



MUTHAYAMMAL ENGINEERING COLLEGE

(An Autonomous Institution)

(Approved by AICTE, New Delhi, Accredited by NAAC, NBA & Affiliated to Anna University)
Rasipuram - 637 408, Namakkal Dist., Tamil Nadu.

Curriculum/Syllabus

Programme Code : BT

Programme Name : B.Tech-Biotechnology

Regulation : R-2019



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(Approved by AICTE, Accredited by NAAC & NBA, Affiliated to Anna University)

Rasipuram - 637 408, Namakkal Dt, Tamil Nadu.

Ph. No.: 04287-220837

Email: principal@mec.edu.in.



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Rasipuram - 637 408, Namakkal Dist., Tamil Nadu.

INSTUTION VISION & MISSION

INSTUTION VISION

To be a Centre of Excellence in Engineering, Technology and Management on par with International Standards.

INSTUTION MISSION

- To prepare the students with high professional skills and ethical values
- To impart knowledge through best practices
- To instill a spirit of innovation through Training, Research and Development
- To undertake continuous assessment and remedial measures
- To achieve academic excellence through intellectual, emotional and social stimulation

INSTUTION MOTTO

Rural upliftment through Technical Education.



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DEPARTMENT VISION & MISSION

DEPARTMENT VISION

To produce competent biotechnologists with advanced skills and knowledge to contribute the society.

DEPARTMENT MISSION

- To establish the advance laboratories to enable the students to face the challenges in pharma industries and laboratories
- To enable collaborative research in contemporary and sustainable technologies in biotechnology
- To produce biotechnology graduates with quest for excellence, enthusiasm for continuous learning, ethical behavior, integrity and exceptional leadership



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DEPARTMENT PROGRAM EDUCATIONAL OBJECTIVES, PROGRAM OUTCOMES **& PROGRAM SPECIFIC OUTCOMES**

PROGRAM EDUCATIONAL OBJECTIVES

The Biotechnology Graduates should be able to

PEO1: Practice as an Engineer in the Biotechnology industries and become an entrepreneur

PEO2: Pursue higher education and research for professional development

PEO3: Exhibit the leadership skills and ethical value for society

PROGRAM OUTCOMES

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
2. **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.
3. **Design/Development 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.
4. **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.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **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.
7. **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.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **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.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering 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.
12. **Lifelong learning:** Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES

PS01: Apply mathematical and engineering knowledge for performing lab experiments

PS02: Derive sustainable solutions for complete problems related to diseases and treatment

PS03: Use modern software tools and techniques related to Biotechnology and industry



**MUTHAYAMMAL ENGINEERING COLLEGE - RASIPURAM
(Autonomous)**

(Approved by AICTE, Affiliated to Anna University, Rasipuram-637408)

**DEPARTMENT OF BIOTECHNOLOGY
GROUPING OF COURSES**

Regulations 2019

1. Humanities and Social Sciences including Management Courses (HS)

S. No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/ Week			C
					L	T	P	
1	19HSS01	Business English	HS	2	2	0	0	2
2	19HSS03	Psychology and Ethics	HS	2	2	0	0	2
3	19HSS02	English Communicative Skills Laboratory	HS	2	0	0	2	1
4	19HSS04	Technical English For Engineers	HS	2	2	0	0	2
5	19HSS05	Communicative English for Engineers	HS	2	2	0	0	2
6	19HSS06	Basics of Japanese Language	HS	2	2	0	0	2
7	19HSS07	Basics of French Language	HS	2	2	0	0	2
8	19HSS08	Professional Ethics and Human Values	HS	3	3	0	0	3

2. Basic Science Courses (BS)

S. No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week			C
					L	T	P	
1	19BSS01	Engineering Physics	BS	3	3	0	0	3
2	19BSS02	Physics and Chemistry Laboratory	BS	2	0	0	2	1
3	19BSS03	Bio and Nanomaterials Sciences	BS	3	3	0	0	3
4	19BSS04	Material Sciences	BS	3	3	0	0	3
5	19BSS05	Physics for Mechanical Engineers	BS	3	3	0	0	3
6	19BSS11	Engineering Chemistry	BS	3	3	0	0	3
7	19BSS12	Environmental Science and Engineering	BS	3	3	0	0	3
8	19BSS13	Organic Chemistry	BS	3	3	0	0	3
9	19BSS14	Physical Chemistry	BS	3	3	0	0	3
10	19BSS15	Applied Chemistry	BS	3	3	0	0	3

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11	19BSS16	Organic Chemistry Laboratory	BS	2	0	0	2	1
12	19BSS17	Physical Chemistry Laboratory	BS	2	0	0	2	1
13	19BSS21	Algebra and Calculus	BS	4	3	2	0	4
14	19BSS22	Differential Equations and Vector Analysis	BS	4	3	2	0	4
15	19BSS23	Transform and Partial Differential Equations	BS	4	3	2	0	4
16	19BSS24	Discrete Mathematics	BS	4	3	2	0	4
17	19BSS25	Statistical and Queuing Model	BS	4	3	2	0	4
18	19BSS26	Numerical Methods	BS	4	3	2	0	4
19	19BSS27	Probability and Random Processes	BS	4	3	2	0	4
20	19BSS28	Statistic and Numerical Methods	BS	4	3	2	0	4

3. General Engineering Science Courses (GES)

S. No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week			C
					L	T	P	
1	19GES01	Programming for Problem Solving Using C	GES	3	3	0	0	3
2	19GES02	Programming for Problem Solving Technique	GES	3	3	0	0	3
3	19GES03	Programming in C Laboratory	GES	2	0	0	2	1
4	19GES04	Programming in C and Python Laboratory	GES	2	0	0	2	1
5	19GES05	Electrical and Electronic Sciences	GES	3	3	0	0	3
6	19GES06	Mechanical and Building Sciences	GES	3	3	0	0	3
7	19GES07	Computer Aided Drafting Laboratory	GES	2	0	0	2	1
8	19GES08	Python Programming	GES	3	3	0	0	3
9	19GES09	Programming in Python Laboratory	GES	2	0	0	2	1
10	19GES10	Soft Skills Laboratory	GES	2	0	0	2	1
11	19GES11	Electronic Devices	GES	3	3	0	0	3
12	19GES12	Electronic Simulation Laboratory	GES	2	0	0	2	1
13	19GES13	Electric Circuits	GES	3	2	2	0	3
14	19GES14	Electric Circuits Laboratory	GES	2	0	0	2	1
15	19GES15	Manufacturing Process	GES	3	3	0	0	3
16	19GES16	Manufacturing Process Laboratory	GES	2	0	0	2	1
17	19GES17	Mechanical and Building Sciences Laboratory	GES	2	0	0	2	1


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18	19GES18	Construction Materials	GES	3	3	0	0	3
19	19GES19	Concepts in Product Design	GES	3	3	0	0	3
20	19GES20	Renewable Energy Sources	GES	3	3	0	0	3
21	19GES21	Electrical Drives and Control	GES	3	3	0	0	3
22	19GES22	Electrical Drives and Control Laboratory	GES	2	0	0	2	1
23	19GES23	Analog and digital communication	GES	3	3	0	0	3
24	19GES24	Digital Principles and System Design	GES	3	3	0	0	3
25	19GES25	Digital Principles and System Design Laboratory	GES	2	0	0	2	1
26	19GES26	Engineering Drawing	GES	5	1	0	4	3
27	19GES27	Engineering Geology	GES	3	3	0	0	3
28	19GES28	Engineering Mechanics	GES	5	3	2	0	4
29	19GES29	Wireless Communication	GES	4	3	2	0	4
30	19GES30	Electronics and Microprocessor	GES	3	3	0	0	3
31	19GES31	Electronics and Microprocessor Laboratory	GES	2	0	0	2	1
32	19GES32	Data Structures using Python	GES	3	3	0	0	3

4. Professional Core Courses (PCC)

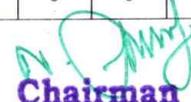
S. No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/ Week			C
					L	T	P	
1	19BTC01	Biochemistry	PCC	3	3	0	0	3
2	19BTC02	Microbiology	PCC	3	3	0	0	3
3	19BTC03	Cell Biology	PCC	3	3	0	0	3
4	19BTC04	Basic Industrial Biotechnology	PCC	3	3	0	0	3
5	19BTC05	Molecular Biology	PCC	3	3	0	0	3
6	19BTC06	Fundamentals of Bioprocess	PCC	3	3	0	0	3
7	19BTC07	Basics of Unit Operation	PCC	3	2	2	0	3
8	19BTC08	Instrumental Methods of Analysis	PCC	3	3	0	0	3
9	19BTC09	Bioprocess Engineering	PCC	3	3	0	0	3
10	19BTC10	Genetic Engineering	PCC	3	3	0	0	3
11	19BTC11	Mass Transfer Operations	PCC	3	2	2	0	3
12	19BTC12	Health and Pharmaceutical Biotechnology	PCC	3	3	0	0	3
13	19BTC13	Bioinformatics	PCC	3	3	0	0	3
14	19BTC14	Chemical Reaction Engineering	PCC	3	2	2	0	3


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15	19BTC15	Downstream Processing	PCC	3	3	0	0	3
16	19BTC16	Immunology	PCC	3	3	0	0	3
17	19BTC17	Disaster Management	PCC	2	2	0	0	2
18	19BTC18	Biochemistry Laboratory	PCC	3	0	0	3	1
19	19BTC19	Microbiology Laboratory	PCC	3	0	0	3	1
20	19BTC20	Instrumental Methods of Analysis Laboratory	PCC	3	0	0	3	1
21	19BTC21	Molecular biology Laboratory	PCC	3	0	0	3	1
22	19BTC22	Genetic Engineering Laboratory	PCC	3	0	0	3	1
23	19BTC23	Bioprocess Engineering Laboratory	PCC	3	0	0	3	1
24	19BTC24	Chemical Reaction Engineering Laboratory	PCC	3	0	0	3	1
25	19BTC25	Bioinformatics Laboratory	PCC	3	0	0	3	1
26	19BTC26	Downstream Processing Laboratory	PCC	3	0	0	3	1
27	19BTC27	Immunology Laboratory	PCC	3	0	0	3	1

5. Professional Elective Courses (PEC)

S. No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/ Week			C
					L	T	P	
1	19BTE01	Food technology	PEC	3	3	0	0	3
2	19BTE02	Animal Biotechnology	PEC	3	3	0	0	3
3	19BTE03	Chemistry of Medicines	PEC	3	3	0	0	3
4	19BTE04	Life Style Diseases	PEC	3	3	0	0	3
5	19BTE05	Intellectual Property Rights	PEC	3	3	0	0	3
6	19BTE06	Biofuel	PEC	3	3	0	0	3
7	19BTE07	Fundamentals of Nanoscience	PEC	3	3	0	0	3
8	19BTE08	Plant Biotechnology	PEC	3	3	0	0	3
9	19BTE09	Process Equipments and Plant Design	PEC	3	3	0	0	3
10	19BTE10	Neurobiology and Conginitive sciences	PEC	3	3	0	0	3
11	19BTE11	Tissue Engineering	PEC	3	3	0	0	3
12	19BTE12	Biosafety and Hazard Management	PEC	3	3	0	0	3
13	19BTE13	Stem cell Technology	PEC	3	3	0	0	3
14	19BTE14	Biophysics	PEC	3	3	0	0	3
15	19BTE15	Biological Spectroscopy	PEC	3	3	0	0	3
16	19BTE16	Bioentrepreneurship	PEC	3	3	0	0	3



