2	1	2	3	2	1	3	3	1	2
BTY114.6	3	2	2	3	1	1	3	2	3	1	1	2	3	1	2

BTY115: Design/Creativity based course

School: SET		**Batch: 2019-2023**	
Program: B. Tech		**Current Academic Year: 2019-20**	
Branch: Biotechnology		**Semester: Even (2nd)**	
1	Course Code	BTY115	
2	Course Title	Design/Creativity based course	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Compulsory	
5	Course Objective	• To explain the principles of physical and chemical methods used in Biotechnology. • To explain the different biological processes used in biotechnology. • To explain the structural morphology of cells and biomolecules. • To develop creative skills to build models using the available knowledge.	
6	Course Outcomes	After successfully completion of this course students will be able to: CO1: Students will learn about the structure and functions of some important biomolecules. CO2: Students will be able to identify and differentiate between Eukaryotic and Prokaryotic cells. CO3: Students will learn about different important biochemical processes in Biotechnology. CO4: Students will learn about the different instruments used in Biotechnology. CO5: Students will learn about biological processes including genetic engineering. CO6: Students will be able to represent different concepts/cells/biomolecules/instruments in creative way apart from learning the basics.	
7	Course Description	In this course, students will learn about different features and processes in Biotechnology. Students will also learn to recreate the model from their theoretical knowledge.	
8	Outline syllabus		CO Mapping
	Unit 1	**Biomolecule**	**CO1, CO6**
		Sub unit - a, b and c detailed in Instructional Plan	
	Unit 2	**Cell Biology**	**CO2, CO6**
		Sub unit - a, b and c detailed in Instructional Plan	
	Unit 3	**Biochemical processes**	**CO3, CO6**
		Sub unit - a, b and c detailed in Instructional Plan	
	Unit 4	**Biological Equipment**	**CO4, CO6**
		Sub unit - a, b and c detailed in Instructional Plan	

	Unit 5	**Bioengineering**			**CO5, CO6**
		Sub unit - a, b and c detailed in Instructional Plan			
	Mode of examination	Creative model design and Viva			
	Weightage Distribution	CA	MTE	ETE	
		60%	0%	40%	
	Text book/s*	1. Smith J. E., Biotechnology, 3rd Edition, Cambridge University Press (2006) 2. Molecular Biology Lab Fax. T.A. Brown (Ed.), bios Scientific Publishers Ltds., Oxford, 1991			
	Other References	1. Bioprocess Engineering (Basic Concepts) by M. L. Shuler & F. Kargi, Prentice Hall of India.			

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
BTY115.1	1	1	-	3	-	2	-	-	-	-	-	-	-	-	-
BTY115.2	-	1	-	2	-	-	-	-	-	3	-	1	-	3	-
BTY115.3	3	2	3	2	2	2	-	1	-	-	-	2	3	3	-
BTY115.4	3	2	3	2	-	-	-	-	3	-	-	-	3	-	-
BTY115.5	2	3	2	2	3	3	-	-	-	-	2	2	1	3	-
BTY115.6	2	3	2	3	1	3	-	-	-	-	-	2	3	1	-

HMM305: Management for Engineers

School: School of Business Studies		**Batch: 2019-2023**	
Program: B. Tech		**Current Academic Year: 2020-21**	
Branch: CSE		**Semester: Odd (3rd)**	
1	Course Code	HMM305	
2	Course Title	Management for Engineers	
3	Credits	03	
4	Contact Hours (L-T-P)	3-0-0	
	Course Type	Compulsory	
5	Course Objective	The objective of this course is to expose the students to understand the basics of Management Foundations. The students will be given a detailed grounding for the theories and cases related to the general management. The aim of the course is to orient the students in theories and practices of Management so as to apply the acquired knowledge in actual business practices. This is a gateway to the real world of management and decision-making.	
6	Course Outcomes	The student will be able to **CO1**: **Define** basic principles and concepts related to management in an organisation including the functions, different theories of management and roles they play in an organization. **CO2: Explain** the primary function Planning with its process. Also, how forecasting is done in organizations with various techniques are used. **CO3**: **Use** of organizing by studying different types of organization and also using decentralisation and span of control in organizations**.** **CO4**: **Analyse** jobs, recruitment process, manpower planning, job rotation trainings and rewards in various organizations. **CO5**: **Measure** motivation and management control concepts to obtain effective controlling in management system in organizations. **CO6**: **Develop** proper system in an organization by using all the functions of management.	
7	Course Description	This course gives an overview of engineering management and help to understand the various functions of management used in an organization. The focus of the course is the development of individual skills and team work.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction of Management & Organisation**	
	A	Management-Definition of Management & Organisation	CO1, CO6

	B	Concept, Nature, Scope and Functions of Management, Levels of Management, Management Theories - Taylors principle, Fayol's Principles, Hawthorne Studies, Systems Approach and Contingency Approach to Management.	CO1, CO6
	C	Mintzberg's Managerial Roles, Skills of Manager	CO1, CO6
	D	Functions of management	CO1, CO6
	Unit 2	**Management Planning Process**	
	A	Planning objectives and characteristics.	CO2, CO6
	B	Hierarchies of planning.	CO2, CO6
	C	The concept and techniques of forecasting.	CO2, CO6
	Unit 3	**Organizing**	
	A	3.1 Meaning, Importance and Principles,	C03, C06
	B	3.2 Departmentalization, Span of Control,	CO3, CO6
	C	3.3 Types of Organization,	CO3, CO6
		Authority, Delegation of Authority.	
	Unit 4	**Staffing**	
	A	4.1 Meaning, Job analysis	CO4, C06
	B	4.2 Manpower planning, Recruitment, Transfers and Promotions	CO4, CO6
	C	4.3 Appraisals, Management Development, Job Rotation, Training, Rewards and Recognition,	CO4, CO6
	Unit 5	**Directing & Controlling**	
	A	Motivation, Co-ordination, Communication,	CO5, CO6
	B	Directing and Management Control, Decision Making,	CO5, CO6
	C	Management by objectives (MBO) the concept and relevance. Objectives and Process of Management Control	CO5, CO6
	Mode of examination	Theory	
	Weightage Distribution	CA / MTE / ETE	
		30% / 20% / 50%	
	Text book/s*	• Principles & practice of Mgmt., L.M. Prasad	
	Other References	• Management Today, Burton & Thakur • Principles & Practices of Mgmt., C.B. Gupta • Understanding Management, Richard L. Daft • Management, Stoner, Freemand & Gilbert • Essential of Management, Koontz O' Donnel	

COURSE ARTICULATION MATRIX

POs Cos	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	-	1	2	2	-	2	1	-	-
CO2	-	1	2	2	-	2	1	-	-
CO3	-	1	1	2	-	2	1	-	-
CO4	-	2	2	1	-	1	1	-	-
CO5	-	1	2	2	-	2	2	-	-
CO6	-	2	1	1	-	2	2	-	-

CHY213: Basics of Organic Chemistry for Engineers

School: SET		**Batch : 2019-2023**
Program: B.Tech		**Current Academic Year: 2019-20**
Branch: Biotech		**Semester:3**
1	Course Code	CHY213
2	Course Title	**Basics of Organic Chemistry for Engineers**
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Type	Compulsory
5	Course Objective	1. To enrich the students with concepts of organic chemistry. Electronic effects, reactive intermediates, types of reactions in organic chemistry. 2. To provide thorough knowledge in organic basics and stereochemistry of the organic molecules and to make its use in biomolecules. 3. To provide the basics of famous name reactions, Chemistry of hetreocyclic molecules and its utilization in drugs. 4. To discuss the basics of heterocyclic chemistry and their involvement in drug development.
6	Course Outcomes	CO1: Important effects, electrophiles and nucleophiles as applied to organic chemistry and reaction intermediatesDifferent types of organic reactions, Knowledge of the basic mechanisms of substitution and elimination (Sn^1, Sn^2, E^1, E^2) CO: Understand the mechanism of important name reactions in organic chemistry CO3: Draw the three dimensional structures of typical organic molecules, differentiating between isomers and identical molecules, Naming Structures including stereoisomers and geometric isomers and recognize stereochemistry of different chiral and achiral molecules and be able to apply the Cahn-Ingold-Prelog system to designation of stereochemistry (E/Z or R/S). CO4: To outline the role of heterocycles in organic, pharmaceutical and biological chemistry .To explain the methods for the chemical synthesis of simple heterocycles and their chemical behaviour. CO5: Important drugs and their classification, examples and applications. CO6: To apply the knowledge of organic chemistry principles and stereochemistry to understand the structure, design and structure activity relationship of drugs
7	Course	This course enriches the students with concepts of organic chemistry.

	Description	Electronic effects, reactive intermediates, types of reactions in organic chemistry, stereochemistry and aliphatic hydrocarbons and some name reactions are the topics covered in this paper. Also the basics of heterocyclic chemistry and their involvement in drug development will be discussed.	
8	Outline syllabus		CO Mapping
	Unit 1	**Principles of Organic Chemistry**	
	A	Electronic Displacements**:** Inductive effect, Resonance effect- Resonance energy and its significance, Hyper conjugation- concept and consequences	CO1, CO6
	B	Reactive intermediates: Generation, structure and general reactions of carbocations, carbanions, free radicals, carbenes (singlet and triplet)	CO1, CO6
	C	Electrophiles and nucleophiles. Different types of Organic Reactions, Mechanism of elimination (E^1 and E^2) and Substitution reaction (SN^1 and SN^2)	CO1, CO6
	Unit 2	**Name reactions**	
	A	Mechanism of Friedel-Crafts Acylation and Alkylation	CO2,CO6
	B	Diels-alder reaction, Aldol Condensation, Claisen condensation, Beckmann Reaction	CO2,CO6
	C	Pinacol-Pinacolone rearrangement, Wanger-Meerwin rearrangement reaction, Cannizzaro Oxidation Reduction	CO2,CO6
	Unit 3	**Stereochemistry**	CO2, CO6
	A	Classification of stereoisomers, Optical Isomers , enentiomers and diastereomers, D and L configuration, Absolute configuration (R and S)	CO3, CO6
	B	Projection formulae. Stereochemistry of compounds containing one and two asymmetric C-atoms, Stereochemistry of biphenyls and spiro compounds, Conformations around a C-C bond in acyclic compounds	CO3, CO6
	C	Structure of cycloalkanes, Cyclohexane (non-substituted) and its conformations, Geometrical isomerism- Concept, E and Z nomenclature	CO3,CO6
	Unit 4	**Heterocyclic compounds**	
	A	Nomenclature of Heterocyclic compounds, aromatic heterocyclic compounds, structure	CO4,CO6
	B	aromatic heterocyclic compounds: importance of biologically significant heterocyclic compounds, five member- sulphur heterocycles (thiamine)	CO4,CO6
	C	nitrogen (pyrrole) heterocycles, Six member-pyrimidines and fused ring-Purines, fused ring-Purines	CO4,CO6
	Unit 5	**Drugs**	
	A	Concepts of drugs, pro-drugs, soft drugs and chemotherapeutic drugs, classification and	CO5,CO6

		nomenclature of drugs			
	B	important terms used in chemistry of drugs, Procedures followed in drug design (flow chart showing various steps involved)			CO5,CO6
	C	Theories of drug activity, Quantitative structure activity relationship(hydrophobic, electronic and steric factor)			CO5,CO6
	Mode of examination	MTE/ETE/CA			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. I .L. Finar, "Organic Chemistry" 6th ed., Pearson Education. 2. R. Morrison,& T. Boyd," Organic Chemistry" 6th ed. , Pears Education. 3. Arun Bahl, B. S. Bahl, "A textbook of organic chemistry", S.Cha &Co. 4. J. A. Joule, K. Mills, " Heterocyclic Chemistry" John Wiley & Sons, 5. S. M. Mukherji, S. P. Singh, "Reaction Mechanism in Orgar Chemistry" Macmillan. 6. Essentials of medical Pharmacology by K.Tripathy			
	Other References	Organic Chemistry by Jerry and March			