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17	19BTE17	Professional Ethics in Engineering	PEC	3	3	0	0	3
18	19BTE18	Marine Biotechnology	PEC	3	3	0	0	3
19	19BTE19	Metabolic Engineering	PEC	3	3	0	0	3
20	19BTE20	Human Rights	PEC	3	3	0	0	3
21	19BTE21	Protein Engineering	PEC	3	3	0	0	3
22	19BTE22	Bioethics and IPR	PEC	3	3	0	0	3

6. EMPLOYABILITY ENHANCEMENT COURSES (EEC)

S. No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week			C
					L	T	P	
1	19BTF01	Project work – Phase-I	EEC	3	0	0	10	5
2	19BTF02	Project work – Phase-II	EEC	20	0	0	18	9

7. OPEN ELECTIVE COURSES (OEC)

S. No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week			C
					L	T	P	
1		Industrial Robotics	OEC	3	3	0	0	3
2		Industrial Waste Management	OEC	3	3	0	0	3
3		Biomedical Engineering	OEC	3	3	0	0	3
4		Electronics and Microprocessor	OEC	3	3	0	0	3
5		Programming in Python	OEC	3	3	0	0	3
6		Database Management Systems	OEC	3	3	0	0	3
7		Internet of Things	OEC	3	3	0	0	3
8		Soft Computing Techniques	OEC	3	3	0	0	3
9		M-Commerce	OEC	3	3	0	0	3
10		Programming in Java	OEC	3	3	0	0	3

8. MANDATORY COURSES (MC)

S. No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week			C
					L	T	P	
1	19BTM01	Organizational Behavior	MC	3	3	0	0	0
2	19BTM02	India Constitution	MC	3	3	0	0	0
3	19BTM03	Essence of Indian Traditional Knowledge	MC	3	3	0	0	0


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**CURRICULUM
UG R - 2019**

Department		Biotechnology						
Programme		B.Tech. – Biotechnology						
SEMESTER – I								
Sl. No.	Course Code	Course Name	Category	Hours/ Week			Credit C	Contact Hrs
				L	T	P		
Theory								
1.	19HSS01	Business English	HS	2	0	0	2	3
2.	19BSS21	Algebra and Calculus	BS	3	2	0	4	5
3.	19BSS01	Engineering Physics	BS	3	0	0	3	4
4.	19BSS11	Engineering Chemistry	BS	3	0	0	3	4
5.	19GES02	Programming for Problem Solving Technique	GES	3	0	0	3	3
6.	19GES05	Electrical and Electronic Sciences	GES	3	0	0	3	3
Practical								
7.	19GES07	CAD Lab	GES	0	0	3	1	3
8.	19GES04	Programming in C and Python Laboratory	GES	0	0	3	1	3
9.	19HSS02	English Communicative skills Laboratory	HS	0	0	2	1	2
Total Credits							21	



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**CURRICULUM
UG R - 2019**

Department		Biotechnology						
Programme		B.Tech. – Biotechnology						
SEMESTER – II								
Sl. No.	Course Code	Course Name	Category	Hours/ Week			Credit C	Contact Hrs
				L	T	P		
Theory								
1.	19HSS03	Life Skills and workplace Psychology	HS	2	0	0	2	3
2.	19BSS22	Differential Equations and Vector Analysis	BS	3	2	0	4	5
3.	19BSS03	Bio and Nanomaterials Sciences	BS	3	0	0	3	4
4.	19BSS12	Environmental Science and Engineering	BS	3	0	0	3	4
5.	19GES19	Concepts in Product Design	GES	3	0	0	3	3
6.	19GES06	Mechanical and Building Sciences	GES	3	0	0	3	3
Practical								
7.	19BSS02	Physics and Chemistry Laboratory	BS	0	0	2	1	2
8.	19GES17	Mechanical and Building Sciences Laboratory	GES	0	0	3	1	3
Total Credits							20	

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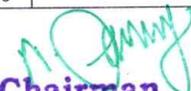
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Department		Biotechnology						
Programme		B.Tech. – Biotechnology						
SEMESTER – III								
Sl. No.	Course Code	Course Name	Category	Hours/ Week			Credit C	Contact Hrs
				L	T	P		
Theory								
1.	19BSS23	Transform and Partial Differential Equations	BS	3	2	0	4	5
2.	19BTC01	Biochemistry	PCC	3	0	0	3	3
3.	19BTC02	Microbiology	PCC	3	0	0	3	3
4.	19BTC03	Cell Biology	PCC	3	0	0	3	3
5.	19BTC04	Basic Industrial Biotechnology	PCC	3	0	0	3	3
6.	19GES28	Engineering Mechanics	GES	3	2	0	3	5
Practical								
7.	19BTC18	Biochemistry Laboratory	PCC	0	0	3	1	3
8.	19BTC19	Microbiology Laboratory	PCC	0	0	3	1	3
Total Credits							21	

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Department		Biotechnology						
Programme		B.Tech. – Biotechnology						
SEMESTER – IV								
Sl. No.	Course Code	Course Name	Category	Hours/ Week			Credit C	Contact Hrs
				L	T	P		
Theory								
1.	19BSS26	Numerical Methods	BS	3	2	0	4	5
2.	19BTC05	Molecular Biology	PCC	3	0	0	3	3
3.	19BTC06	Fundamentals of Bioprocess	PCC	3	0	0	3	3
4.	19BTC07	Basics of Unit Operation	PCC	2	2	0	3	3
5.	19BTC08	Instrumental Methods of Analysis	PCC	3	2	0	3	3
6.	19GES20	Renewable Energy Sources	GES	3	0	0	3	3
Practical								
7.	19BTC20	Instrumental Methods of Analysis Laboratory	PCC	0	0	3	1	3
8.	19BTC21	Molecular biology Laboratory	PCC	0	0	3	1	3
Mandatory course								
9.	19BTM01	Organizational Behavior	MC	3	0	0	0	3
Total Credits							21	


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Department		Biotechnology						
Programme		B.Tech. – Biotechnology						
SEMESTER – V								
Sl. No.	Course Code	Course Name	Category	Hours/ Week			Credit C	Contact Hrs
				L	T	P		
Theory								
1	19HSS08	Professional Ethics and Human Values	HS	3	0	0	3	3
2	19BTC09	Bioprocess Engineering	PCC	3	0	0	3	3
3	19BTC10	Genetic Engineering	PCC	3	0	0	3	3
4	19BTC11	Mass Transfer Operations	PCC	2	2	0	3	3
5		Professional Electives - I	PEC	3	0	0	3	3
6		Professional Electives - II	PEC	3	0	0	3	3
7		Open Electives - I	OEC	3	0	0	3	3
Practical								
8	19BTC22	Genetic Engineering Laboratory	PCC	0	0	3	1	3
9	19BTC23	Bioprocess Engineering Laboratory	PCC	0	0	3	1	3
Mandatory course								
10	19BTM02	India Constitution	MC	3	0	0	0	3
Total Credits							23	

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Department		Biotechnology						
Programme		B.Tech. – Biotechnology						
SEMESTER – VI								
Sl. No.	Course Code	Course Name	Category	Hours/ Week			Credit C	Contact Hrs
				L	T	P		
Theory								
1.	19BTC12	Health and Pharmaceutical Biotechnology	PCC	3	0	0	3	3
2.	19BTC13	Bioinformatics	PCC	3	0	0	3	3
3.	19BTC14	Chemical Reaction Engineering	PCC	2	2	0	3	3
4.		Professional Electives - III	PEC	3	0	0	3	3
5.		Professional Electives – IV	PEC	3	0	0	3	3
6.		Open Electives-II	OEC	3	0	0	3	3
Practical								
7	19BTC24	Chemical Reaction Engineering Laboratory	PCC	0	0	3	1	3
8	19BTC25	Bioinformatics Laboratory	PCC	0	0	3	1	3
Mandatory course								
9	19BTM03	Essence of Indian Traditional Knowledge	MC	3	0	0	0	3
Total Credits							20	


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Department		Biotechnology							
Programme		B.Tech. – Biotechnology							
SEMESTER – VII									
Sl. No.	Course Code	Course Name	Category	Hours/ Week			Credit C	Contact Hrs	
				L	T	P			
Theory									
1.	19BTC15	Downstream Processing	PCC	3	0	0	3	3	
2.	19BTC16	Immunology	PCC	3	0	0	3	3	
3.	19BTC17	Disaster Management	PCC	3	0	0	3	3	
4.		Professional Electives - V	PEC	3	0	0	3	3	
5.		Professional Electives - VI	PEC	3	0	0	3	3	
6.		Open Electives-III	OEC	3	0	0	3	3	
Practical									
7.	19BTF01	Project Phase-I	EEC	0	0	10	5	10	
8.	19BTC26	Downstream Processing Laboratory	PCC	0	0	3	1	3	
9.	19BTC27	Immunology Laboratory	PCC	0	0	3	1	3	
Total Credits							25		

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Department		Biotechnology							
Programme		B.Tech. – Biotechnology							
SEMESTER – VIII									
Sl. No.	Course Code	Course Name	Category	Hours/ Week			Credit C	Contact Hrs	
				L	T	P			
1.	19BTF02	Project work Phase - II	EEC	0	0	18	9	18	
Total Credits							9		

Total Credits: 160

Semester	I	II	III	IV	V	VI	VII	VIII	Total	%
HSS	3	2			3				8	5
BSS	10	11	4	4					29	18
GES	8	7	3	3					22	13
PC			14	14	11	13	9		61	38
PE					6	6	6		18	11
EEC							5	9	14	9
OE					3	3	3		9	6
Total	21	20	21	21	23	22	23	9	160	


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PROFESSIONAL CORE
(PC)

19BTC01

BIOCHEMISTRY

L T P C

3 0 0 3

Course Objectives

- To provide the basic knowledge of various biomolecules.
- To understand the concept of structure and properties of important biomolecules
- To learn metabolism concepts
- To know the metabolism and its regulation
- To enable students learn the fundamentals of Biochemical Processes and Biomolecules.

Course Outcomes

1. Demonstrate the structure and reactions of Biomolecules.
2. Identify the metabolic pathways of the major biomolecules and relevance to clinical conditions.
3. Gain knowledge about Biochemical processes with Biotechnology applications.
4. Acquire knowledge related to functions and interrelationships of biomolecules in clinical research and industry.
5. Idea about the consequences of interpreting and solving clinical problems.

UNIT I INTRODUCTION TO BIOMOLECULES – CARBOHYDRATES 9

Introduction to biochemistry, types of functional groups, biomolecules, water as biological solvent, pH, biological buffers, Handerson - hasselbalch equation. Carbohydrates: Mono, Di, Oligo and Polysaccharides (Starch, Glycogen, Cellulose and Chitin). Proteoglycans, glucosaminoglycans. Hyaluronic acid, Chondroitin sulfate.

UNIT II STRUCTURE AND PROPERTIES OF OTHER BIOMOLECULES 9

Lipids: Fatty acids, glycerol, saponification, iodination, phospholipids, glycolipids, sphingolipids, cholesterol, steroids.

Proteins: Amino Acids, Peptides, Polypeptides, Primary, Secondary, Tertiary and Quaternary structures, Glycoproteins, Lipoproteins.

Nucleic acids: Purines, Pyrimidines, nucleoside, nucleotide, RNA, DNA-Watson and Crick structure of DNA

UNIT III METABOLISM CONCEPTS AND CARBOHYDRATE METABOLISM 9

Metabolic pathways, primary and secondary metabolites. Enzymes-introduction to biocatalysts, Glycolysis, TCA cycle, Gluconeogenesis, Pentose phosphate shunt, Glyoxalate shunt

UNIT IV METABOLISM AND REGULATION 9

Fatty acid synthesis and oxidation, Reactions of amino acids, Deamination, Transamination and Decarboxylation, Urea cycle, Metabolic disorders of carbohydrate metabolism (pathophysiology, clinical symptoms and treatment): Diabetes mellitus. Metabolic disorders of lipid metabolism: familial hypercholesterolemia. Metabolic disorders of amino acid metabolism: Phenyl ketonuria, Albinism Metabolic disorders of nucleic acid metabolism: Lesch-Nyhan syndrome, Gout

UNIT V BIOENERGETICS 9


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High energy compounds, electronegative potential of compounds, Introduction of energy yielding, oxidative phosphorylation and energy requiring reactions-Respiratory chain, ATP cycle, calculation of ATP yield during oxidation of glucose and fatty acids.

Total Hours 45

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Lehninger	Principles of Biochemistry	W.H. Freeman,	2008
2.	Satyanarayana, U. and U. Chakerapani	Biochemistry	Books & Allied (P) Ltd	2006

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Rastogi, S.C	Biochemistry	Tata McGraw-Hill	2003
2.	Conn, E.E	Outlines of Biochemistry	John Wiley & Sons	1987
3.	Berg, Jeremy M	Biochemistry	W.H. Freeman	2006
4.	Murray, R.K	Harper's Illustrated Biochemistry	McGraw-Hill	2006
5.	Voet, D. and Voet, J.G	Biochemistry	John Wiley & Sons	2004

WEB URLs

1. <https://www.cliffsnotes.com/study-guides/biology/biochemistry-i/the-scope-of-biochemistry/introduction-to-biochemistry>
2. <https://www.uwyo.edu/molecbio/courses/molb-3610/files/3610%20chpts%201-2%20notes>
3. <https://home.apu.edu/~jsimons/Bio101/biochem.htm>
4. https://www.youtube.com/watch?v=BsEW6iK_IcQ
5. <https://www.youtube.com/watch?v=-fy8-owt6sk>


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19BTC02

MICROBIOLOGY

L T P C
3 0 0 3

Course Objectives

- To provide the basic knowledge in classification of microorganism.
- To understand the microorganism structure and multiplication
- To learn metabolism concepts
- To know the control of microorganism
- To enable students learn the environmental microbiology.

Course Outcomes

1. Demonstrate the classification of microorganism.
2. Identify the microorganism structure and multiplication.
3. Gain knowledge about metabolism.
4. Acquire knowledge related to the control of microorganism.
5. Idea about the environmental microbiology.

UNIT I INTRODUCTION

6

Basics of microbial existence; history of microbiology, classification and nomenclature of microorganisms, microscopic examination of microorganisms, light and electron microscopy; principles of different staining techniques like gram staining, acid fast, capsular staining, flagellar staining.

UNIT II MICROBES- STRUCTURE AND MULTIPLICATION

12

Structural organization and multiplication of bacteria, viruses, algae and fungi, with special mention of life history of actinomycetes, yeast, mycoplasma and bacteriophages.

UNIT III MICROBIAL NUTRITION, GROWTH AND METABOLISM

12

Nutritional requirements of bacteria; different media used for bacterial culture; growth curve and different methods to quantify bacterial growth; aerobic and anaerobic bioenergetics and utilization of energy for biosynthesis of important molecules.

UNIT IV CONTROL OF MICROORGANISMS

6

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

UNIT V INDUSTRIAL AND ENVIRONMENTAL MICROBIOLOGY

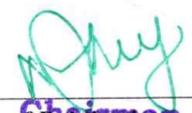
9

Biofertilizers, Biopesticides, Production of alcohol, amoxicillin; bioremediation; leaching of ores by microbes; microbial treatment of wastewater - aerobic and anaerobic methods

TOTAL: 45 PERIODS

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication


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1.	Talaron K, Talaron A, Casita, Pelczar and Reid	Foundations in Microbiology	W.C. Brown Publishers	1993
2.	Pelczar MJ, Chan ECS and Krein NR	Microbiology	Tata McGraw Hill Edition, New Delhi	1999

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Prescott L.M., Harley J.P., Klein DA	Microbiology	W.C. Brown Publishers	1996
2.	G. J. Tortora, B. R. Funke and C. L. Case	Microbiology	Addison Wesley Longman, Inc	2001
3.	R. M. Atlas and Renk	Principles of Microbiology	McGraw-Hill Higher Education	1995
4.	M.J. Heboffee aw BE Pierce,.	Micro Biology : Laboratory Theory and applications	Morten Publishing House	2006
5.	Jeffrey C. Pommerville	Alcamo's Fundamentals of Microbiology	Jones & Bartlett Publishers	2012

WEB URLs

1. www.bestebestworld.com/cat/microbiology
2. <http://www.microbiologyinfo.com/top-and-best-microbiology-books/>
3. <https://www.youtube.com/watch?v=OBej7rFyN7U&t=434s>
4. <https://www.youtube.com/watch?v=V0BzQQCCwgo&t=119s>
5. <https://www.youtube.com/watch?v=H0xmeh6qoo>


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19BTC03

CELL BIOLOGY

L T P C
3 0 0 3**Course Objectives**

- To provide the basic knowledge in cell structure and organelles.
- To understand the cell division
- To learn transport across membranes
- To know about the signal transduction
- To enable students to learn various techniques used to study the cells.

Course Outcomes

1. Demonstrate the deeper understanding of cell at structural and functional level.
2. Identify the cell division and immortalization of cells.
3. Gain knowledge about molecular interaction between cells.
4. Demonstrate a clear understanding of the signal transduction, secondary messengers.
5. Develop skill on working principles of microscopy and identification of cell types.

UNIT I CELL STRUCTURE AND FUNCTION OF THE ORGANELLES

9

Prokaryotic, Eukaryotic cells, Sub-cellular organelles and functions. Principles of membrane organization membrane proteins, cytoskeletal proteins. Extra cellular matrix, cell-cell junctions.

UNIT II CELL DIVISION, CANCER, APOPTOSIS AND IMMORTALIZATION OF CELLS

9

Cell cycle – Mitosis, Meiosis, Molecules controlling cell cycle, cancer, role of Ras and Raf in oncogenesis and apoptosis. Stem cells, Cell culture and immortalization of cells and its applications.

UNIT III TRANSPORT ACROSS CELL MEMBRANE

9

Passive and Active Transport, Permeases, Ion channels, ATP pumps. Na⁺ / K⁺ / Ca²⁺ pumps, uniport, symport antiporter system. Ligand gated / voltage gated channels, Agonists and Antagonists.

UNIT IV SIGNAL TRANSDUCTION

9

Receptors – extracellular signaling, Cell surface / cytosolic receptors and examples, Different classes of receptors autocrine / paracrine / endocrine models, Secondary messengers molecules.

UNIT V TECHNIQUES USED TO STUDY CELLS

9

Cell fractionation and flow cytometry, Morphology and identification of cells using microscopic studies like SEM, TEM and Confocal Microscopy. Localization of proteins in cells – Immunostaining.

TOTAL: 45 PERIODS**TEXT BOOKS:**

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Lodish, Harvey	Molecular Cell Biology	W.H.Freeman	2005
2.	Sadava, D.E	Cell Biology: Organelle Structure and Function	Panama Publishing	2004

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Alberts, Bruce	Molecular Biology of the Cell	Garland Science (Taylors Francis)	2002

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2.	Cooper, G.M. and R.E. Hansman	The Cell: A Molecular Approach	ASM Press	2007
3.	Rastogi, S.C	Cell Biology	New Age International	2002
4.	Becker, W.M.	The World of the Cell	Pearson Education	2003
5.	Campbell, N.A., J.B. Reece and E.J. Simon	Essential Biology	Pearson International	2007

WEB URLs

1. <https://plato.stanford.edu/entries/cell-biology/>
2. <https://microbenotes.com/category/cell-biology/>
3. https://www.youtube.com/watch?v=L_gx1hozqOQ
4. <https://www.youtube.com/watch?v=43cyTVczB68>
5. <https://www.youtube.com/watch?v=WM2hJmjctI>


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19BTC04

BASIC INDUSTRIAL BIOTECHNOLOGY

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To make the students aware of the overall industrial bioprocess
- To evaluate the process to the requirement of the primary metabolites.
- To gain the knowledge about the secondary metabolites.
- To study the production of enzymes
- To understand the modern biotechnology products

COURSE OUTCOMES:

1. To explain the steps involved in the production of bioproducts and methods to improve modern biotechnology.
2. To apply basic biotechnological principles, methods and models to solve biotechnological tasks.
3. To identify and debate the ethical, legal, professional, and social issues in the field of biotechnology.
4. To explain the industrial application of bioproducts.
5. To design and deliver useful modern biotechnology products to the Society.

UNIT I INTRODUCTION TO INDUSTRIAL BIOPROCESS

9

Fermentation - Bacterial, Fungal and Yeast, Traditional and Modern industrial biotechnology, Basic concepts of Upstream and Downstream processing in Bioprocess, Process flow sheeting – block diagrams, pictorial representation.

UNIT II PRODUCTION OF PRIMARY METABOLITES

9

Primary Metabolites- Production of commercially important primary metabolites like organic acids (Citric acid, lactic acid), amino acids (glutamic acid, aspartic acid) and alcohols (ethanol, butanol)

UNIT III PRODUCTION OF SECONDARY METABOLITES

9

Secondary Metabolites- Production processes for various classes of secondary metabolites: Antibiotics (Penicillin), Vitamins and Steroids

UNIT IV PRODUCTION OF ENZYMES AND OTHER BIOPRODUCTS

9

Production of Industrial Enzymes (amylase, lipase), Biopesticides, Biofertilizers, Biopreservatives (nisin), Biopolymers (PHB), Single Cell Protein, Cheese.