COURSE ARTICULATION MATRIX

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2	PSO3
CHY213.1	2	1	1	1	1	-	-	-	-	-	1	1	2	2	2
CHY213.2	2	1	1	1	1	-	-	-	-	-	1	1	2	2	2
CHY213.3	2	1	1	1	1	-	-	-	-	-	1	1	2	2	2
CHY213.4	2	1	1	1	1	-	-	-	-	-	1	1	2	2	2
CHY213.5	2	1	1	1	2	-	-	-	-	-	1	1	3	3	3
CHY213.6	3	1	1	1	2	-	-	-	-	-	1	1	3	3	3

BTY211: Genetics

School: SET		**Batch: 2019-2023**	
Program: B. Tech.		**Current Academic Year: 2020-21**	
Branch: Biotechnology		**Semester: 03**	
1	Course Code	**BTY211**	
2	Course Title	**Genetics**	
3	Credits	4	
4	Contact Hours (L-T-P)	3-1-0	
	Course Status	**Compulsory** /Elective/Open Elective	
5	Course Objective	1. Describe and demonstrate Mendel's laws of inheritance chromosomal theory of inheritance and correlate between alleles and multiple alleles for different traits 2. Analyze the structure of chromatin and chromosomes. Demonstrate linkage and crossing over, different types of variations in structure of chromosome. 3. Explain mutations using different recombination methods in microbes and Recognize the structure of gene and demonstrate the flow of genetic information in cells.	
6	Course Outcomes	CO1: Describe and demonstrate Mendel's laws of inheritance chromosomal theory of inheritance and Correlate between alleles and multiple alleles for different traits CO2: Analyze the structure of chromatin and chromosomes. CO3: Describe linkage and crossing over, different types of variations in structure of chromosome and their effects and examine extranuclear and maternal inheritance. CO4: Identify mutations using different recombination methods in microbes. CO5: Recognize the structure of gene and demonstrate the flow of genetic information in cells. CO6: Explain mendelian genetics, chromosome structure, linkage and crossing over, microbial genetics, mutation and gene structure.	
7	Course Description	To understand the basic principles of Classical Mendelian genetics. To develop analytical approach for understanding inheritance of characteristics from one generation to other.	
8	Outline syllabus		CO Mapping
	Unit 1	**Mendelian Genetics**	
	A	Mendelian genetics and heredity	CO1, CO6
	B	Mendel's experiments, principles of segregation, Principle of independent assortment	CO1, CO6
	C	Alleles and multiple alleles, classical example - ABO blood group and pseudo alleles	CO1, CO6
	Unit 2	**Chromosome Fine Structure**	
	A	Chromosomal theory of Inheritance	CO2, CO6

	B	Prokaryotic and nucleoid structure			CO2, CO6
	C	Nucleosome structure			CO2, CO6
	Unit 3	**Linkage and Crossing Over**			
	A	Linkage, crossing over			CO3, CO6
	B	Variation in chromosome structure, variation in chromosome number			CO3, CO6
	C	Extra- nuclear and maternal inheritance			CO3, CO6
	Unit 4	**Mutation and Microbial Genetics**			
	A	Molecular basis of mutation and their different types			CO4, CO6
	B	Microbial genetics: conjugation, transformation, transduction			CO4, CO6
	C	Plasmids and transposable elements			CO4, CO6
	Unit 5	**Gene Fine Structure**			
	A	DNA as the genetic material, its structure and forms			CO5, CO6
	B	Gene fine structure, Molecular concept of gene			CO5, CO6
	C	Central Dogma of life and regulation of Gene expression			CO5, CO6
	Mode of examination	**Theory**/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	Griffiths J. F. "Introduction to Genetic Analysis", W. H. Freeman, 2010.			
	Other References	1. Gardener. E. J. "Principles of Genetics",Wiley, 1991.			

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
BTY211.1	3	2	-	1	-	-	-	-	-	-	-	-	-	-	1
BTY211.2	3	2	-	2	-	-	-	2	-	-	-	1	2	-	-
BTY211.3	3	2	2	2	2	-	3	-	-	2	-	2	2	3	2
BTY211.4	3	2	-	2	-	-	-	-	2	-	-	-	-	-	-
BTY211.5	3	3	3	2	3	3	-	-	-	-	-	2	3	3	-
BTY211.6	3	2	1	-	-	2	-	-	1	-	-	-	2	-	-

BTY209: Cell Biology

School: SET		**Batch : 2019-2023**
Program: B Tech		**Current Academic Year: 2020-21**
Branch: BT		**Semester: 03**
1	Course Code	**BTY209**
2	Course Title	**Cell Biology**
3	Credits	4
4	Contact Hours (L-T-P)	3-0-0
	Course Status	**Compulsory** /Elective/Open Elective
5	Course Objective	4. Understand the concept of structure and function of biological cells and its living and non-living parts. 5. Describe bioenergetics and movement of molecules across the plasma membrane. 6. Understand the cell to cell communication
6	Course Outcomes	CO1: Describe characteristics of the cell, detailed structure and function of the different cell organelles. Analyse different type of cell and compare on the basis of structure and functions CO2: Explain metabolic activity and production and utilisation of energy inside the cell and endo- membranous system in cell and understand basic concepts of bioenergetics. CO3: Understand mechanics of membrane transport and cellular respiration CO4: Describe the detail structure and function of nucleus and chromatin fibres, cell division. CO5: Extend the cell communication and structural framework of the cell. CO6: Analyse the characteristics of different type of cells and their structures and subcellular structures are related to their functions.
7	Course Description	To introduce the concept of structure and function of biological cells and its living and non-living parts. To develop an understanding of the subject by studying, designing and analysing different experiments in this most rapidly progressing areas of the life sciences, especially the cell components and their molecular mechanism of activities.
8	Outline syllabus		CO Mapping
	Unit 1	**Cell and Cell Theory**	
	A	Cell as a basic unit of life, Cell theory, Cell size and shape	CO1, CO6
	B	Prokaryotic and Eukaryotic cells	
	C	Different types of cells (description with examples of each type of cell)	
	Unit 2	**Ultra-structure of Cell and Cell Organelles**	CO1, CO2,CO6
	A	Endoplasmic Reticulum and	

	B	Lysosomes and peroxisomes			
	C	Bioenergetics and Metabolism; Mitochondria and chloroplast			
	Unit 3	**Plasma Membrane and Transport**			
	A	Structure of plasma membrane			CO3 and CO6
	B	Golgi apparatus			
	C	Protein sorting and transportation			
	Unit 4	**Nucleus and Chromosomes**			
	A	Ultra-structure of nucleus, nuclear membrane			CO4 and CO6
	B	Chromosome structure, chemical composition			
	C	Growth cycle and cell division			
	Unit 5	**Cytoskeleton and Cell to cell interaction**			
	A	Concept about cytoskeleton, microtubules, microfilaments, intermediary filaments			CO5 and CO1
	B	Structure of cilia and flagella and their movement			
	C	Cell to cell interaction			
	Mode of examination	**Theory**/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	Gerald K., "Cell and Molecular Biology", John Wiley and Sons, 2006.			
	Other References	1. Cooper G.M., "The Cell: A Molecular Approach", Sinaner Associates, 2004. Verma P.S. and Agarwal, V.K., "Cell Biology, Genetics, Molecular Biology Evolution and Ecology", S. Chand and Company, 2004.			

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
BTY209.1	3	2	-	1	-	-	-	-	-	-	-	1	3	3	3
BTY209.2	3	2	-	2	-	-	-	-	-	-	-	1	3	2	2
BTY209.3	3	2	2	2	2	-	-	-	-	-	-	2	2	3	3
BTY209.4	3	2	-	2	-	-	-	-	-	-	-	2	3	2	2
BTY209.5	3	3	3	2	-	-	-	-	-	-	-	2	2	2	2
BTY209.6	-	-	-	1	-	-	-	-	-	-	-	3	2	2	2

BTY232: Immunology

School: SET		**Batch : 2019-2023**	
Program: B. Tech		**Current Academic Year: 2020-21**	
Branch: Biotechnology		**Semester: Odd (3rd)**	
1	Course Code	**BTY232**	
2	Course Title	**Immunology**	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	**Compulsory**	
5	Course Objective	7. Understand the overall organization of the immune system 8. Describe the roles of the immune system in both maintaining health and contributing to disease. 9. Appreciate the structure and function of MHC molecules	
6	Course Outcomes	CO1: Demonstrate functions of cells and organs of the immune system CO2: Test antibody-antigen interaction and examine the contribution of antigens towards generation of immune response CO3: Show how MHC recognizes self and non-self molecules and helps in generation of immune response. CO4: Establish the role of cytokines in activation of immune response and antibody-dependent and macrophage-mediated cytotoxicity. CO5: Examine the genetic and molecular mechanisms associated with autoimmunity and graft rejection and review clinical interventions required in organ transplantation. CO6: Overall understanding of immune responses and methods of clinical diagnosis for identifying Ag-Ab interactions.	
7	Course Description	This course will cover the major topics in cellular immunology, including antigen recognition, antigen processing and presentation to B and T cells, the events leading to the generation of antibody and T cell receptor diversity, antibody effector functions, the role of CD4 and CD8 T cell subsets and NK cells in immune responses, self-tolerance and autoimmunity, the inflammatory response and the role of immunity in protection against pathogens and cancer.	
8	Outline syllabus		CO Mapping
	Unit 1	**Cells and organs of immune system**	
	A	Immune responses, innate and acquired immunity.	CO1, CO2
	B	Humoral and cell mediated immune response.	
	C	Haematopoiesis and differentiation of cells, Cells and organs of immune system	
	Unit 2	**Antigen and antibody**	
	A	Antigens and super-antigens,	
	B	Antibodies and their types.	CO1, CO3
	C	Monoclonal antibodies and hybridoma technology.	

	Unit 3	**Antigen antibody interactions**			
	A	Precipitation and Agglutination reactions			CO1 and CO3
	B	ELISA and its types			
	C	Immunofluorescence and Radioimmunoassay.			
	Unit 4	**MHC and Antigen Presentation**			
	A	MHC and its types			CO4
	B	Pathways for antigen processing and presentation.			
	C	Cytokines and their role in immune regulations.			
	Unit 5	**Hypersensitivity and Autoimmunity**			
	A	Hypersensitivity and its types			CO5 and CO6
	B	Autoimmunity			
	C	Transplantation Immunology			
	Mode of examination	**Theory**/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	Goldsby R A "Kuby Immunology", Freeman, 2006.			
	Other References	2. Roitt, I. M. Essentials of Immunology", Blackwell Scientific publishers, London 1998.			