UNIT V PRODUCTION MODERN BIOTECHNOLOGY PRODUCTS

9

Production of recombinant proteins having diagnostic applications, vaccines. Production of monoclonal antibodies.

Total Hours

45

TEXT BOOKS:


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Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Satyanarayana, U	Biotechnology	Books & Allied (P) Ltd	2005
2.	Kumar, H.D	A Textbook on Biotechnology	Affiliated East West Press Pvt.Ltd	1998

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Casida, L.E	Industrial Microbiology	New Age International (P) Ltd	1968
2.	Presscott, S.C. and Cecil G. Dunn	Industrial Microbiology	Agrobios (India)	2005
3.	Cruger, Wulf and Anneliese Crueger	Biotechnology: A Textbook of Industrial Microbiology	Panima Publishing	2000
4.	Moo-Young, Murrey	Comprehensive Biotechnology	Pergamon Press	2004
5.	Stanbury, P.F., A. Whitaker and S.J. Hall	Principles of Fermentation Technology	Butterworth – Heinemann	1995

WEB URLs

1. <http://www.vitorrentz.co/search/Prescott+and+Dunn%E2%80%99s+Industrial+Microbiology,+4th+E>
2. <https://www.edx.org/course/industrial-biotechnology-delftx-ib01x-0>
3. <https://online-learning.tudelft.nl/courses/industrial-biotechnology/>
4. <https://www.youtube.com/watch?v=2CqjfuTu4K0&list=PL0sPYH8zyA44ZIVNCxYhfJOK5MyKXufXQ>
5. <https://www.youtube.com/watch?v=2CqjfuTu4K0>


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19BTC05

MOLECULAR BIOLOGYL T P C
3 0 0 3**COURSE OBJECTIVES:**

- To familiarize with the molecular biology of both Prokaryotes and Eukaryotes.
- To understand the replication process
- To familiarize students on macromolecule's properties, structures and functions
- To expose students to various molecular events in prokaryotes
- To create deeper understanding on regulation of genes activities

COURSE OUTCOMES:

1. Analyze three major macromolecules and their properties in living organisms.
2. Organize the mechanism of DNA replication.
3. Analyze the mechanism of transcription and universal genetic.
4. Analyze the process of translation and DNA repair system.
5. Apply the concept of gene regulation and its significance

UNIT I CHEMISTRY OF NUCLEIC ACIDS

9

Introduction to nucleic acids: Nucleic acids as genetic material, Structure and physicochemical properties of elements in DNA and RNA, Biological significance of differences in DNA and RNA. Primary structure of DNA: Chemical and structural qualities of 3',5'-Phosphodiester bond. Secondary Structure of DNA: Watson & Crick model, Chargaff's rule, X-ray diffraction analysis of DNA, Forces stabilizes DNA structure, Conformational variants of double helical DNA, Hogsteen base pairing, Triple helix, Quadruple helix, Reversible denaturation and hyperchromic effect. Tertiary structure of DNA: DNA supercoiling

UNIT II DNA REPLICATION & REPAIR

9

Overview of Central dogma. Organization of prokaryotic and eukaryotic chromosomes. DNA replication: Meselson & Stahl experiment, bi-directional DNA replication, Okazaki fragments, Proteomics of DNA replication, Fidelity of DNA replication, Inhibitors of DNA replication, Overview of differences in prokaryotic and eukaryotic DNA replication, Telomere replication in eukaryotes. D-loop and rolling circle mode of replication. Mutagens, DNA mutations and their mechanism, various types of repair mechanisms.

UNIT III TRANSCRIPTION

9

Structure and function of mRNA, rRNA and tRNA. Characteristics of promoter and enhancer sequences. RNA synthesis: Initiation, elongation and termination of RNA synthesis, Proteins of RNA synthesis, Fidelity of RNA synthesis, Inhibitors of transcription, Differences in prokaryotic and eukaryotic transcription. Basic concepts in RNA world: Ribozymes, RNA processing: 5'-Capping, Splicing-Alternative splicing, Poly 'A' tail addition and base modification.

UNIT IV TRANSLATION

9

Introduction to Genetic code: Elucidation of genetic code, Codon degeneracy, Wobble hypothesis and its importance, Prokaryotic and eukaryotic ribosomes. Steps in translation: Initiation, Elongation and termination of protein synthesis. Inhibitors of protein synthesis. Posttranslational modifications and its importance.

UNIT V REGULATION OF GENE EXPRESSION


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Organization of genes in prokaryotic and eukaryotic chromosomes, Hierarchical levels of gene regulation, Prokaryotic gene regulation –lac and trp operon, Regulation of gene expression with reference to λ phage life cycle.

Total Hours

45

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Friefelder, David	Molecular Biology	Narosa Publications	1999
2.	Weaver, Robert F	Molecular Biology	Tata McGraw-Hill	2003

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Karp, Gerald	Cell and Molecular Biology: Concepts and Experiments	John Wiley	2005
2.	Friefelder, David and George M. Malacinski	Essentials of Molecular Biology	Panima Publishing	1993
3.	Tropp, Burton E	Molecular Biology: Genes to Proteins	Jones and Bartlett	2008
4.	Glick, B.R. and J.J. Pasternak	Molecular Biotechnology: Principles and Applications of Recombinant DNA	ASM	2010
5.	Harvey Lodish, Arnold Berk, S.L Zipursky, Paul Matsudaira, David Baltimore and James Danell	Molecular Cell Biology	W.H Freeman	2016

WEB URLs

1. <http://leadingstrand.cshl.edu/Course/Keynote/2013/A-MEMBRANE/93>
2. <http://leadingstrand.cshl.edu/Course/Keynote/2012/A-SYSTEM/83>
3. <https://www.youtube.com/watch?v=HgTXc4ZESB8&list=PLyjWMictIvv2D2gV4bknO8D-HLkqjG-Jr>
4. <https://www.youtube.com/watch?v=ZYhQZXtRCks>
5. https://www.youtube.com/watch?v=tJVIFTS1YN0&list=PLrl4F_rRUyHuxM3NyTlyvHiK4IK9F_glj


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19BTC06

FUNDAMENTALS OF BIOPROCESSL T P C
3 0 0 3**COURSE OBJECTIVES:**

- To study the historical development of bio process technology, design of fermenter and types of fermentation process
- To gain knowledge about formulation, optimization of medium.
- To study the principles of sterilization and their kinetics
- To inculcate the stoichiometry and energetics of cell growth and product formation
- To evaluate the kinetics and mechanism of microbial growth

COURSE OUTCOMES:

1. Ability to develop skills of the students in the area of bio process technology with emphasis on bioprocess principles
2. Ability to discuss and distinguish the medium requirements and optimization methods
3. Ability to explain the sterilization kinetics of medium and equipments
4. Ability to learn about fermentation processes, metabolic stoichiometry, energetics, kinetics of microbial growth etc
5. Ability to understand the kinetics of microbial growth that plays a vital role in the fermentation process

UNIT I OVERVIEW OF FERMENTATION PROCESSES

9

Overview of fermentation industry, general requirements of fermentation processes, basic configuration of fermentor and ancillaries, main parameters to be monitored and controlled in fermentation processes.

UNIT II RAW MATERIALS AND MEDIA DESIGN FOR FERMENTATION PROCESS

9

Criteria for good medium, medium requirements for fermentation processes, carbon, nitrogen, minerals, vitamins and other complex nutrients, oxygen requirements, medium formulation of optimal growth and product formation, examples of simple and complex media, design of various commercial media for industrial fermentations – medium optimization methods

UNIT III STERILIZATION KINETICS

9

Thermal death kinetics of microorganisms, batch and continuous heat sterilization of liquid media, filter sterilization of liquid media, air sterilization and design of sterilization equipment - batch and continuous

UNIT IV METABOLIC STOICHIOMETRY AND ENERGETICS

9

Stoichiometry of cell growth and product formation, elemental balances, degrees of reduction of substrate and biomass, available electron balances, yield coefficients of biomass and product formation, maintenance coefficients energetic analysis of microbial growth and product formation, oxygen consumption and heat evolution in aerobic cultures, thermodynamic efficiency of growth.

UNIT V KINETICS OF MICROBIAL GROWTH AND PRODUCT FORMATION

9

Batch cultivation and continuous cultivation. Simple unstructured models for microbial growth, Monod model, growth of filamentous organisms, product formation kinetics - Leudeking- Piret models, substrate and product inhibition on cell growth and product formation.

Total Hours

45


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TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Shuler, Michael L. and Fikret Kargi	Bioprocess Engineering	Prentice Hall	1992
2.	Doran, Pauline	Bioprocess Engineering Principles	Elsevier	1995

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Lydersen, Bjorn K	Bioprocess Engineering Systems, Equipment and Facilities	John Wiley	1994
2.	Bailey, James E. and David F. Ollis	Biochemical Engineering Fundamentals	McGraw Hill	1986
3.	Peter F. Stanbury, Stephen J. Hall & A. Whitaker	Principles of Fermentation Technology	Science & Technology Books	1995
4.	Harvey W. Blanch, Douglas S. Clark	Biochemical Engineering	Marcel Dekker, Inc	1997
5.	P. A. Belter, E. L. Cussler and Wei-Shou Hu	Bioseparations - Downstream Processing for Biotechnology	Wiley Interscience	1988

WEB URLs

1. <https://nptel.ac.in/courses/113104060/4>
2. <https://nptel.ac.in/courses/103101004/>
3. <https://nptel.ac.in/courses/103104043/>
4. <https://www.youtube.com/watch?v=5eKdZ0dVCCo>
5. <https://www.youtube.com/watch?v=-BFRwlgB2QQ>


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19BTC07

BASICS OF UNIT OPERATIONS

L T P C
2 2 0 3

COURSE OBJECTIVES:

- To explain the basic principles of mass transfer operations and other separation processes with examples.
- To impart knowledge on how certain substances undergo the physical change with diffusion/mass transfer of components from one phase to other phases.
- To focus on absorption and distillation operations and the process design aspects of the same operations.
- To understand extraction and leaching operations and their applications in bioprocessing
- To industry. understand adsorption and drying operations and the process design aspects of the same operations

COURSE OUTCOMES:

1. Ability to define the basic principles of mass transfer operations and the measurement of diffusivity, mass transfer coefficient
2. Ability to understand the importance of mass transfer phenomena in the design of process equipment in distillation operations
3. Ability to understand the HETP, NTU and HTU concepts of various gas absorption packed tower columns
4. Ability to understand the design aspects of extraction and various leaching equipments
5. Ability to understand the importance of adsorption and drying processes and their industrial applications.

UNIT I MIXING AND AGITATION 8
Dimensional analysis; power for agitation; agitation of liquids; gas-liquid systems; gassolid suspensions; agitator scale up.

UNIT II FILTRATION 8
Constant pressure, constant volume batch filtration; continuous filtration; industrial filters; settling and sedimentation; centrifugation

UNIT III MECHANISM OF HEAT TRANSFER 10
Steady state conduction; combined resistances; unsteady state conduction; lumped heat capacity; extended surfaces; combined conduction and convection

UNIT IV CONVECTION HEAT TRANSFER 10
Dimensional analysis; forced and natural convection; convection in flow over surfaces through pipes boiling and condensation

UNIT V HEAT EXCHANGERS 9
Equipments; overall heat transfer coefficients; design of heat exchangers; NTU concept; evaporators; single and multiple effects; mass and enthalpy balances.

Total Hours 45

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication


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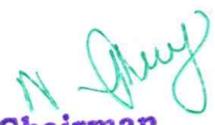
1.	Geankoplis C.J	. Transport Processes And Unit Operations	Prentice Hall India	2002
2.	McCabe W.L., Smith J.C	Unit Operations In Chemical Engineering	Mcgrawhill	1993

REFERENCE BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Incropera F.P	Fundamentals Of Heat And Mass Transfer	John Wiley	1998
2.	Gavhane, K.A	Unit Operations-I [Fluid Flow and Mechanical Operations]	Nirali Prakashan	2016
3.	Frank M. White	Fluid mechanics	McGraw-Hill Education	2015
4.	R.K.Bansal	A Textbook of Fluid Mechanics and Hydraulic Machines	Laxmi publications (P) Ltd	2009
5.	Badger W.L. and Banchemo J.T	Introduction to Chemical Engineering	TataMcGraw Hill	1997

WEB URLs

1. <https://nptel.ac.in/courses/103104043/>
2. <https://nptel.ac.in/courses/103107127/>
3. <https://www.youtube.com/watch?v=-Qx5k3BMVPO>
4. <https://www.youtube.com/watch?v=0CWCo2PV3Eg>
5. <https://www.youtube.com/watch?v=fIX-nOHHExs>


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19BTC08

INSTRUMENTAL METHODS OF ANALYSIS**L T P C**
3 0 0 3**COURSE OBJECTIVES:**

- To enable the students to have a fundamental knowledge about the Light spectrum, Absorption
- To expose students with electrical and electronic components used in the analytical instruments
- To learn and understand the principles and operation of different instrumentation techniques
- To acquire knowledge on the different chromatographic methods for separation of biological products
- To know the different molecular spectroscopic techniques and their analytical applications

COURSE OUTCOMES:

1. Ability to analyze the function of electrical and optical component in analytical instruments and their calibration
2. Ability to apply the spectroscopic techniques to identify, estimate and characterize analytes
3. Ability to analyze the thermal behavior of materials using thermal analysis
4. Ability to apply chromatographic and electrophoretic techniques to separate, purify and quantify molecules
5. Ability to analyze different types of electrodes and electroanalytical techniques for sensing and quantifying analytes.

UNIT I INTRODUCTION TO SPECTROMETRY**9**

Properties of electromagnetic radiation- wave properties – components of optical instruments – Sources of radiation – wavelength selectors – sample containers – radiation transducers – Signal process and read outs – signal to noise ratio - sources of noise – Enhancement of signal to noise - types of optical instruments – Principle of Fourier Transform optical Measurements.

UNIT II MOLECULAR SPECTROSCOPY**9**

Molecular absorption spectrometry – Measurement of Transmittance and Absorbance – Beer's law – Instrumentation - Applications -Theory of fluorescence and Phosphorescence – Instrumentation – Applications – Theory of Infrared absorption spectrometry – IR instrumentation – Applications – Theory of Raman spectroscopy – Instrumentation – applications.

UNIT III MAGNETIC RESONANCE SPECTROSCOPY AND MASS SPECTROMETRY**9**

Theory of NMR – environmental effects on NMR spectra – chemical shift- NMR-spectrometers – applications of ^1H and ^{13}C NMR- Molecular mass spectra – ion sources – Mass spectrometer. Applications of molecular mass - Electron paramagnetic resonance- g values –instrumentation

UNIT IV SEPARATION METHODS**9**

General description of chromatography – Band broadening and optimization of column performance- Liquid chromatography – Partition chromatography – Adsorption chromatography – Ion exchange chromatography -size exclusion chromatography- Affinity chromatography principles of GC and applications – HPLC- Capillary electrophoresis – Applications

UNIT V ELECTRO ANALYSIS AND SURFACE MICROSCOPY**9**

Electrochemical cells- Electrode potential cell potentials – potentiometry- reference electrode – ion selective and molecular selective electrodes – Instrument for potentiometric studies – Voltametry – Cyclic and pulse voltametry- Applications of voltametry . Study of surfaces – Scanning probe microscopes – AFM and STM.

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45

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Skoog, D.A. F. James Holler, and Stanky, R.Crouch	Instrumental Methods of Analysis	Cengage Learning	2007
2.	Willard, Hobart	Instrumental Methods of Analysis	CBS	1986

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Braun, Robert D	Introduction to Instrumental Analysis	Pharma Book Syndicate	1987
2.	Ewing,G.W	Instrumental Methods of Chemical Analysis	McGraw-Hill	1985
3.	Sharma, B.K	Instrumental Methods of Chemical Analysis: Analytical Chemistry	Goel Publishing House	1972
4.	Haven, Mary C	Laboratory Instrumentation	John Wiley	1995
5.	Arthur I. Vogel	Quantitative Inorganic Analysis including Elementary Instrumental Analysis	ELBS, Group	1989

WEB URLs

1. <http://nptel.ac.in/courses.php>
2. <http://nptel.ac.in/downloads/102103044/>
3. <http://nptel.ac.in/courses.php?disciplineId=102>
4. <https://www.youtube.com/watch?v=dAM0CVa8IkQ>
5. <https://www.youtube.com/watch?v=vrIR4oBslV8>


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19BTC09

BIOPROCESS ENGINEERINGL T P C
3 0 0 3**COURSE OBJECTIVES:**

- To provide the students with the basics of bioreactor engineering.
- To develop bioengineering skills for the production of biochemical product using integrated biochemical processes
- To understand the role of biotechnologists in bioprocess industry.
- To apply the engineering concepts for biological conversion of raw materials
- To perform simulations of reactors and model the kinetics of product formation

COURSE OUTCOMES:

1. Ability to select appropriate bioreactor configurations and operation modes based upon the nature of bioproducts and cell lines and other process criteria.
2. Ability to plan a research career or to work in the biotechnology industry with strong foundation about bioreactor design and scale-up.
3. Ability to perform in enzyme systems
4. Ability to apply modeling and simulation of bioprocesses so as to reduce costs and to enhance the quality of products and systems.
5. Ability to integrate research lab and Industry; identify problems and seek practical solutions for large scale implementation of Biotechnology.

UNIT I CONFIGURATION OF BIOREACTORS

9

Ideal reactors and its characteristics Fed batch cultivation, Cell recycle cultivation, Cell recycle cultivation in waste water treatment two stage cultivation Packed bed reactor, airlift reactor, introduction to fluidized bed reactor bubble column reactors

UNIT II BIOREACTOR SCALE – UP

9

Regime analysis of bioreactor processes, oxygen mass transfer in bioreactors – microbial oxygen demands; methods for the determination of mass transfer coefficients; mass transfer correlations. Scale up criteria for bioreactors based on oxygen transfer, power consumption and impeller tip speed

UNIT III BIOREACTOR CONSIDERATION IN ENZYME SYSTEMS

9

Analysis of film and pore diffusion effects on kinetics of immobilized enzyme reactions; formulation of dimensionless groups and calculation of effectiveness factors. Design of immobilized enzyme reactors – packed bed, fluidized bed and membrane reactors

UNIT IV MODELLING AND SIMULATION OF BIOPROCESSES

9

Study of structured models for analysis of various bioprocess – compartmental models, models of cellular energetics and metabolism, single cell models, plasmid replication and plasmid stability model. Dynamic simulation of batch, fed batch, steady and transient culture metabolism

UNIT V RECOMBINANT CELL CULTIVATION

9

Different host vector system for recombinant cell cultivation strategies and advantages. E.coli, yeast Pichia pastoris / Saccharomyces cerevisiae, Animal cell cultivation, plant cell cultivation, Insect cell cultivation. High cell density cultivation, process strategies, reactor considerations in the above system

Total Hours

45

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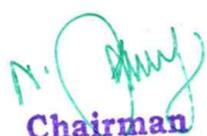
Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Michael L. Shuler and Fikret Kargi	Bioprocess Engineering, Basic Concept	Prentice Hall PTR	2002
2.	Pauline Doran	Bioprocess Engineering Calculation	Academic Press	2012

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Bailey and Ollis	Biochemical Engineering Fundamentals	McGraw-Hill	2010
2.	Rajiv Dutta	Fundamentals of Biochemical Engineering	Ane Books India	2008
3.	Lee, J. M	Biochemical Engineering	NJ: Prentice Hall	2010
4.	Blanch H. W. And Clark D. S	Biochemical Engineering	CRC Press	2007
5.	Stanbury P. F., Hall, S., and Whitaker A	Principles of Fermentation Technology	Butterworth-Heinesmann	2016

WEB URLs

1. <http://www.nptel.ac.in/syllabus/syllabus.php?subjectId=102107029>
2. <http://users.ox.ac.uk/~dplb0149/publication/NPRBiocatalysisRev.pdf> 4
3. https://www.youtube.com/watch?v=V0BzQQCCwgo&list=PL9lnBEiCe6o60eSoHRIT_rwpZKJfnFY-W
4. <https://www.youtube.com/watch?v=5eKdZ0dVCCo&t=3s>
5. https://www.youtube.com/watch?v=D73_DzPqJU0


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19BTC10

GENETIC ENGINEERING

L T P C

3 0 0 3

COURSE OBJECTIVES:

- To discuss the gene cloning methods and the tools
- To understand the techniques involved in gene cloning and genome analysis and genomics.
- To explain the heterologous expression of cloned genes in different hosts.
- To apply types of host-vector systems and steps in creating a recombinant DNA molecule
- To gain knowledge on various recombinant DNA techniques and their applications

COURSE OUTCOMES:

1. Ability to know how to clone commercially important genes.
2. Ability to know how to produce the commercially important recombinant proteins.
3. Ability to know about gene and genome sequencing techniques.
4. Ability to know about microarrays, Analysis of Gene expression and proteomics
5. Ability to know about genome sequencing

UNIT I BASICS OF RECOMBINANT DNA TECHNOLOGY

9

Manipulation of DNA – Restriction and Modification enzymes, Design of linkers and adaptors. Characteristics of cloning and expression vectors based on plasmid and bacteriophage, Vectors for insect, yeast and mammalian system, Prokaryotic and eukaryotic host systems, Introduction of recombinant DNA in to host cells and selection methods.

UNIT II DNA LIBRARIES

9

Construction of genomic and cDNA libraries, Artificial chromosomes – BACs and YACs, Chromosomal walking, Screening of DNA libraries using nucleic acid probes and antisera.