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
BTY232.1	2	2	-	1	-	2	-	-	-	-	-	-	-	-	-
BTY232.2	3	2	-	2	-	-	-	-	-	3	-	1	-	-	-
BTY232.3	3	2	2	2	2	2	-	1	-	-	-	2	2	3	-
BTY232.4	2	2	-	2	-	-	-	-	3	-	-	-	-	-	-
BTY232.5	2	3	3	2	3	3	-	-	-	-	2	2	3	3	-
BTY232.6	2	3	2	3	1	3	-	-	-	-	-	2	2	1	-

CHY253: Organic Chemistry lab

School: SET		**Batch:2019-23**	
Program: B. Tech		**Current Academic Year: 2019-2020**	
Branch: Biotechnology		**Semester: Odd (3rd)**	
1	Course Code	CHY253	
2	Course Title	Organic Chemistry Lab	
3	Credits		
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Compulsory	
5	Course Objective	1. To learn methods for extra elements detection in organic compounds. 2. To detect the functional groups present in unknown organic compound. 3. To execute simple one step organic synthesis. 4. To record the specific rotation of an optically active compound. 5. To separate and identify organic compounds by TLC.	
6	Course Outcomes	Students are able to 1. Understand the Qualitative analysis of organic compounds 2. Understand the methods of functional group detection in organic compounds 3. Execute the simple organic synthesis procedures. 4. Understand and record optical rotation. 5. Perform the thin layer chromatography. 6. Will obtain the knowledge of qualitative, quantitative analysis and synthesis of organic compounds.	
7	Course Description	This course involves the qualitative analysis, Organic synthesis process, purification and separation of organic compounds. It also involves extraction of organic compounds from natural products and characterization.	
8	Outline syllabus		CO Mapping
	Unit 1	**Qualitative analysis of organic compounds-I**	
	A	To analyze the extra elements(N,S,X) in the given unknown organic compound.	CO1, CO6
	B,C	To analyze the extra elements(N,S,X) in the given unknown organic compound.	CO1, CO6
	Unit 2	**Qualitative analysis of organic compounds-II**	
	A	To analyze the extra elements(N,S,X) and functional groups in the given unknown organic compound.	CO2, CO6
	B,C	To analyze the extra elements(N,S,X) and functional groups in the given unknown organic compound.	CO2, CO6
	Unit 3	**Organic synthesis-I**	
	A	To prepare dibenzalacetone by aldol condensation.	CO3, CO6

	B,C	To prepare phthalimide from phthalic anhydride and record its m.p. and percentage yield.			CO3, CO6
	Unit 4	**Quantitative estimation**			
	A	To determine the specific rotation of an optically active compound.			CO4, CO6
	B,C	To determine the neutralization equivalent of an organic acid.			CO4, CO6
	C	To synthesize o-and p-nitro aniline by two step process			CO4, CO6
	Unit 5	**Separation of Organic compounds**			
	A,B,C	To separate Organic compounds with the help of Thin Layer Chromatography.			CO5, CO6
	Mode of examination	Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		60%	0%	40%	
	Text book/s*	O.P. Pandey, D.N. Bajpai, S.Giri, " Practical Chemistry", S. Chand & Co.			
	Other References	Vogel's "Textbook of quantitative Analysis", Pearson.			

COURSE ARTICULATION MATRIX

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CHY253.1	2	1	1	1	1	-	-	-	-	-	1	1	2	2	2
CHY253.2	2	1	1	1	1	-	-	-	-	-	1	1	2	2	2
CHY253.3	2	1	1	1	1	-	-	-	-	-	1	1	2	2	2
CHY253.4	2	1	1	1	1	-	-	-	-	-	1	1	2	2	2
CHY253.5	2	1	1	1	2	-	-	-	-	-	1	1	3	3	3
CHY253.6	3	1	1	1	2	-	-	-	-	-	1	1	3	3	3

BTP209: Cell Biology Lab

School: SET		**Batch: 2019-23**			
Program: B. Tech		**Current Academic Year: 2020-21**			
Branch: Biotechnology		**Semester: Odd (3rd)**			
1	Course Code	BTP209			
2	Course Title	Cell Biology Lab			
3	Credits	1			
4	Contact Hours (L-T-P)	0-0-2			
	Course Status	Compulsory			
5	Course Objective	• To understand how cell is to maintain life			
6	Course Outcomes	After finishing the course the students will be able to CO1: To Understand the basic components of prokaryotic and eukaryotic cell. CO2: To understand the structure and purpose of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membrane and organelles. CO3: To learn the transpiration by stomata. CO4: To understand movement across the cell membrane. CO5: To learn different phases of growth cycle and cell division. CO6: To Understand the basic concept of Biology			
7	Course Description	Introduces the basics of cell biology. The structure and function of the cell.			
8	Outline syllabus				CO Mapping
	MMB202, Unit 1	**Practical based on Cell observation**			
		Sub unit – a ,b.c			CO1, CO6
	MMB202, Unit 2	**Practical related to cell and cell organelle**			
		Sub unit –c			CO2, CO6
	MMB202, Unit 3	**Practical based to Transportation**			
		Sub unit – a			CO3, CO6
	MMB201, Unit 4	**Practical based upon Nucleus and Chromosomes**			
		Sub unit – c			CO4, CO6
	MMB201, Unit 5	**Practical related to Cytoskeleton and Cell to cell interaction**			
		Sub unit - a			CO5, CO6
	Mode of examination	Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		60%	0%	40%	
	Text book/s*	-			
	Other References				

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
BTP209.1	3	2	-	1	-	-	-	-	-	-	-	1	3	3	3
BTP209.2	3	2	-	2	-	-	-	-	-	-	-	1	3	2	2
BTP209.3	3	2	2	2	2	-	-	-	-	-	-	2	2	3	3
BTP209.4	3	2	-	2	-	-	-	-	-	-	-	2	3	2	2
BTP209.5	3	3	3	2	-	-	-	-	-	-	-	2	2	2	2
BTP209.6	-	-	-	1	-	-	-	-	-	-	-	3	2	2	2

BTY210: Instrumentation and Bioanalytical Techniques

School: SET		**Batch : 2019-23**	
Program: B. Tech		**Current Academic Year: 2020-21**	
Branch: Biotechnology		**Semester: Even (4th)**	
1	Course Code	BTY210	
2	Course Title	Instrumentation and Bioanalytical Techniques	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Compulsory	
5	Course Objective	1. The primary objectives of this course are to develop the skills to describe, illustrate and compare theory and practice of bio analytical techniques. 2. To evaluate, summarize and integrate analytical techniques for detailed interpretation of results.	
6	Course Outcomes	After successfully completion of this course students will be able to: CO1: Enumerate microscopic techniques to identify differences between cells, cell organelles and intracellular localization of nucleic acids/proteins. CO2: Classify and demonstrate sterilization techniques, and purification of water/proteins using dialysis/ultrafiltration. CO3: Illustrate and construct biosensors for biological systems. CO4: Separate and visualize nucleic acids/proteins using centrifugation and gel electrophoresis. CO5: Estimate nuclic cids/proteins using spectrophotometer, ELISA and chromatography. CO6: Create experiments for integrating bionalytical techniques for problem solving.	
7	Course Description	This course acts as a bridge between academics, research and industry. This course begins with basic bio analytical technique and serves to lessen the gap between theory, working principal, common instrumentation and possible applications of bio-analytical techniques. This course will be equally beneficial to various scientific areas including, life science, chemical science, material science and environmental science.	
8	Outline syllabus		CO Mapping
	Unit 1	**Microscopy**	**CO1, CO6**
	A	Components of microscopes	CO1
	B	Optical microscopy	CO1
	C	Transmission and Scanning electron microscopy	CO1, CO6
	Unit 2	**Physical Separation Techniques**	**CO2, CO6**
	A	Usage and applications of autoclave; Incubator; Oven; Rotary shaker	CO2
	B	Dialysis	CO2
	C	Ultrafiltration	CO2, CO6
	Unit 3	**Biosensors**	**CO3, CO6**
	A	Principle of biosensors	CO3
	B	Characteristics and components of biosensors	CO3
	C	Applications of biosensors	CO3, CO6
	Unit 4	**Centrifugation and Electrophoresis**	**CO4**
	A	Working and principle of centrifugation	CO4

	B	Preparative, differential and density gradient centrifugation			CO4
	C	Principle and applications of various types of electrophoresis			CO4, CO6
	Unit 5	**Spectrophotometer and Chromatography Techniques**			**CO5, CO6**
	A	Principle, Instrumentation, working and applications of Spectrophotometer			CO5, CO6
	B	Principle and applications of ELISA			CO5, CO6
	C	Paper chromatography and TLC			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. Wilson K. and Walker J., "Principles and Techniques of Biochemistry and Molecular Biology", Cambridge Press, 2010.			
	Other References	1. Cottenil R.M.S., "Biophysics: An Introduction", John Wiley and Sons, 2002. 2. Gupta A., "Instrumentation and Bioanalytical Techniques", Pragati Prakashan, 2009.			

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
BTY210.1	3	2	2	2	1				2	2		2	3	2	2
BTY210.2	2	2	2	1			1	1	1		1	2	3	2	2
BTY210.3	3	3	3	2	2	2	2	1	2		1	2	2	2	2
BTY210.4	2	3	2	2	2				2	1		2	3	2	3
BTY210.5	2	3	2	2	3	1	1		2	2	2	3	3	2	2
BTY210.6	3	2	2	2	1				2	2		2	3	2	2

BTY234: Molecular Biology

School: SET		**Batch : 2019-2023**	
Program: B. Tech		**Current Academic Year: 2021-2022**	
Branch: Biotechnology		**Semester: Odd (5th)**	
1	Course Code	BTY234	
2	Course Title	**MOLECULAR BIOLOGY**	
3	Credits	4	
4	Contact Hours (L-T-P)	3-1-0	
	Course Status	**Compulsory**	
5	Course Objective	1. To acquire a fundamental knowledge of central dogma of life relating processes of replication, transcription and translation. 2. To understand the different theories of recombination. 3. To learn about the fundamental concept of cancer and oncogenes.	
6	Course Outcomes	CO1: Differentiate between prokaryotic and eukaryotic replication, compare prokaryotic and eukaryotic transcription and examine the functions of different types of RNA polymerases. CO2: Demonstrate the regulation of transcription and identify post-transcriptional modifications. CO3: Experimentally demonstrate the process of translation in prokaryotes and eukaryotes and presence of post translational modification CO4: Recognize the process of recombination and formation of Holliday junction. CO5: Investigate the role of viral oncogenes, cellular oncogenes and tumour suppressor genes and proteins in cancer. CO6: Discuss the various aspects of central dogma and DNA repair mechanisms.	
7	Course Description	Molecular biology is a course to acquire a fundamental knowledge of central dogma of life relating processes of replication, transcription and translation. To understand the different theories of recombination. To learn about the fundamental concept of cancer and oncogenes.	
8	Outline syllabus		CO Mapping
	Unit 1	**DNA Replication**	CO1, CO2
	A	Process of replication in Prokaryotes.	
	B	Mechanism of DNA replication in Eukaryotes.	
	C	Enzymes and proteins involved in replication.	
	Unit 2	**Transcription**	
	A	Prokaryotic and eukaryotic initiation of transcription.	CO1, CO3

	B	Elongation and termination of m RNA synthesis.			
	C	Regulation of transcription and posttranscriptional modifications.			
	Unit 3	**Translation**			CO4 and CO6
	A	Comparison of prokaryotic and eukaryotic translation mechanism			
	B	Post translational modification			
	C	Operon concept and lac, trp operons.			
	Unit 4	**DNA repair and Recombination**			CO5
	A	DNA repair mechanisms and their types.			
	B	Holliday junction			
	C	Process of recombination.			
	Unit 5	**Molecular Biology in Oncology**			CO5 and CO6
	A	Viral and cellular oncogenes			
	B	Tumour suppressor genes.			
	C	Role of p53			
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	Molecular Biology Lab Fax. T.A. Brown (Ed.), bios Scientific Publishers Ltds., Oxford, 1991			
	Other References	1. Molecular biology of the Gene (4th Edition),J .D. Watson, N. H. Hopkins, J. W. Roberts,J.A. Steitz and A.M. 2. Molecular Cell biology (2nd Edition) J. Darnell, H. Lodish and D. Baltimore, Scientific American Books, USA, 1994. 3. Molecular Biology of the Cell (2nd Edition) B. Alberts, D.Bray, J.Lewis, M.Raff, K. Roberts, and J.D. Watson, Garland publishing. Inc., New York, 1994.			