UNIT III SEQUENCING AND AMPLIFICATION OF DNA

9

Maxam Gilbert's and Sanger's methods of DNA sequencing. Inverse PCR, Nested PCR, AFLP PCR, Allele specific PCR, Assembly PCR, Asymmetric PCR, Hot start PCR, inverse PCR, Colony PCR, single cell PCR, Real-time PCR/qPCR – SYBR green assay, Taqman assay, Molecular beacons. Site directed mutagenesis.

UNIT IV ORGANIZATION AND STRUCTURE OF GENOMES

9

Organization and structure of genomes, Genome sequencing methods, Conventional and shotgun genome sequencing methods, Next generation sequencing technologies, Ordering the genome sequence, Genetic maps and Physical maps, STS content based mapping, Restriction Enzyme Finger Printing, Hybridization mapping, Radiation Hybrid Maps, Optical mapping. ORF finding and functional annotation.

UNIT V CURRENT STATUS OF GENOME SEQUENCING PROJECTS

9

Current status of genome sequencing projects, Introduction to Functional genomics, Microarrays, Serial Analysis of Gene expression (SAGE), Subtractive hybridization, DIGE, TOGA, Yeast Two hybrid System, Comparative Genomics, Proteogenomics, Web resources for Genomics, Applications of genome analysis and genomics.

TEXT BOOKS:

Total Hours 45

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Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Brown T.A	Genomes	Bios Scientific Publishers Ltd	2017
2.	Primrose S.B., Twyman RM	Principles of Gene Manipulation and Genomics	Blackwell Science	2006

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Glick B.R.,and Pasternick J.J	Molecular Biotechnology: Principles and Applications of Recombinant DNA	ASM press	2017
2.	Sathyanarayana U	Biotechnology	Books & Allied (p) ltd	2008
3.	Howe C. J	Gene Cloning and Manipulation	Cambridge University Press	2007
4.	Watson.J.D	Recombinant DNA	Scientific American Book	1993
5.	T A Brown	Gene Cloning and DNA Analysis: An Introduction	Wiley – Blackwell Publications.	2006

WEB URLs

1. <http://nptel.ac.in/courses/102103013/>
2. http://www.lsic.ucla.edu/l3/tutorials/gene_cloning.html
3. <https://ocw.mit.edu/courses/biology/7-01sc-fundamentals-of-biology-fall-2011/recombinant-dna/>
4. <https://www.youtube.com/watch?v=WwFwDGkGPlc>
5. <https://www.youtube.com/watch?v=jAhjPd4uNFY>


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19BTC11

MASS TRANSFER OPERATIONS

L T P C
2 2 0 3

COURSE OBJECTIVES:

- To explain the basic principles of mass transfer operations and other separation processes with examples.
- To impart knowledge on how certain substances undergo the physical change with diffusion/mass transfer of components from one phase to other phases.
- To focus on absorption and distillation operations and the process design aspects of the same operations.
- To understand extraction and leaching operations and their applications in bioprocessing industry.
- To understand adsorption and drying operations and the process design aspects of the same operations

COURSE OUTCOMES:

1. Ability to define the basic principles of mass transfer operations and the measurement of diffusivity, mass transfer coefficient
2. Ability to understand the importance of mass transfer phenomena in the design of process equipment in distillation operations
3. Ability to understand the HETP, NTU and HTU concepts of various gas absorption packed tower columns
4. Ability to understand the design aspects of extraction and various leaching equipments
5. Ability to understand the importance of adsorption and drying processes and their industrial applications.

UNIT I DIFFUSION AND MASS TRANSFER

9

Molecular diffusion in fluids and solids; Interphase Mass Transfer; Mass Transfer coefficients; Analogies in Transport Phenomenon.

UNIT II GAS LIQUID OPERATIONS

9

Principles of gas absorption; Single and Multi component absorption; Absorption with Chemical Reaction; Design principles of absorbers; Industrial absorbers; HTU, NTU concepts

UNIT III VAPOUR LIQUID OPERATIONS

9

V-L Equilibria; Simple, Steam and Flash Distillation; Continuous distillation; McCabe-Thiele & Ponchon-Savarit Principles; Industrial distillation equipments, HETP, HTU and NTU concepts.

UNIT IV EXTRACTION OPERATIONS

9

L-L equilibria, Staged and continuous extraction, Solid-liquid equilibria, Leaching Principles.

UNIT V SOLID FLUID OPERATIONS

9

Adsorption equilibria – Batch and fixed bed adsorption; Drying-Mechanism-Drying curves-Time of Drying; Batch and continuous dryers.

Total Hours


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TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Treybal R.E	Mass Transfer Operations	Mcgraw Hill	2017
2.	Geankoplis C.J	Transport Processes and Unit Operations	Prentice Hall of India	2002

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Coulson and Richardson's	Chemical Engineering. Vol I & II	Asian Books Pvt Ltd	1998
2.	Rajput, R.K	Heat and Mass Transfer	S. Chand and Co	2008
3.	G. K. Roy	Fundamentals of Heat and Mass Transfer	Kanna Publications	2004
4.	W. L. McCabe, J.C. Smith and P. Harriott	Unit Operations in Chemical Engineering	Tata McGraw-Hill Professional	2005
5.	Gavahne. K.A., Unit Operations-II	Heat & Mass Transfer	Nirali prakasan	2012

WEB URLs

1. <http://nptel.ac.in/courses/103103032>
2. <http://nptel.ac.in/courses/103103035>
3. https://www.youtube.com/watch?v=Yc2eSffzhBI&list=PLwdnzlV3ogoVX_S_8DyKa7RudEazDL0o
4. https://www.youtube.com/watch?v=HIHyEcP_7SU&list=PL38769A2045D58D20
5. https://www.youtube.com/watch?v=EG4ZoVTSA5I&list=PLvpgTFzUKO4_51rEIT6AbggF1UY_YkLg2X



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19BTC12 HEALTH AND PHARMACEUTICAL BIOTECHNOLOGY

**L T P C
3 0 0 3**

COURSE OBJECTIVES:

- To explain the basic principles of pharmacology.
- To impart knowledge on drug discovery.
- To focus on pharmacokinetics and transformation.
- To understand pharmaceutical dosage forms.
- To understand the biopharmaceuticals

COURSE OUTCOMES:

1. Ability to define the basic principles of pharmacology
2. Ability to understand the importance of drug discovery
3. Ability to understand the pharmacokinetics and transformation
4. Ability to understand the design pharmaceutical dosage forms
5. Ability to understand the importance of biopharmaceuticals.

UNIT I INTRODUCTION TO PHARMACOLOGY 9

Historical outlines of drugs, classifications of drugs, physico-chemical properties of drugs, Routes of administration of drugs, drugs metabolism, controlled release drug delivery system, drug stability, Sources: plant, marine and microorganisms

UNIT II DRUG DISCOVERY 9

Drug discovery an introduction, basic clinical evolution of new drugs, bioavailability of drugs, quantitative and qualitative assay of drugs by biological testing, packing techniques like compression of tablets, wet & dry granulation, direct compression, tablet presses and coating

UNIT III PHARMACOKINETICS AND BIOTRANSFORMATION 9

Pharmacokinetics: introduction, absorption, distribution, elimination and metabolism of drugs, site of action, Phase I and Phase II reactions, prodrugs, adverse drug effects, Role of Enzymes in drug metabolism

UNIT IV PHARMACEUTICAL DOSAGE FORMS AND APPLICATIONS 9

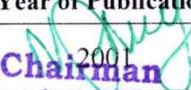
Oral solid dosage forms, compressed tablets, types, pills, solutions, syrups, juices, nasal solutions, emulsions, lotions and extracts. Applications of various drugs in human body and site of action

UNIT V BIO PHARMACEUTICALS 9

Various categories of therapeutics like vitamins, laxatives, analgesics, contraceptives, common drugs which are abused, Antibiotics, human insulin, interferon, somatostalin, somatotropin – its preservation and analytical methods

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Remington	The science and practice of pharmacy	Lippincott Williams and Wilkins	2001


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2.	Gareth Thomas	Medicinal Chemistry an Introduction	John Wiley	2000
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REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Ram I. Mahato, Ajit S. Narang,	Pharmaceutical Dosage Forms and Drug Delivery	CRC Press	2011
2.	Mohsen A. Hedaya	Basic Pharmacokinetics	Routledge	2012
3.	Katzung, B.G	Basic and Clinical Pharmacology	Prentice Hall of India	1995
4.	Tripathi, K.D	Essentials of Medical Pharmacology	John Wiley	2000
5.	Brahmankar, D.M. and Jaiswal, S.B	Biopharmaceutics and Pharmacokinetics	Vallabh Prakashan Publication	2009

WEB URLs

1. <http://onlinelibrary.wiley.com/book/10.1002/9780470259818>
2. <https://ocw.mit.edu/courses/health-sciences-and-technology/hst-151-principles-of-pharmacology-spring-2005/lecture-notes/>
3. <https://www.youtube.com/watch?v=1oNEdTke82o>
4. <https://www.youtube.com/watch?v=BwBEAUgBZBw&list=PLMSPJ8kbQ9lnn7TQJGquIx9s-wDBNTOA>
5. <https://www.youtube.com/watch?v=BwBEAUgBZBw>



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19BTC13

BIOINFORMATICS

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To understand the theory and background of commonly available bioinformatics tools
- To navigate through internet-based biological databases and genomic browsers
- To use online resources for biological applications
- To navigate through internet-based biological databases and genomic browsers
- To let the students know the recent evolution in biological science.

COURSE OUTCOMES:

1. Ability to understand the importance of bioinformatics and their basic requirements
2. Ability to apply the knowledge of bioinformatics in analysis of biological databases
3. Ability to analyze the concepts of dynamic programming
4. Ability to analyze the evolutionary concepts to build phylogenetic tree
5. Ability to evaluate the drug designing techniques with online resources

UNIT I INTRODUCTION

9

Introduction to Bioinformatics – applications, Operating systems- types, Elementary UNIX commands, TCP/IP, Telnet, FTP, Protocols, Hardwares, Network topology, Search engines.

UNIT II BIOLOGICAL DATABASES

9

Introduction to databases – Data life cycle Biological databases; Primary nucleotide databases (EMBL, GeneBank and DDBJ); Primary protein databases (SwissProt) Secondary protein databases (PROSITE); Structural databases – SCOP and CATH. Sequence retrieval from database

UNIT III PATTERN MATCHING AND DYNAMIC PROGRAMMING

9

Introduction to pairwise sequence alignment – local vs. global; Dynamic programming – Needleman – Wunsch algorithm & Smith – Waterman algorithm; Dot matrix analysis; substitution matrices, BLAST – FASTA— Statistical methods – Hidden Markov models

UNIT IV PHYLOGENY

9

Introduction to multiple sequence alignment, Introduction; mutations; mutations as a measure of time; Phylogenetic analysis Distance matrix methods, character based methods. Molecular clock theory, Bootstrapping.