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
BTY234.1	3	2	-	1	-	-	-	-	-	-	-	-	-	-	1
BTY234.2	3	2	-	2	-	-	-	2	-	-	-	1	2	-	-
BTY234.3	3	2	2	2	2	-	3	-	-	2	-	2	2	3	2
BTY234.4	3	2	-	2	-	-	-	-	2	-	-	-	-	-	-
BTY234.5	3	3	3	2	3	3	-	-	-	-	-	2	3	3	-
BTY234.6	3	2	1	-	-	2	-	-	1	-	-	-	2	-	-

BTY235: Biochemistry

School: SET		**Batch : 2019-2023**	
Program: B. Tech		**Current Academic Year: 2021-22**	
Branch: Biotechnology		**Semester: Even (4th)**	
1	Course Code	**BTY235**	
2	Course Title	**Biochemistry**	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	**Compulsory**	
5	Course Objective	1. Understand the overall organization of the biochemical metabolism. 2. Describe the structure and function of various biomolecules in maintaining balance in body. 3. Appreciate the function of Vitamins and their deficiency related diseases.	
6	Course Outcomes	CO1: Identify the five classes of polymeric biomolecules and their monomeric building blocks. CO2: Demonstrate the breakdown of glucose and synthesis of ATP. CO3: Elaborate different types of lipids and their metabolism. CO4: Verify the structure of amino acids, and demonstrate how they are responsible for protein building. CO5: Describe structure of nucleotides and nucleosides and their role in making structure of DNA and RNA. CO6: Correlate vitamins, their types and deficiency with origin and progression of diseases.	
7	Course Description	The Biochemistry is designed to equip students with a broad understanding of the chemical and molecular events involved in biological processes. It helps students in understanding of structural and functional aspects of different biomolecules. The Biochemistry provides a foundation for careers in medicine, biotechnology, or research in all branches of the biological sciences.	
8	Outline syllabus		CO Mapping
	Unit 1	**Carbohydrate metabolism**	
	A	Structure and Classification of carbohydrates	CO1, CO2
	B	Glycolysis and TCA cycle	
	C	Electron Transport chain	
	Unit 2	**Lipids- structure and metabolism**	
	A	Function of lipids	
	B	Classification of lipids	CO1, CO3
	C	Beta oxidation of fatty acids and Ketone bodies	

	Unit 3	**Amino acids and Proteins**			
	A	Structure and classification of amino acids			CO1 and CO4
	B	Levels of protein structure			
	C	Function of proteins			
	Unit 4	**Purines and Pyrimidines**			
	A	Purines and Pyrimidines			CO1 and CO5
	B	Nucleosides and nucleotides			
	C	DNA and RNA structure			
	Unit 5	**Vitamins**			
	A	Function of Vitamins			CO1 and CO6
	B	Types of Vitamins			
	C	Disorders related to vitamin deficiency			
	Mode of examination	**Theory**/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	David L Nelson, Michael M Cox, "Principles of Biochemistry" W. H. Freeman; Seventh edition Jan, 2017.			
	Other References	3. Biochemistry by Voet and Voet, Wiley New York, April 2012. 4. Biochemistry by Stryer, W. H. Freeman, 2019			

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
BTY235.1	2	2	-	1	-	2	-	-	-	-	-	-	-	-	-
BTY235.2	3	2	-	2	-	-	-	-	-	3	-	1	-	-	-
BTY235.3	3	2	2	2	2	2	-	1	-	-	-	2	2	3	-
BTY235.4	2	2	-	2	-	-	-	-	3	-	-	-	-	-	-
BTY235.5	2	3	3	2	3	3	-	-	-	-	2	2	3	3	-
BTY235.6	2	3	2	3	1	3	-	-	-	-	-	2	2	1	-

BTP210: Instrumentation and Bio analytical Techniques Lab

School: SET		**Batch: 2019-23**			
Program: B.Tech		**Current Academic Year: 2021-22**			
Branch: Biotechnology		**Semester: Even (4th)**			
1	Course Code	BTP210			
2	Course Title	**Instrumentation And Bioanalytical Techniques Lab**			
3	Credits	1			
4	Contact Hours (L-T-P)	0-0-2			
	Course Status	**Compulsory**/Elective			
5	Course Objective	To give students a thorough understanding of tools and techniques in Biomedical and Biotechnology Laboratories. To make students learn the working and operation of various biotechnological instruments			
6	Course Outcomes	CO1: Operate autoclave, Laminar Air flow and Hot air oven and sterilize glass and plasticwares. CO2: Operate centrifuge and refrigerated centrifuge and separate cell components. CO3: Separate and visualize nucleic acids and proteins using gel electrophoresis. CO4: Operate spectrophotometer and perform absorbance assays. CO5: Separation of pigments, drugs, amino acids and hormones using chromatographic techniques. CO6 : Operation and working of different instruments and bioanalytical techniques			
7	Course Description	This course is designed to make students learn about various instruments and techniques of biomedical and biotechnology laboratory and will also enable them to use and apply these techniques and equipments to solve experimental problems.			
8	Outline syllabus				CO Mapping
	Unit 1	**Practical based on Sterillization**			CO1
		Sub unit - a, b and c detailed in Instructional Plan			CO1
	Unit 2	**Practical related to centrifuge**			CO2
		Sub unit - a, b and c detailed in Instructional Plan			CO2
	Unit 3	**Practical related to gel electrophoresis**			CO3
		Sub unit - a, b and c detailed in Instructional Plan			CO3
	Unit 4	**Practical related to spectrophotometer**			CO4
		Sub unit - a, b and c detailed in Instructional Plan			CO4
	Unit 5	**Practical related to chromatography**			CO5
		Sub unit - a, b and c detailed in Instructional Plan			CO5
	Mode of exam	Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		60%	0%	40%	
	Text book/s*	Wilson K. and Walker J., "Principles and Techniques of Biochemistry			

		and Molecular Biology", Cambridge Press, 2010.
	Other References	1. Cottenil R.M.S., "Biophysics: An Introduction", John Wiley and Sons, 2002. 2. Gupta A., "Instrumentation and Bioanalytical Techniques", Pragati Prakashan, 2009.

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
BTP210.1	3	2	2	2	1				2	2		2	3	2	2
BTP210.2	2	2	2	1			1	1	1		1	2	3	2	2
BTP210.3	3	3	3	2	2	2	2	1	2		1	2	2	2	2
BTP210.4	2	3	2	2	2				2	1		2	3	2	3
BTP210.5	2	3	2	2	3	1	1		2	2	2	3	3	2	2
BTP210.6	3	2	2	2	1				2	2		2	3	2	2

BTP307: Molecular Biology Lab

School: SET		**Batch: 2019-23**	
Program: B. Tech		**Current Academic Year: 2020-21**	
Branch: Biotechnology		**Semester: Even (4th)**	
1	Course Code	BTP307	
2	Course	Molecular Biology Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Compulsory	
5	Course Objective	1. To familiarize students with sterilization techniques and solution/media preparations etc. 2. To motivate students towards molecular techniques for better genome understanding. 3. To acquaint with principles, technical requirement, scientific and commercial applications in molecular biology. 4. Design and manage techniques for understanding interplay amongst macromolecules.	
6	Course Outcomes	CO1: Demonstrate safe laboratory practices and handle the equipment safely. CO2: To isolate the nucleic acids/ proteins from given tissue samples. CO3: To design primers and carry out amplification of DNA fragments using PCR. CO4: To analyse quality and quantity of biomolecules by Electrophoresis. CO5: To analyse quality and quantity of biomolecules by Spectrophotometer. CO6: To correlate and apply the techniques learnt to resolve practical problems in varied fields of Biotechnology.	
7	Course Description	The aim of this course is to acquaint the students about the versatile tools and techniques employed in molecular biotechnology. The course will also provide students with a hands-on understanding of how modern DNA-sequencing technology, along with bioinformatic tools, can be used to discover genetic differences and understand molecular function.	
8	Outline syllabus		CO Mapping
	Unit 1	**Practical based on introduction to molecular biology lab**	**CO1, CO6**
	A	Good lab practices in molecular biology laboratory.	
	B	Sterilization Techniques	
	C	Preparation of standard solutions for molecular biology experiments	
	Unit 2	**Isolation of Nucleic acids/ proteins**	**CO2, CO6**
	A	Preparation of working solution of buffers for isolation of nucleic acids/ proteins.	

	B	Isolation of nucleic acids/ proteins from plant.			
	C	Elusion and storage at -20 Degree Celsius.			
	Unit 3	**Practical related to gene amplification**			**CO3, CO6**
	A	Designing of primers for PCR.			
	B	Demonstration of Thermo-cycler and its programming.			
	C	Performing PCR reactions			
	Unit 4	**Practical related to Electrophoresis**			**CO4, CO6**
	A	Preparation of samples and working solution of TAE buffer for Electrophoresis.			
	B	Separation of nucleic acids/ proteins using Electrophoresis.			
	C	Visualization on Trans-Illuminator.			
	Unit 5	**Practical related to Spectrophotometer.**			**CO5, CO6**
	A	Preparation of standard curve and samples.			
	B	Observation of sample's OD reading on Spectrophotometer.			
	C	Estimation of sample using standard curve			
	Mode of examination	Practical and/or Viva			
	Weightage Distribution	CA	MTE	ETE	
		60%	0%	40%	
	Text book/s	Michael, R. G., Sambrook. J., "Molecular Cloning-A Laboratory Manual", 4th edition, Cold Spring Harbor Laboratory Press, 2012.			
	Other References	1. Davis, L. (2012). Basic methods in molecular biology. Elsevier. 2. Chard, T., Work, T. S., & Work, E. (1987). Laboratory techniques in biochemistry and molecular biology. Elsevier, Amsterdam.			

COURSE ARTICULATION MATRIX

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
BTP307.1	3	-	-	2	-	1	-	-	3	2	-	3	3	1	2
BTP307.2	3	-	-	1	-	-	-	-	2	-	-	2	3	2	3
BTP307.3	3	3	3	2	3	-	-	-	2	-	-	2	3	1	2
BTP307.4	3	3	2	3	3	-	-	-	3	-	1	2	3	-	2
BTP307.5	3	-	3	1	-	2	2	-	3	-	-	3	3	1	3
BTP307.6	3	3	3	3	3	3	1	-	3	-	1	3	3	2	2

BTY320: Microbiology

School: SET		**Batch : 2019-23**
Program: B. Tech		**Current Academic Year: 2021-22**
Branch: Biotechnology		**Semester: Odd (5th)**
1	Course Code	BTY320
2	Course Title	Microbiology
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Compulsory
5	Course Objective	1. To explain relationships and apply appropriate terminology relating to the structure, metabolism, and ecology of prokaryotic microorganisms, eukaryotic microorganisms, and viruses. 2. To explain the principles of physical and chemical methods used in the control of microorganisms and apply this understanding to the prevention and control of infectious diseases. 3. To develop the appropriate laboratory skills and techniques related to the isolation, staining, identification, assessment of metabolism, and control of microorganisms. 4. To develop an information base for making personal health decisions concerning infectious diseases.
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Analyse, identify, characterise, and classify the bacteria in terms of nutritional development, oxygen requirement and other characters. CO2: Apply different techniques for isolation and culture of bacteria in laboratory under both aerobic and anaerobic conditions, and also they can determine factors affecting growth and methods of growth determination. CO3: Explain the bacterial reproduction and comprehend the kinetics of bacterial growth in terms of growth phases, generation time, and yields. CO4: Determine the impact of microbes on human health, examine physical and chemical methods used in the control of microorganisms, and apply this understanding to the prevention and control of infectious diseases. CO5: Understand about the viruses and its life cycle. CO6: Learn about the characteristics and life cycle of different microorganisms and apply different techniques for culture and control of microbes.
7	Course Description	This course covers principles of microbiology with emphasis on life cycle of microorganisms and its application. Topics include History

		of microbiology and different culture techniques, multiplication of bacteria, significance and control of bacteria and viruses and life cycle of viruses.			
8	Outline syllabus				CO Mapping
	Unit 1	**Ultra structure of Bacteria**			**CO1, CO6**
	A	History of Microbiology			
	B	Ultra Structure of bacteria, nutrition of bacteria			
	C	Concept of PPLO, Archaea, Cyanobacteria			
	Unit 2	**Methods of Bacterial Culture**			**CO2, CO6**
	A	Pure culture, Method of isolating pure culture (Streak-plate technique, Pour-plate and spread-plate technique),			
	B	Factors affecting growth of bacteria - Physicochemical			
	C	Factors affecting growth of bacteria – Nutritional			
	Unit 3	**Growth and Reproduction in Bacteria**			**CO3, CO6**
	A	Modes of cell division -Binary fission, Budding and Septum formation.			
	B	Growth curve, Synchronous and Asynchronous growth			
	C	Kinetics of Bacterial Growth			
	Unit 4	**Significance of Bacteria and methods of control**			**CO4, CO6**
	A	Microbes in medical & chemical industry			
	B	Microbes in food industry			
	C	Physical and chemical methods to control bacteria			
	Unit 5	**Virus and Its Control**			**CO5, CO6**
	A	Ultra-structure of Virus and its types			
	B	Lytic and lysogenic cycles			
	C	Diseases Caused by Viruses, Methods to Control Viruses			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. ***Microbiology - Pelczar,*** M.J. Reid, R.D. and E.C.S. Chan, Tata Mc Graw Hill, New Delhi.1977 (4th Edition)			
	Other References	1. **Prescott**, **Harley** and **Kelvin** – **Microbiology**, 2nd ed. TMH Publication 2. General Microbiology: Roger & Strainer et.al. PHL Publication			

COURSE ARTICULATION MATRIX

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
BTY320.1	3	-	-	1	-	-	-	-	2	-	-	1	3	2	2
BTY320.2	3	-	3	1	3	-	-	-	-	-	-	3	3	3	2
BTY320.3	3	3	3	2	3	-	-	2	1	-	-	3	3	3	3
BTY320.4	3	1	2	2	-	-	-	3	-	-	-	2	3	2	2
BTY320.5	3	1	3	1	2	2	-	3	3	-	-	1	3	3	2
BTY320.6	3	3	3	3	3	3	-	3	3	-	-	2	3	3	2

BTY310: Recombinant DNA Technology

School: SET		**Batch : 2019-2023**	
Program: B. Tech		**Current Academic Year: 2021-22**	
Branch: Biotechnology		**Semester: Odd (5th)**	
1	Course Code	**BTY310**	
2	Course Title	**Recombinant Dna Technology**	
3	Credits	4	
4	Contact Hours (L-T-P)	3-1-0	
	Course Status	Compulsory	
5	Course Objective	1. To understand the basic principles of recombinant DNA technology. 2. To learn about applications of PCR 3. To Analyze sequencing of nucleic acid, 4. To undersdtand Blotting techniques, antisense RNA technology and cDNA cloning	
6	Course Outcomes	CO1: Test the ability of restriction endonucleases and other modification enzymes used in genetic engineering CO2: Correlate between DNA isolation methods from plants, bacteria and animal cells. CO3: Perform gene amplification using polymerase chain reaction and demonstrate DNA sequencing methods. CO4: Use different types of cloning and expression vectors for genetic transformation. CO5: Knock down gene expression by antisense RNA technology and ribozyme technology and able to introduce gene for treating human genetic disorders. CO6: Understanding of Different methods of gene manipulation and creation of transgenic cells.	
7	Course Description	This course covers various enzymes used in Genetic manipulation, Cloning Vectors and Method of Transformations, Gene Isolation Approaches, PCR amplification, cDNA cloning Ribozymes and antisense RNA Technology. It also gives introductory idea about CRISPR technology.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Genetic Engineering**	
	A	Milestones of Genetic engineering	CO1, CO6
	B	Introduction to gene cloning	
	C	Laboratory requirements	
	Unit 2	**Enzymes used in Genetic Engineering**	
	A	Restriction and modification system	
	B	DNA polymerases	CO1

	C	End labelling and steps to cloning			
	Unit 3	**Isolation, amplification and sequencing of nucleic acid**			
	A	Isolation of nucleic acid			
	B	PCR and its application			CO 3
	C	Nucleic acid sequencing			
	Unit 4	**cDNA Synthesis and Cloning**			
	A	Cloning vectors.			CO4
	B	Reverse transcription and cDNA cloning.			
	C	Screening methods			
	Unit 5	**Techniques in Biotechnology**			
	A	Blotting techniques			CO5 and CO6
	B	Antisense RNA and Ribozyme technology			
	C	Genome editing by CRISPR/Cas9			
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. Griffiths J. F. "Introduction to Genetic Analysis", W. H. Freeman, 2010.			
	Other References	4. J. Sambrook. E. F. Fritsch and T. Maniatis, "Molecular Cloning: a Laboratory Manual" Cold Spring Harbor Laboratory Press, New York, 2000. 5. S.B. Primrose, "Molecular Biotechnology" Blackwell Scientific Publishers, Oxford, 1994.			

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
BTY310.1	3	2	-	1	-	-	-	-	-	-	-	-	-	-	1
BTY310.2	3	2	-	2	-	-	-	2	-	-	-	1	2	-	-
BTY310.3	3	2	2	2	2	-	3	-	-	2	-	2	2	3	2
BTY310.4	3	2	-	2	-	-	-	-	2	-	-	-	-	-	-
BTY310.5	3	3	3	2	3	3	-	-	-	-	-	2	3	3	-
BTY310.6	3	2	2	-	1	3	-	-	-	-	-	2	1	-	-

BTY321: Bioinformatics

School: SET		**Batch: 2019-23**
Program: B. Tech		**Current Academic Year: 2021-22**
Branch: Biotechnology		**Semester: Odd (5th)**
1	Course Code	BTY321
2	Course Title	Bioinformatics
3	Credits	2
4	Contact Hours (L-T-P)	2-0-0
	Course Status	**Compulsory**/Elective/Open Elective
5	Course Objective	1. To acquire an advanced knowledge of bioinformatics tools used for designing and analyzing *in silico* experiments and different techniques used for molecular modeling. 2. This course surveys a wide range of biological databases and their access tools and enables students to develop proficiency in their use. 3. The course also focuses on the design of biological databases and examines issues related to heterogeneity, interoperability, complex data structures, object orientation and tool integration.
6	Course Outcomes	After successfully completion of this course students will be able to: CO1: Students will be able to understand about fundamental of bioinformatics and also having insight about various databases and tools. CO2: Students will have basic knowledge about information molecules (DNA, RNA and proteins), their structure and functions. CO3: Develop computing tools for analyzing various kinds of biological and experimental data, data mining from databases, computer simulation of living systems and so on. CO4: Will gain knowledge about various alignment tools and their applications. CO5: Will gain knowledge about gene, genome and genome analysis. CO6: Overall knowledge about basic computational biology and their applications in biotechnology.
7	Course Description	1. Analyze sequence similarity search using BLAST. 2. Examine phyolgenetic relationship using clustal and parsimony. 3. Assess motif consensus by Markov model. 4. Identify regulatory sequence by Meme. 5. Determine structure of biomolecules by software (Pymol, Rasmol) and database. 6. Compute structure of biomolecules using modeling and docking. 7. Perform microarray and protein array analysis for drug target identification and gene prediction.
8	Outline syllabus		CO Mapping
	Unit 1	**Bioinformatics and Databases**	

	A	Introduction to bioinformatics			CO1, CO6
	B	Scope and importance			CO1, CO6
	C	Major bioinformatics databases and tools			CO1, CO6
	Unit 2	**Information Molecules and Sequence Analysis**			
	A	Information molecules, Information Flow and DNA sequencing, Protein structure, functions and protein folding, Nucleic acid protein interaction			CO2, CO6
	B	BLAST			CO2, CO6
	C	Sequence assembly, Clustal, phylogenetics: distance based approaches, parsimony			CO2, CO6
	Unit 3	**Data Storage and Analysis**			
	A	File Format (Genbank, DDBJ, FASTA, PDB, SwissProt)			CO3, CO6
	B	Introduction to Metadata; File Storage; Boolean Search and Fuzzy Search			CO3, CO6
	C	Representation of molecular structures (DNA, mRNA, protein), secondary structures, domains and motifs			CO3, CO6
	Unit 4	**Sequence Alignments and Analysis**			
	A	Sequence alignment			CO4, CO6
	B	Global and Local alignment, Pairwise alignment and Multiple sequence alignment			CO4, CO6
	C	Phlylogenetic tree analysis			CO4, CO6
	Unit 5	**Gene , Genome and Analysis**			
	A	Structure of Prokaryotic and Eukaryotic gene; DNA and genome sequencing Motif and consensus			CO5, CO6
	B	Gene finding: composition based finding			CO5, CO6
	C	Sequence motif-based finding			CO5, CO6
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. Lesk A., *Introduction to Bioinformatics, 3rd Edition.* Oxford University Press (2008). 2. Dan E. Krane and Michael L. Raymer., *Fundamental Concepts of Bioinformatics, 3rd Edition*, Pearson Education (2009). 3. Xiong J., *Essential Bioinformatics.* Cambridge University Press (2006).			
	Other References	NA			

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
BTY321.1	2	2	-	1	-	2	-	-	-	-	-	-	-	-	-
BTY321.2	3	2	-	2	-	-	-	-	-	3	-	1	-	-	-
BTY321.3	3	2	2	2	2	2	-	1	-	-	-	2	2	3	-
BTY321.4	2	2	-	2	-	-	-	-	3	-	-	-	-	-	-
BTY321.5	2	3	3	2	3	3	-	-	-	-	2	2	3	3	-
BTY321.6	2	3	2	3	1	3	-	-	-	-	-	2	2	1	-

BTP214: Microbiology Lab

School: SET		**Batch: 2019-23**			
Program: B. Tech		**Current Academic Year: 2021-22**			
Branch: Biotechnology		**Semester: Odd (5th)**			
1	Course Code	BTP214			
2	Course Title	Microbiology Lab			
3	Credits	1			
4	Contact Hours (L-T-P)	0-0-2			
	Course Status	Compulsory/Elective			
5	Course Objective	• To develop knowledge of various safety measures implemented in microbiology lab. • To give students a thorough understanding of various microbiological techniques for obtaining pure culture			
6	Course Outcomes	CO1 : Learn safety measures in microbiological laboratory CO2 : Understand various methodologies to work in contamination free environment CO3 : Prepare media for culturing various microorganisms CO4 : Isolate pure microorganism of choice using pure culture techniques CO5 : Prepare agar slants for subculture and storage of various microorganisms. CO6 : Learn various methods to isolate, handle, store and work with various micro-organisms under aseptic conditions			
7	Course Description	This course is designed to make students learn about various microbiological techniques for isolation, working and storage of various microorganisms and will also enable them to use and apply these techniques to solve experimental as well as industrial problems.			
8	Outline syllabus				CO Mapping
	Unit 1	**Practical based on semi-conductors**			CO1
		Sub unit - a, b and c detailed in Instructional Plan			CO1
	Unit 2	**Practical related to --**			CO2
		Sub unit - a, b and c detailed in Instructional Plan			CO2
	Unit 3	**Practical related to---**			CO3
		Sub unit - a, b and c detailed in Instructional Plan			CO3
	Unit 4	**Practical related to---**			CO4
		Sub unit - a, b and c detailed in Instructional Plan			CO4
	Unit 5	**Practical related to---**			CO5
		Sub unit - a, b and c detailed in Instructional Plan			CO5
	Mode of examination	Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		60%	0%	40%	