UNIT V ADVANCED TOPICS IN BIOINFORMATICS

9

Introduction to Systems Biology and Synthetic Biology, Microarray analysis - types and applications, Bioinformatics approaches for drug discovery.

Total Hours

45

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher
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Chairman
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1.	Lesk, A. K	Introduction to Bioinformatics	Oxford University Press	2013
2.	Dan Gusfield	Algorithms on Strings, Trees and Sequences: Computer Science and Computational Biology	Cambridge University Press	1997

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Durbin, R., Eddy, S., Krogh, A., and Mitchison, G	Biological Sequence Analysis Probabilistic Models of proteins and nucleic acids	Cambridge, UK: Cambridge University Press	1998
2.	Mount, D.W	Bioinformatics Sequence and Genome Analysis	Cold Spring Harbor Laboratory Press	2004
3.	Bergeron.B	Bioinformatics Computing	Prentice Hall of India Learning Pvt (Ltd)	2009
4.	Attwood, T.K and Parry Smith. D.J	Introduction to Bioinformatics	Pearson Education	2002
5.	Uri Alon	An Introduction to Systems Biology: Design Principles of Biological Circuits	Chapman & Hall	2006

WEB URLs

1. <http://bioconductor.org/>
2. <https://onlinecourses.science.psu.edu/statprogram/r>
3. https://www.youtube.com/watch?v=w-uk-_TOgR0
4. <https://www.youtube.com/watch?v=K9MqyU298uE>
5. https://www.youtube.com/watch?v=w-uk-_TOgR0&list=PLb0WW0k29aHrF8aZzK17ORTesZsd-IING


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19BTC14

CHEMICAL REACTION ENGINEERING

L T P C

2 2 0 3

COURSE OBJECTIVES:

- To impart the basic concepts in reaction kinetics
- To provide the information about different reactor systems and deriving the performance equations for different reactor systems.
- To develop knowledge for design of non ideal reactors
- To develop knowledge for design of ideal reactors
- To acquire knowledge in heterogeneous reactions and reactor types.

COURSE OUTCOMES:

1. Ability to elucidate the basic laws on chemical kinetics and its application on different types of reactions
2. Ability to apply the various ideal reactors and their design equations
3. Ability to elaborate the non-ideal behaviour of reactors
4. Ability to conceptualize the basic of heterogeneous reacting systems
5. Ability to identify and analyse the various multiphase reactors

UNIT I SCOPE OF CHEMICAL KINETICS & CHEMICAL REACTION ENGINEERING 9

Broad outline of chemical reactors; rate equations; concentration and temperature dependence; development of rate equations for different homogeneous reactions. Industrial scale reactors.

UNIT II IDEAL REACTORS 9

Isothermal batch, flow, semi-batch reactors; performance equations for single reactors; multiple reactor systems; multiple reactions.

UNIT III NON IDEAL REACTORS 9

RTD in non-ideal flow; non-ideal flow models; reactor performance with non-ideal flow..

UNIT IV IDEAL FLOW AND NON IDEAL FLOW 9

Resistances and rate equations; heterogeneous catalysis; reactions steps; resistances and rate equations.

UNIT V FIXED BED AND FLUID BED REACTORS 9

G/L reactions on solid catalysis; trickle bed, slurry reactors; three phase-fluidized beds; reactors for fluid-fluid reactions; tank reactors.

Total Hours 45

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Levenspiel O	Chemical Reaction Engineering	John Wiley	2006
2.	Fogler H.S	Elements Of Chemical Reaction Engineering	Prentice Hall India	2002

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REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Missen R.W., Mims C.A., Saville B.A	Introduction to Chemical Reaction Engineering and Kinetics	John Wiley	1999
2.	Dawande, S.D	Principles of Reaction Engineering	Central Techno Publications	2001
3.	Richardson, J.F. and Peacock, D.G, Coulson Richardson	Chemical Engineering Vol.III	Butterworth- Heinemann- Elsevier	2006
4.	Walker, D	Chemical Reactions	Evans Brothers	2007
5.	Forment G F and Bischoff K B	Chemical Reactor Analysis and Design	John Wiley	2010

WEB URLs

1. <https://nptel.ac.in/courses/103108097/>
2. <https://www.youtube.com/watch?v=DpLAsVcofao&list=PLwdnzlV3ogoUC9IWVVOPTGqV5eEVNRAfGa>
3. <https://www.youtube.com/watch?v=OGWwdT6UGVM&list=PLwdnzlV3ogoUC9IWVVOPTGqV5eEVNRAfGa&index=2>
4. <https://www.youtube.com/watch?v=WcHd7yFvp6Q&list=PLgzL8klq6DLxhjPKpyF9aHjxSbykVvQ3>
5. <https://www.youtube.com/watch?v=IkqoqF-keiE&list=PLOzRYVm0a65cyrKMms9dQtcMnMK-rQ6DX>



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19BTC15

DOWNSTREAM PROCESSING

L T P C

3 0 0 3

COURSE OBJECTIVES:

- To introduce the methods of separation technology
- To expose students to techniques of product fractionation
- To gain knowledge about isolation of products
- To create deeper understanding of final product purification
- To understand the methods to obtain pure proteins, enzymes

COURSE OUTCOMES:

1. Apply separation techniques used in downstream process for the purification of biomolecules
2. Analyze techniques of insoluble removal and predict the parameters for large scale operations
3. Analyze the techniques used in bulk product isolation
4. Evaluate the techniques of high-resolution product purification based on product characteristics and cost effectiveness
5. Evaluate the techniques of final product formulation

UNIT I INTRODUCTION

9

Introduction to downstream processing, principles, characteristics of bio-molecules and bioprocesses. Cell disruption for product release – mechanical, enzymatic and chemical methods. Pre treatment and stabilisation of bio-products.

UNIT II PHYSICAL METHODS OF SEPARATION

9

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

UNIT III ISOLATION OF PRODUCTS

9

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

UNIT IV PRODUCT PURIFICATION

9

Chromatography – principles, instruments and practice, adsorption, reverse phase, ion exchange, size exclusion, hydrophobic interaction, bio-affinity and pseudo affinity chromatographic techniques

UNIT V PRODUCT FORMULATION AND FINISHING OPERATIONS

9

Crystallization, drying and lyophilization in final product formulation.

Total Hours

45

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Belter, P.A., E.L. Cussler and Wei-Houhu	Bioseparations – Downstream Processing for Biotechnology	John Wiley	1988
2.	Sivasankar, B	Bioseparations: Principles and	PHI	2005

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REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Asenjo, Juan A	Separation Processes in Biotechnology	CRC / Taylor & Francis	1990
2.	Ghosh, Raja	Principles of Bioseparations Engineering	World Scientific	2006
3.	R. G. Harrison, P. Todd, S. R. Rudger and D. P. Petrides	Bioseparation Science and Engineering	Oxford University Press	2003
4.	Nooralabetta Krishna Prasad	Downstream Process Technology – A new horizon in Biotechnology	PHI Learning Private Limited	2010
5.	Ajay Kumar	Bioseparation Engineering	IK Intl.Ltd	2006

WEB URLs

1. <http://nptel.ac.in/courses/102106022/>
2. <https://www.class-central.com/tag/bioprocess>
3. <https://www.youtube.com/watch?v=Uut1cUs6GpA>
4. <https://www.youtube.com/watch?v=6wY480YHxF4>
5. <https://www.youtube.com/watch?v=VKpthcW1IU>


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19BTC16

IMMUNOLOGY

L T P C

2 0 0 2

COURSE OBJECTIVES:

- To discuss the structure, functions and integration of immune system.
- To mechanisms involved in immune system development and responsiveness
- To explain various techniques of monoclonal and engineered antibodies
- To understand of activation of system of a complement. Receptors. Negative immune regulation.
- To explain the antigen-antibody interactions and how the immune system is protecting the body from foreign pathogens.

COURSE OUTCOMES:

1. Ability to explain about immune system structure and functions.
2. Ability to describe immunity to various pathogens
3. Ability to know the concepts and mechanism behind tumour development, allergy and hypersensitivity reactions.
4. Ability to understand the principles behind the production of therapeutic/diagnostic molecules.
5. Ability to explain about monoclonal antibodies

UNIT I INTRODUCTION TO IMMUNE SYSTEM

9

Organisation and classification of immune system – immune cells and organs; innate and acquired immunity; Toll receptors and responses, classification of antigens – chemical and molecular nature; haptens, adjuvants; cytokines; complement pathway, antigen presenting cells; major histocompatibility complex

UNIT II HUMORAL AND CELLULAR IMMUNITY

9

Development, maturation, activation, regulation, differentiation and classification of T-cells and Bcells, antigen processing and presentation, theory of clonal selection, TCR; antibodies: structure and functions; antibodies: genes and generation of diversity; antigen-antibody reactions

UNIT III IMMUNITY AGAINST PATHOGENS AND TUMORS

9

Inflammation; protective immune responses to virus, bacteria, fungi and parasites; tumor antigens, tumor immune response, tumor diagnosis, tumor immunotherapy

UNIT IV IMMUNE TOLERANCE AND HYPERSENSITIVITY

9

Immune tolerance, Immuno deficiencies; Transplantation – genetics of transplantation; laws of transplantation; Allergy and hypersensitivity – Types of hypersensitivity, Autoimmunity, Auto immune disorders and diagnosis

UNIT V APPLIED IMMUNOLOGY

9

Monoclonal antibodies, engineering of antibodies; Classification of Vaccines, methods of vaccine development, immunodiagnostic methods (Immuno diffusion ELISA, FACS), immune modulatory drugs

Total Hours

45

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
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A. Princy

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1.	Peter J Delves, Seamus J Martin, Dennis R Burtn and Ivan M Roitt	Roitts Essential Immunology	Wiley –Blackwell	2016
2.	Judith a Owen, Jenni Punt and Sharon A Stranford, Kuby	Immunology	Macmillan International	2012

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Coico, Richard	Immunology: A Short Course	John Wiley	2008
2.	Khan, Fahim Halim	Elements of Immunology	Pearson Education	2009
3.	Abbas. A., Lichman, A.H., Pillai, S	Cellular and Molecular Immunology	Elsevier Health Services	2017
4.	Pillai, A	A Textbook of Immunology and Immunotechnology	S.Chand & Co. New Delhi	2008
5.	Tizard, R.I	Immunology: An Introduction	Brooks/Cole publisher	2007

WEB URLs

1. <http://www.raymondcheong.com/Year1/immuno.html>
2. <https://www.mooc-list.com/course/bioc3721x-fundamentals-immunology-part-1-edx?static=true>
3. <http://nptel.ac.in/courses/102103038/download/module1.pdf>
4. <https://www.youtube.com/watch?v=k9QAYP3bYmc>
5. <https://www.youtube.com/watch?v=XI2KRLVkz4s>


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19BTC17

DISASTER MANAGEMENTL T P C
2 0 0 2**COURSE OBJECTIVES:**

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

COURSE OUTCOMES:

1. Ability to differentiate the types of disasters, causes and their impact on environment and society.
2. Ability to assess vulnerability and various methods of risk reduction measures as well as mitigation.
3. Ability to analyze the relation between disaster and development
4. Ability to draw the hazard and vulnerability profile of India, Scenarios in the Indian context
5. Ability to analyze the disaster damage assessment and management.