	Text book/s*	Practical Manual of Biotechnology, By Ritu Mahajan, Jitender Sharma, R.K. Mahajan	

COURSE ARTICULATION MATRIX

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
BTY320.1	3	-	-	1	-	-	-	-	2	-	-	1	3	2	2
BTY320.2	3	-	3	1	3	-	-	-	-	-	-	3	3	3	2
BTY320.3	3	3	3	2	3	-	-	2	1	-	-	3	3	3	3
BTY320.4	3	1	2	2	-	-	-	3	-	-	-	2	3	2	2
BTY320.5	3	1	3	1	2	2	-	3	3	-	-	1	3	3	2
BTY320.6	3	3	3	3	3	3	-	3	3	-	-	2	3	3	2

BTP310: Recombinant DNA Technology Lab

School: SET		**Batch: 2019-23**	
Program: B. Tech		**Current Academic Year: 2021-22**	
Branch: Biotechnology		**Semester: Odd 5th**	
1	Course Code	BTP310	
2	Course Title	Recombinant DNA Technology Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Compulsory	
5	Course Objective	1. To illustrate creative utility of modern tools and techniques for manipulation of genomic sequences. 2. To expose students to application of recombinant DNA technology in biotechnological research. 3. To train students in strategizing research methodologies employing genetic engineering techniques. 1. 4. To acquaint the students for analyzing modification carried out in genomic sequences.	
6	Course Outcomes	CO1: Development of an ability to design and conduct genetic engineering experiments. CO2: Development of an ability to analyse and interpret data of modified genomic/proteomic nature. CO3: Amalgamation of tools for creating diversification in genome. CO4: Perform time course analysis of gene expression CO5: Development of research aptitude and technical skills to secure a job in genetic engineering. CO6: To correlate and apply the techniques learnt to resolve practical problems in varied fields of Biotechnology.	
7	Course Description	The aim of this course is to acquaint the students about versatile tools and techniques employed in genetic engineering. A sound knowledge on methodological repertoire allows students to innovatively apply these in basic and applied fields of biological research. This course provides applied part of the theory by utilizing DNA modifying enzymes, cloning strategies, vector types, host genotype specificities for selection and screening of recombinants and/or recombinant transformants. This course may be deemed as a foundation course serving as a platform for introduction of more advanced cutting-edge technologies that essentially are an amalgamation of basic techniques combined in diverse forms and sequence.	
8	Outline syllabus		CO Mapping
	Unit 1	**Practical based on introduction to Recombinant DNA Technology lab**	**CO1, CO6**
	A	Good lab practices in Recombinant DNA Technology	

		laboratory and Sterilization Techniques			
	B	Preparation of CTAB Buffer for genomic DNA isolation.			
	C	Isolation of genomic DNA from given plant sample.			
	Unit 2	**Practical related to gene amplification**			**CO2, CO6**
	A	Designing of primers for PCR.			
	B	Demonstration of Thermo-cycler and its programming.			
	C	Performing PCR reactions to amplify the desired gene.			
	Unit 3	**Practical related to preparation of recombinant plasmids**			**CO3, CO6**
	A	Plasmid isolation			
	B	Restriction digestion of plasmids			
	C	Ligation of desired gene in the plasmid vector.			
	Unit 4	**Practical related to Electrophoresis**			**CO4, CO6**
	A	Preparation of samples and working solution of TAE buffer for Electrophoresis.			
	B	Separation of DNA samples using Agarose Gel Electrophoresis.			
	C	Visualization on Trans-Illuminator.			
	Unit 5	**Practical related to Transformation & Selection**			**CO5, CO6**
	A	Transformation of recombinant vector in bacterial host.			
	B	Selection of transformed cells			
	C	Culturing of transformed cells for gene cloning/ expression and its validation.			
	Mode of examination	Practical and/or Viva			
	Weightage Distribution	CA	MTE	ETE	
		60%	0%	40%	
	Text book/s	Michael, R. G., Sambrook. J., "Molecular Cloning-A Laboratory Manual", 4th edition, Cold Spring Harbor Laboratory Press, 2012.			
	Other References	Frederick. M., Ausubel., Brent R., Kingston. R. E., Moore D.D., Seidman J. G., John A. Smith and Kevin Struhl, "Current Protocols in Molecular Biology", John Wiley& Son, Inc., 2003.			

COURSE ARTICULATION MATRIX

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
BTP310.1	3	3	-	2	-	2	-	-	2	3	-	3	2	2	3
BTP310.2	3	-	-	1	-	-	-	-	2	-	-	2	3	2	2
BTP310.3	3	2	3	2	3	-	-	-	2	-	-	3	3	1	2
BTP310.4	3	3	2	3	3	-	-	-	3	2	1	2	2	-	2
BTP310.5	3	-	3	1	-	2	2	-	3	-	-	3	3	1	3
BTP310.6	3	3	3	3	3	3	1	-	3	-	1	3	3	2	2

BTY318: Bioprocess Engineering

School: SET		**Batch : 2019-23**
Program: B. Tech		**Current Academic Year: 2021-22**
Branch: Biotechnology		**Semester: 6 (Even)**
1	Course Code	**BTY318**
2	Course Title	**Bioprocess Engineering**
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Compulsory
5	Course Objective	1. To enable students bridge the gap between theoretical concepts and practical aspects in industrial settings 2. In-depth knowledge of laboratory/industrial skills required for employment or for creation of employment in bioprocess engineering. 3. Knowledge to develop industrial process to produce antibiotics, vitamins, vaccines and organic solvents using a bioreactor.
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Comprehend the different types of microorganisms and techniques for their production. CO2: Apply the different techniques used in upstream processing along the method for calculation of death kinetics of microorganisms. CO3: Understand the concept of bioreactor design to achieve the desired results (i.e. specified cell concentration, production rates, etc) and apply the models for analysis of immobilized enzymatic bioreactors. CO4: Calculate the heat and mass transfer, which is major component in efficiency of bioreactor. CO5: Understand the industrial production of different biomolecules, organic compounds and solvents. CO6: Be familiar with the different bioprocess engineering methods for the production of important microbial products. In addition, they will be able to design process/bioreactors for microbial production of different compounds.
7	Course Description	The subject provides a deeper basis of modern bioprocess technology. It specifically concentrates on bioprocess engineering and bioreactor

		operation. A considerable part is devoted to the growth analysis using process analytical technology (PAT) and the evaluation of process data in connection to the generally used cultivation principles.			
8	Outline syllabus				CO Mapping
	Unit 1	**Microbial Biomass and its production**			CO1, CO6
	A	Various types of microbial biomass			CO1
	B	Bakers and brewer's yeast; food and fodder yeast			CO1
	C	Single cell protein			CO1
	Unit 2	**Fermentation**			CO2, CO6
	A	Inoculum Development; Mode of fermentation (Batch, fed-batch and continuous)			CO2
	B	Types of fermentation (Solid-state and Submerged),			CO2
	C	Sterilization and death kinetics			CO2
	Unit 3	**Bioreactor Operations**			CO3, CO6
	A	Types of bioreactors			CO3
	B	Components of Bioreactors and their role			CO3
	C	Factors affecting fermentation			CO3
	Unit 4	**Downstream Processing**			CO4, CO6
	A	Separation by filtration and centrifugation			CO4
	B	Cell disruption techniques			CO4
	C	Purification by extraction techniques			CO4
	Unit 5	**Industrial Applications**			CO5, CO6
	A	Industrial production of Enzymes and vitamins			CO5
	B	Industrial production of Citric acid and ethanol			CO5
	C	Industrial production of antibiotics and biopolymers			CO5
	Mode of examination	**Theory**/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. Michael L. Shuler and Fikret Kargi (2009, Second edition) Bioprocess Engineering-Basic concepts. Pearson Prentice Hall 2. Biochemical & Biological Engg. Science, N. Blakebraugh, Academic Press, 2007.			
	Other References	1. Biochemical Engg. Bailly & Ollis, Academic Press, 1986. 2. P. F. Stanbury, S. J. Hall and A. Whitaker, Principles of Fermentation Technology, 2nd Edn., Elsevier, Science & Technology Books, 2005. 3. Introduction to Chemical Engg. Series, MCH Int. Series, 2008. 4. B.D.Singh (2009, Revised edition) Biotechnology-Expanding Horizons. Kalyani publishers, Ludhiana-141008			

COURSE ARTICULATION MATRIX

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
BTY318.1	3	-	-	1	-	-	-	-	3	-	-	3	3	1	2
BTY318.2	3	-	-	1	-	-	-	-	3	-	-	3	3	1	3
BTY318.3	3	3	3	2	3	-	-	-	2	-	-	2	3	-	2
BTY318.4	3	3	3	2	3	-	-	-	-	-	1	2	3	-	2
BTY318.5	3	-	3	1	-	2	2	-	3	-	-	3	3	1	3
BTY318.6	3	3	3	3	3	3	1	-	3	-	1	2	3	1	2

BTY319: Signal Transduction

School: SET		**Batch : 2019-2023**	
Program: B. Tech		**Current Academic Year: 2021-22**	
Branch: Biotechnology		**Semester: 06**	
1	Course Code	**BTY319**	
2	Course Title	**Signal Transduction**	
3	Credits	3	
4	Contact hours (L-T-P)	3-0-0	
	Course Status	Compulsory	
5	Course Objective	5. To understand how communication takes place between different cells in the body. 6. To elucidate the signal transduction pathways involved in several diseases which is important to define the new target for drug development.	
6	Course Outcomes	CO1: Determine the types of communication and cross-talk between cells. CO2: Analyse the progression of signals inside the cell.. CO3: Identify the role of secondary messengers in signalling pathways. CO4: Perform covalent modification (phosphorylation) by using serine/threonine and tyrosine protein kinases CO5: Discuss the role of Phosphatases in cell signalling CO6: Understand the mechanism of Apoptosis and its role in cancer.	
7	Course Description	Signal transduction is a course designed to understand various pathways of intermediary signalling in cell. Also to understand role of various ligands and receptors in transmitting signal from outside to level of regulation of gene expression.	
8	Outline syllabus		CO Mapping
	Unit 1	**Cellular Communication**	
	A	Different ways of intercellular communication	CO1, CO2
	B	Extracellular matrix	
	C	Neurotransmitters and neurohormones.	
	Unit 2	**Types of receptors**	
	A	Different types of cellular receptors	
	B	G-Protein linked receptors	CO1, CO3
	C	Ion channel linked, Enzyme linked receptors	
	Unit 3	**Secondary messengers**	
	A	Types of secondary messengers	CO3 and CO4
	B	Cyclic nucleotides- cAMP and cGMP	
	C	Lipid and lipid derived second messengers.	
	Unit 4	**Kinases and Phosphatases**	

	A	Kinases and their types			CO4
	B	Phosphatases and their types			
	C	Role of Kinases and phosphatases in cellular signaling			
	Unit 5	**Apoptosis**			
	A	Apoptosis vs Necrosis			CO5 and CO6
	B	Classification and functions of caspases			
	C	Intrinsic and Extrinsic death pathways			
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	2. Krauss G., "Biochemistry of Signal Transduction and Regulation", Wiley-VCH, 2008.			
	Other References	6. Hancock J.T., "Cell Signalling", Oxford University Press, 2010. 7. Gomperts B.D., Kramer I.M. and Tatham P.E.R., "Signal Transduction", Academic Press, 2009.			

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
BTY319.1	3	2	-	1	-	-	-	-	-	-	-	-	-	-	1
BTY319.2	3	2	-	2	-	-	-	-	-	-	-	1	2	-	-
BTY319.3	3	2	2	2	2	-	-	-	-	-	-	2	2	3	2
BTY319.4	3	2	-	2	-	-	-	-	-	-	-	-	-	-	-
BTY319.5	3	3	3	2	3	-	-	-	-	-	-	2	3	3	-
BTY319.6	2	1	3	2	-	-	-	-	-	-	-	2	1	2	1

BTP306: Bioprocess Engineering Lab

School: SET		**Batch: 2019-23**
Program: B. Tech		**Current Academic Year: 2021-22**
Branch: Biotechnology		**Semester: 6th (Even)**
1	Course Code	BTP306
2	Course Title	**Bioprocess Engineering Lab**
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	Compulsory/Elective
5	Course Objective	1. To enable students bridge the gap between theoretical concepts and practical aspects in industrial settings 2. In-depth knowledge of laboratory/industrial skills required for employment or for creation of employment in bioprocess engineering. 3. Knowledge to develop industrial process to produce antibiotics, vitamins, vaccines and organic solvents using a bioreactor.
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Use the fermenter and its components CO2: Understand the different modes of fermentation and their advantages and disadvantages. CO3: Understand the microbial growth kinetics and fermentative production of enzymes. CO4: Estimate the total protein and enzyme activity CO5: Apply different techniques of downstream processing for separation and purification of biomolecules CO6: Apply different techniques used in fermentative production of biomolecules and their downstream processing.
7	Course Description	**Bioprocess engineering**, is a specialization of biotechnology, It deals with the design and development of reactor and processes for the manufacturing of products such as like enzymes, acids, biopolymers etc. This lab covers the design of bioreactor and its operations.
8	Outline syllabus		CO Mapping
	Unit 1	**Bioreactor operation**	**CO1, CO6**
		Demonstration of working of glass bioreactor	
		Demonstration of working principles of various components of a batch bioreactor	
	Unit 2	**Mode of fermentation**	**CO2, CO6**
		Citric acid production by Solid-state fermentation	
		Citric acid production by Submerged fermentation	
	Unit 3	**Microbial Growth and fermentation**	**CO3, CO6**

		Growth kinetic studies of *Aspergillus niger* under controlled conditions			
		Fermentative production of Enzyme			
	Unit 4	**Analytical techniques**			**CO4, CO6**
		Estimation of total Protein using Lowry's method			
		Estimation of Protease activity using casein digestion unit method			
	Unit 5	**Downstream Processing**			**CO5, CO6**
		Separation of extracellular Protein from fermented culture			
		Purification of protein using precipitation technique			
	Mode of examination	Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		60%	0%	40%	
	Text book/s*	-			
	Other References				

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
BTP306.1	3	-	-	1	-	-	-	-	3	-	-	3	3	1	2
BTP306.2	3	-	-	1	-	-	-	-	3	-	-	3	3	1	3
BTP306.3	3	3	3	2	3	-	-	-	2	-	-	2	3	-	2
BTP306.4	3	3	3	2	3	-	-	-	-	-	1	2	3	-	2
BTP306.5	3	-	3	1	-	2	2	-	3	-	-	3	3	1	3
BTP306.6	3	3	3	3	3	3	1	-	3	-	1	2	3	1	2

BTY416: Animal Biotechnology

School: SET		**Batch : 2019-2023**	
Program: B. Tech		**Current Academic Year: 2022-23**	
Branch: Biotechnology		**Semester: Odd (7th)**	
1	Course Code	**BTY416**	
2	Course Title	**Animal Biotechnology**	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Compulsory	
5	Course Objective	1. To acquire a fundamental knowledge of animal cell biology 2. Studying, designing and analyzing cell culture experiments. 3. To learn the procedure of stem cell culture and its application in medicine. 4. To understand different techniques used for cloning and creation of transgenic animals.	
6	Course Outcomes	After successfully completion of this course students will be able to: CO1: Establish an animal cell culture facility and demonstrate mechanical and enzymatic methods of cell isolation from tissues and organs. CO2: Establish a continuous cell line from cells of different origin and determine their nutrient and environment requirements. CO3: Differentiate between adherent and non-adherent cell culture techniques, calculate growth kinetics parameters and apply cryopreservation technique for long term storing of cells. CO4: Apply different techniques for cell cloning and genetic engineering of cells and review the risks related with use of cloning. CO5: Examine differentiation status of stem cells and compare properties of embryonic stem cells and adult stem cells. CO6: Review the future perspectives, importance and ethical issues related with stem cell technology and transgenic animals.	
7	Course Description	This course covers Animal cell culture, its molecular biology, recombinant DNA technology; Stem Cells, production of transgenic animals, reproductive biotechnology, biotechnology in animal breeding and ethics.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Animal Cell Culture**	CO1
	A	Sources of cells	CO1
	B	Isolation of cells from tissues	CO1
	C	Cell culture and propagation	CO1
	Unit 2	**Media Preparation and Development of Cell Lines**	CO2,3
	A	Medium and essential nutrients for cell growth	CO2,3

	B	Establishment of cell lines			CO2,3
	C	Growth characterization and kinetics			CO2,3
	Unit 3	**Animal Cell Cloning**			CO4
	A	Cell cloning			CO4
	B	Methods of gene transfer to cells			CO4
	C	Risks of cloning			CO4
	Unit 4	**Animal Cell Cloning and Stem Cell Technology**			CO5,6,7
	A	Stem cell culture			CO5,6
	B	Haematopoiesis and bone marrow culture			CO 6
	C	Application of stem cells			CO6,7
	Unit 5	**Application of Animal Cell Culture Technology and Ethics**			CO7,8
	A	Cell engineering and transgenic animals			CO7
	B	Applications of transgenic animals			CO7,8
	C	Ethical issues of cell culture			CO8
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	Butler M., "Animal Cell Culture and Technology", Garland Science, 2008.			
	Other References	1. Jenkins N., "Animal Cell Biotechnology: Methods and Protocols", Humana Press, 2006. 2. Freshney I.R., "Culture of Animal Cells: A Manual of Basic Technique", Wiley, 2005. 3. Shenoy M., "Animal Biotechnology", Laxmi Pub, 2007.			

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
BTY416.1	3	2	-	1	-	-	-	-	-	-	-	-	-	-	1
BTY416.2	3	2	-	2	-	-	-	2	-	-	-	1	2	-	-
BTY416.3	3	2	2	2	2	-	3	-	-	2	-	2	2	3	2
BTY416.4	3	2	-	2	-	-	-	-	2	-	-	-	-	-	-
BTY416.5	3	3	3	2	3	3	-	-	-	-	-	2	3	3	-
BTY416.6	3	2	1	-	-	2	-	-	1	-	-	-	2	-	-

BTP309: Plant Biotechnology Lab

School: SET		**Batch: 2019-23**	
Program: B. Tech		**Current Academic Year: 2022-23**	
Branch: Biotechnology		**Semester: Odd (7th)**	
1	Course Code	**BTP309**	
2	Course Title	**Plant Biotechnology Lab**	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	**Compulsory**/Elective	
5	Course Objective	To introduce the topic of plant tissue culture and its industrial and agricultural application. To develop the knowledge and techniques of production of industrial compounds. To set up appropriate conditions for regeneration of transgenic plants from genetically manipulated cells, clonal propagation of horticultural and forest species, etc. To develop the knowledge of conservation of germplasm of endangered plant species and other important plants.	
6	Course Outcomes	CO1: Comprehend the basic concept of plant tissue culture and the requirements necessary for its application. CO2. To understand the idea for the preparation of medium and sterilization. CO3. Review new and exciting developments that have taken place in the field of plant tissue culture. CO4. Describe the role of meristematic tissue in asexual plant propagation CO5. Improve the characters of crop plants using micro propagation techniques. CO6. Demonstrate shoot tip culturing.	
7	Course Description	The course will provide an overview of plant biotechnology with focus on industrial applications. The course will even provide basic knowledge in plant biology, plant molecular biology and plant biochemistry	
8	Outline syllabus		CO Mapping
	Unit 1	Equipment's and other basic requirements for plant tissue culture laboratory, Different aseptics techniques for maintenance of cultures.	CO1
	Unit 2	Preparation of stock solutions	CO2,C01
		Sterilization of media	
	Unit 3	To study seed viability	CO3, C01
		Preparation of synthetic seeds	
		In vitro seed germination	
	Unit 4	Explant inoculation	CO4,CO1

		Callus induction			
	Unit 5	To perform shoot tip culture.			C06,CO1
	Mode of examination	Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		60%	0%	40%	
	Text book/s*	-			
	Other References				

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
BTP309.1	3	2	-	1	-	2	-	1	3	-	-	2	3	2	2
BTP309.2	3	2	-	2	-	2	-	-	3	-	-	2	3	3	2
BTP309.3	3	2	2	2	-	1	-	1	3	-	-	2	3	3	2
BTP309.4	3	2	-	2	-	3	-	-	3	-	-	2	3	3	2
BTP309.5	3	3	3	2	-	3	-	-	3	-	-	2	3	3	2
BTP309.6	3	2	-	2	-	3	-	1	3	-	-	2	3	2	2

PROGRAM ELECTIVE

Analysis of Genes and Genome

School:		**Batch : 2018-2022**	
Program: B.Tech		**Current Academic Year: 2018-2019**	
Branch: Biotechnology		**Semester: VII**	
1	Course Code	BTY	
2	Course Title	**Analysis of Genes and Genome**	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Department Elective	
5	Course Objective	1. To comprehend the basic principles of genomics, so that may use it for human benefit. 2. To acquire knowledge of techniques and strategies involved in understanding and modification of genes and proteins	
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Comprehend the principle of gene expression and its application in various analytical process. CO2: Understand the genome intricacy and choose rationally the appropriate gene prediction method CO3: Apply the concept of molecular markers in genome analysis and mapping CO4: Justify the importance of mutagenesis and the role of Phage display techniques in mutagenesis studies CO5: Apply the concept of protein engineering and gene shuffling for production of chimeric proteins CO6: Be familiar with the different techniques used in genome analysis and choose rationally the appropriate methodology for solving problems.	
7	Course Description	The course content of this subject includes an introduction to the basics of genome analysis. It provides a comprehensive view on current methods that can be used to investigate genomes. This course also focuses on gene expression, its diagnosis and its application. Topics include methods for gene disruption their role in understanding the function of genes and in protein engineering.	
8	Outline syllabus		CO Mapping
	Unit A	**Gene Expression and analysis**	CO1, CO6
	Unit A Topic 1	Gene expression ; Cloning of Interacting genes	
	Unit A Topic 2	Yeast two hybrid systems; *In vitro* transcription and translation	
	Unit A Topic	DNA microarray technology and its applications	

	3				
	Unit B	**Genome analysis**			CO2, CO6
	Unit B Topic 1	Genomics overview; Sequencing technologies; Genome databases			
	Unit B Topic 2	Gene prediction methods; Gene identification;			
	Unit B Topic 3	Annotation of genome ; Genome organization			
	Unit C	**Molecular Markers**			**CO3, CO6**
	Unit C Topic 1	Introduction to molecular markers; Types of DNA markers			
	Unit C Topic 2	Use of molecular markers			
	Unit C Topic 3	Genome maps and types			
	Unit D	**Mutagenesis**			**CO4, CO6**
	Unit D Topic 1	Mutagenesis, Random mutagenesis			
	Unit D Topic 2	Site directed mutagenesis; functional mutagenesis			
	Unit D Topic 3	Phage display technique and its application			
	Unit E	**Protein Engineering**			**CO5, CO6**
	Unit E Topic 1	Gene shuffling; Directed evolution			
	Unit E Topic 2	Protein engineering; production of chimeric proteins			
	Unit E Topic 3	Applications of protein engineering			
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. Brown TA. Genomes 3. 3rd edition. Oxford: Wiley-Lis; (2002) 2. Principles of genome analysis and genomics by Primrose and Twyman, 3rd edition, Blackwell Publishing (2003)			
	Other References	1. Bioinformatics and Functional genomics by Jonathan Pevsner, 2nd edition, John Wiley and Sons (2008) 2. Introduction to genomics by Arthus M. Lesk, Oxford University Press (2007)			

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO.1	3	3	2	3	3	2	-	1	2	-	-	3	3	3	2
CO.2	3	3	2	3	3	1	-	1	2	-	-	3	3	3	2
CO.3	3	3	2	2	3	-	-	1	2	-	-	3	3	3	2
CO.4	3	3	2	2	3	-	-	1	2	-	-	3	3	3	2
CO.5	3	3	2	2	3	-	-	1	2	-	-	3	3	3	2
CO.6	3	3	2	3	3	-		1	2			3	3	3	

BTY325 Biosafety Regulation and IPR

School: SET		**Batch : 2018-2022**	
Program: B.Tech		**Current Academic Year: 2018-2019**	
Branch: Biotechnology		**Semester: 8**	
1	Course Code	BTY325	
2	Course Title	**Biosafety Regulation and IPR**	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Elective/Open Elective	
5	Course Objective	To understand different ethical issues related to genetic engineering, drug development and release of GMO in environment. To elucidate the ways of protection of intellectual property and research with the help of WIPO and its different treaties. To correlate different instruments of IP protection and their enforcement in different countries.	
6	Course Outcomes	The student should be able to CO1: Review different social, philosophical and ethical issues in medical and biotechnological research and recognize regulatory mechanisms. CO2: Apply and follow regulatory steps related with use of GMOs. Identify the roles and activities of different regulatory authorities of bio safety and bioethics. CO3: Administer and follow the guidelines of WIPO. Interpret and implement Indian Laws and treaties for protection of IPRs. Determine and apply remedies for infringement of IPRs. CO4: Identify different categories for copyrights and trademarks. Implement rules for protecting traditional knowledge and geographical indications. CO5: Enforce instructions issued under TRIPS, GATT and biodiversity bill and protection of plant varieties.	
7	Course Description	The course content of this subject includes an ethical issues related to the release of GMOs in the environment and the myth associated with gene cloning. Roles and responsibilities of regulatory authorities of bio safety and bioethics. Intellectual property and intellectual property right. Field of intellectual property protection. Intellectual property right in biotechnology.	
8	Outline syllabus		CO Mapping
	Unit 1	**Ethical issues in Biotechnology**	**CO1**
	A	GMOs and their release in environment	
	B	Myths associated with gene cloning	
	C	Issues related with rDNA technology	
	Unit 2	**Roles and Responsibilities of Committees**	**CO2**
	A	Regulatory authorities of bio safety and bioethics	
	B	National Biosafety Committees: Roles and Responsibilities	
	C	Role of Institutional Biosafety Committee	
	Unit 3	**IP and IPRs**	**CO3**
	A	WIPO- mission and vision	

	B	Indian laws and treaties for IPRs			
	C	Remedies for infringement			
	Unit 4	**Fields of IP protection**			**CO4**
	A	Patents and conditions for patentability			
	B	Copyrights and their categories			
	C	Trademarks and geographical indications			
	Unit 5	**IPR in Biotechnology**			**CO5**
	A	Traditional knowledge protection			
	B	GATT and TRIPS and their policies			
	C	Biodiversity bill and protection of plant varieties.			
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	Goel D, "IPR, Bio safety and Bioethics", Pearson Education, 2013.			
	Other References				

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	-	-	-	-	1	2	1
CO2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
CO3	2	-	-	1	1	1	1	1	1	-	1	1	3	3	3
CO4	1	1	-	-	2	-	1	-	2	-	2	2	2	1	3
CO5	1	-	1	-	1	1	-	-	1	2	-	2	2	2	2
CO6	1	-	-	-	1	1	1	-	1	1	1	2	2	2	2

OPEN ELECTIVES

Waste Management

School: SET		**Batch : 2019-2023**	
Program: B Tech		**Current Academic Year:**	
Branch: Biotechnology		**Semester:**	
1	Course Code	**BTY**	
2	Course Title	**Waste Management**	
3	Credits	2	
4	Contact Hours (L-T-P)	2-0-0	
	Course Status	**Elective**/Open Elective	
5	Course Objective	1. To acquire a fundamental knowledge of different types of waste materials and their classification. 2. To understand the different methods of waste disposal. 3. To learn about the fundamental concept of energy generation from solid wastes.	
6	Course Outcomes	CO1: Identify the different sources and types of wastes. CO2: Characterize municipal, commercial and industrial wastes and identify options available for storing, collecting and transporting of waste. CO3: Design methods for aerobic and anaerobic composting and develop mechanical and semi-mechanical composting processes. CO4: Design and identify sites for landfill and recognize methods to detect formation of gases and leachate. CO5: Review how material and energy can be recovered and reused and its significance on the environment. CO6: Elaborate methods of sustainable waste management and disposable methods.	
7	Course Description	Waste Management will give students a thorough understanding of the issues surrounding waste, tools and methods to contain and treat waste and various types of management practices used for the treatment of solid waste.	
8	Outline syllabus		CO Mapping
	Unit 1	**Sources of Solid Waste**	
	A	Solid waste management	CO1
	B	Sources and types of solid wastes	
	C	Characteristics of municipal, commercial and industrial wastes	
	Unit 2	**Collection, Transportation and Treatment**	
	A	Waste storage and collection	

	B	Collection equipments and			CO1, CO2
	C	Transfer stations and their types			
	Unit 3	**Composting**			
	A	Science of Composting			CO3
	B	Aerobic and Anaerobic composting			
	C	Vermicomposting			
	Unit 4	**Landfilling**			
	A	Landfill site, layout and sections			
	B	Formation, composition and characteristics of leachate.			CO4
	C	Formation, composition and characteristics of gases			
	Unit 5	**Recycle and Reuse**			
	A	3 R's of waste management			CO5, CO6
	B	Plastic waste and reuse			
	C	Environmental significance of waste mangement			
	Mode of examination	**Theory**/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	Letcher T. and Vallero D., "Waste: A Handbook for Management", Academic Press, 2011			
	Other References	1. Vaughn J., "Waste Management: A Reference Handbook", ABC-CLIO, 2008. 2. "Manual on Municipal Solid Waste Management", CPHEEO, Govt. of India.			

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO.1	3	2	-	1	-	-	-	-	-	-	-	-	-	-	1
CO.2	3	2	-	2	-	-	-	2	-	-	-	1	2	-	-
CO.3	3	2	2	2	2	-	3	-	-	2	-	2	2	3	2
CO.4	3	2	-	2	-	-	-	-	2	-	-	-	-	-	-
CO.5	3	3	3	2	3	3	-	-	-	-	-	2	3	3	-
CO.6	3	2	2	-	1	3	-	-	-	-	-	2	1	-	-

Downstream Processing

School: SET		**Batch : 2019-2023**
Program: B Tech		**Current Academic Year:**
Branch: Biotechnology		**Semester:**
1	Course Code	**BTY**
2	Course Title	**Downstream Processing**
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Elective/**Open Elective**
5	Course Objective	1. To enable students bridge the gap between theoretical concepts and practical aspects in industrial settings. 2. To have In-depth knowledge and hands-on laboratory/industrial skills required for employment or for creation of employment in desired product processing.
6	Course Outcomes	After successfully completion of this course students will be able to: CO1: Separate different bio-products from any mixture keeping in mind the cost involved for the production. CO2: Identify requirement for successful operation of downstream processes for efficient recovery of product. CO3: Choose various electrophoresis and chromatographic techniques for separating pigments, drugs, amino acids and hormones etc for enhanced purification of desired product. CO4: Product extraction from extracellular/intracellular compartment of cells and carry out different strategies for differentiating between the products of varying sizes. CO5: Improving the marketability of product by innovative packaging and polishing approaches for industrially important enzymes, organic acids etc. in specified cell concentration, production rates, etc). CO6: Create experiments for integrating separation, extraction and bioanalytical techniques for problem solving.
7	Course Description	The challenge for biochemical engineers is to design compact and clean processes to make and efficiently separate instable products, such as recombinant proteins, from dilute complex fermentation broths to the required pharmaceutical degree of purity. Therefore, the quantitative systematic design of integrated bioreactors and downstream processes is the general theme of this course and helps the students in quantitatively and

		systematically design an integrated industrial process.			
8	Outline syllabus				CO Mapping
	Unit 1	**Bioseparation**			**CO1, CO6**
	A	Overview of Bioseparation; Nature of Bioseparation; Basis of bio-separation			CO1
	B	Nature of Bioseparation; Economic importance of Bioseparation; RIPP scheme			CO1
	C	Cost cutting strategies			CO1
	Unit 2	**Membrane based bioseparation**			**CO2, CO6**
	A	Types of membranes; Factors affecting membrane based separation;			CO2
	B	Dialysis; Microfiltration			CO2
	C	Ultrafiltration: Types of membrane modules in ultra-filtration assembly			CO2
	Unit 3	**Product Purification**			**CO3, CO6**
	A	Electrophoresis: Agarose gel electrophoresis; SDS-PAGE and 2D electrophoresis			CO3
	B	Chromatography: Affinity chromatography; Gel permeation chromatography; Ion exchange chromatography			CO3
	C	HPLC: Principle, working and applications			CO3
	Unit 4	**Product Recovery**			**CO4, CO6**
	A	Physical, chemical and enzymatic methods of cell disruption			CO4
	B	Precipitation; Factors utilized for precipitation			CO4
	C	Precipitation using organic solvents and anti-chaotropic salts			CO4
	Unit 5	**Polishing of Products**			**CO5, CO6**
	A	Product polishing by crystallization and drying			CO5
	B	Polishing of citric acid, glutamic acid and Penicillin G			CO5
	C	Polishing of extracellular and intracellular enzymes			CO5
	Mode of examination	**Theory**/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. Bioseperations: Principles and Techniques- B. Sivasankar,Published by PHI Learning Pvt. Ltd., 2006.			
	Other References	1. Principles And Techniques Of Practical			

		Biochemistry- Keith Wilson And John Walker, Cambridge Press. 2. Bioseparation Technology- Mishra Neeraj, P ublisher: CRC Press, 2008.	

COURSE ARTICULATION MATRIX

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO.1	3	1	-	1	-	-	-	-	2	-	-	2	3	2	2
CO.2	3	2	-	1	-	-	-	-	-	-	-	-	3	2	2
CO.3	3	2	2	2	-	-	-	-	1	-	2	-	3	2	2
CO.4	3	2	2	2	-	-	-	-	-	-	2	-	3	2	2
CO.5	3	2	3	1	-	2	-	-	3	2	-	-	3	2	2
CO.6	3	3	3	3	3	3	-	-	3	3	3	2	3	2	2