UNIT I INTRODUCTION TO DISASTERS

9

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR)

9

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stakeholders- Institutional Processes and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT

9

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT IV DISASTER RISK MANAGEMENT IN INDIA

9

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

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plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS **9**

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

Total Hours **45**

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Singhal J.P	Disaster Management	Laxmi Publications	2010
2.	Tushar Bhattacharya	Disaster Science and Management	McGraw Hill India Education Pvt. Ltd	2012

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Gupta Anil K, Sreeja S. Nair	Environmental Knowledge for Disaster Risk Management	NIDM, New Delhi	2011
2.	Kapur Anu	Vulnerable India: A Geographical Study of Disasters	IAS and Sage Publishers, New Delhi	2010
3.	R Rajagopalan	Environmental Studies –From Crisis to Cure	Oxford Publisher	2005
4.		Govt. of India: Disaster Management Act	Government of India, New Delhi	2005
5.		National Disaster Management Policy	Government of India, New Delhi	2009

WEB URLs

1. https://www.youtube.com/watch?v=9WIwlljva_s
2. <https://www.youtube.com/watch?v=DExlZTfKZAM&list=PLC4PaTsQiLcbejXqJR7S59Ohk2OK1rgEG>
3. https://www.youtube.com/watch?v=-e_jireqahY
4. <https://www.youtube.com/watch?v=HMPBf5rkc0>
5. <https://www.youtube.com/watch?v=Qe2UZ2zm0Ik>


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19BTC18

BIOCHEMISTRY LABORATORY

L T P C
0 0 3 1

COURSE OBJECTIVES:

- To provide knowledge on qualitative analysis of biomolecules.
- To understand the concept of quantitative estimation of biomolecules.
- To gain a preliminary understanding of preparation of standard buffer solution.
- To enhance awareness of estimation of amino acids
- To develop rudimentary ability to quantitative analysis of lipids.

COURSE OUTCOMES:

1. Ability to differentiate qualitative analysis of biomolecules.
2. Ability to assess quantitative estimation of biomolecules.
3. Ability to analyze the relation between buffer solutions
4. Ability to estimate the amino acids
5. Ability to analyze the lipids.

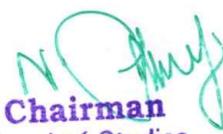
LIST OF EXPERIMENTS

1. General guidelines for working in biochemistry lab (theory)
2. Units of volume, weight, density and concentration measurements and their range in biological measurements. Demonstration of proper use of volume and weight measurement devices.
3. Accuracy, precision, sensitivity and specificity (theory)
4. Preparation of buffer –titration of a weak acid and a weak base.
5. Qualitative tests for carbohydrates – distinguishing reducing from non-reducing sugars and keto from aldo sugars.
6. Quantitative method for amino acid estimation using ninhydrin – distinguishing amino from imino acid.
7. Protein estimation by Biuret and Lowry's methods.
8. Protein estimation by Bradford and spectroscopic methods.
9. Extraction of lipids and analysis by TLC.
10. Estimation of nucleic acids by absorbance at 260 nm and hyperchromic effect (demo).
11. Enzymatic assay: phosphatase from potato.
12. Enzymatic assay: estimation of glucose by GOD-POD method after hydrolysis of starch with acid and specificity of the enzymatic method.

TOTAL: 30 PERIODS

Equipment Needed for 30 Students

Autoclave 1
Hot Air Oven 1
Incubators 2
Light Microscopes 4
Incubator Shaker 1
Colorimeter 2
Laminar Flow Chamber 1
Glassware, Chemicals, Media as required


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19BTC19

MICROBIOLOGY LABORATORY

L T P C
0 0 3 1

COURSE OBJECTIVES:

- To provide knowledge on laboratory safety and sterilization techniques.
- To understand the concept of culture media.
- To gain a preliminary understanding of staining techniques.
- To enhance awareness of isolation of microorganism from various sources
- To develop rudimentary ability to parameters of microbial growth.

COURSE OUTCOMES:

1. Ability to differentiate the microroganisms.
2. Ability to assess culture medias.
3. Ability to analyze the staining techniques
4. Ability to emphasize the isolation of microorganisms
5. Ability to analyze the parameters for the microbial growth.

LIST OF EXPERIMENTS

1. Laboratory safety and sterilization techniques-Dry heat sterilization (Autoclave, hot air oven)
2. Microscopic methods in the identification of microorganisms
3. Preparation of culture media – nutrient broth and nutrient agar
4. culturing of microorganisms – in broth and in plates (pour plates, streak plates, spread plates isolation and preservation of bacterial cultures)
5. Staining techniques – Grams' and differential, lactophenol cotton blue
6. Quantification of microorganisms-serial dilution and plating
7. Effect of disinfectants on microbial flora
8. Isolation of microorganisms from different sources – soil, water and milk
9. Antibiotic sensitivity assay
10. Growth curve – observation and growth characteristics of bacteria.
11. Effect of different parameters on bacterial growth (pH, temperature, and substrate concentration)

TOTAL: 30 PERIODS

Equipment Needed for 30 Students

Autoclave 1
Hot Air Oven 1
Incubators 2
Light Microscopes 4
Incubator Shaker 1
Colorimeter 2
Lamina Flow Chamber 1
Glassware, Chemicals, Media as required



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19BTC20 INSTRUMENTAL METHODS OF ANALYSIS LABORATORY

L T P C
0 0 3 1

COURSE OBJECTIVES:

- To provide students an exposure to spectroscopic methods.
- To have a practical hands on experience on Absorption Spectroscopic methods
- To acquire experience in the purification by performing thin layer chromatography
- To validate and analysis using spectrometric and microscopic techniques
- To enhance the knowledge on column chromatography

COURSE OUTCOMES:

1. Ability to differentiate the spectroscopic methods.
2. Ability to assess absorption spectroscopic methods.
3. Ability to analyze the thin layer chromatography.
4. Ability to emphasize the spectrometric and microscopic techniques.
5. Ability to analyze the column chromatography.

LIST OF EXPERIMENTS

1. Precision and validity in an experiment using absorption spectroscopy.
2. Validating Lambert-Beer's law using KMnO_4
3. Finding the molar absorptivity and stoichiometry of the Fe (1,10 phenanthroline) using absorption spectrometry.
4. Finding the pK_a of 4-nitrophenol using absorption spectroscopy.
5. UV spectra of nucleic acids.
6. Chemical actinometry using potassium ferrioxalate.
7. Estimation of SO_4^{--} by nephelometry.
8. Estimation of Al^{3+} by Fluorimetry.
9. Limits of detection using aluminium alizarin complex.
10. Chromatography analysis using TLC.
11. Chromatography analysis using column chromatography.

TOTAL: 30 PERIODS

Equipment Needed for 20 Students

Colorimeter -2

Glassware, Chemicals, Media as required



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19BTC21

MOLECULAR BIOLOGY LABORATORY

L T P C
0 0 3 1

COURSE OBJECTIVES:

- To provide hands-on experience in performing basic molecular biology techniques.
- To introduce students to the theory behind in each technique
- To describe common applications of each methodology in biological research.
- To take up specialized project in Molecular biology
- To develop pre-requisite knowledge for research work.

COURSE OUTCOMES:

1. Ability to demonstrate knowledge and understanding of the principles underpinning important techniques in molecular biology.
2. Ability to demonstrate knowledge and understanding of applications of these techniques.
3. Ability to demonstrate the ability to carry out laboratory experiments and interpret the results.
4. Ability to aware of the hazardous chemicals and safety precautions in case of emergency.
5. Ability to perform electrophoresis techniques

LIST OF EXPERIMENTS:

- 1 Electrophoresis -Agarose and Polyacrylamide Gel
- 2 Isolation of microbial DNA
- 3 Isolation of genomic DNA
- 4 Quantification of DNA (UV/ Vis) and analysis of purity
- 5 Restriction enzyme digestion & Ligation
- 6 Competent cells preparation
- 7 Transformation
- 8 Selection of recombinants – Antibiotic sensitivity assay
- 9 Plating of λ phage
- 10 Lamda phage lysis of liquid cultures

Total Hours 30

Equipment Needed for 30 Students

Electrophoresis Kit 1
Incubators 2
Light Microscopes 2
Incubator Shaker 1
Spectrophotometer 1
Laminar Flow Chamber 1
Glassware, Chemicals, Media as required


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19BTC22

GENETIC ENGINEERING LABORATORY

L T P C
0 0 3 1

COURSE OBJECTIVES:

- To provide students an exposure to cloning techniques.
- To ensure that students begin to understand the gene amplification methods.
- To gain a preliminary understanding of genetic and biotechnological techniques.
- To enhance awareness of hazardous chemicals
- To develop rudimentary ability to blotting techniques

COURSE OUTCOMES:

1. Ability to describe the main principles, methods for preparation and cloning of DNA in various organisms.
2. Ability to express clearly about the gene amplification and methods for analysis of DNA, such as hybridization, restriction analysis and gene expressions.
3. Ability to use genetic and biotechnological techniques to manipulate genetic materials and develops new and improved living organisms.
4. Ability to aware of the hazardous chemicals and safety precautions in case of emergency.
5. Ability to perform blotting techniques

LIST OF EXPERIMENTS:

- 1 Preparation of plasmid DNA
- 2 Elution of DNA from agarose gels
- 3 Restriction digestion
- 4 Ligation of DNA into expression vectors
- 5 Transformation & Selection of recombinants – Blue white screening assay
- 6 Optimisation of time of inducer for recombinant protein expression
- 7 Expression of protein profiling by SDS - PAGE
- 8 Western blotting, Southern blotting
- 9 PCR amplification of genes
- 10 Colony lysate PCR.

Total Hours 30

Equipment Needed for 30 Students

Electrophoresis Kit 1
PCR 1
Incubators 2
Light Microscopes 4
Incubator Shaker 1
Spectrophotometer 2
Laminar Flow Chamber 2
Glassware, Chemicals, Media as required



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19BTC23

BIOPROCESS ENGINEERING LABORATORY

L T P C
0 0 3 1

COURSE OBJECTIVES:

- To provide students an exposure to enzyme kinetics.
- To ensure that students begin to understand the growth kinetics of microorganism
- To gain a preliminary understanding of approaches of enzyme inhibition
- To enhance awareness of immobilization
- To develop rudimentary ability to optimization techniques

COURSE OUTCOMES:

1. Ability to explain about Enzyme kinetics and characterization and how to use them for practical applications.
2. Ability to evaluate the growth kinetics of microorganisms and become adept with medium optimization techniques.
3. Ability to determine an experimental objective, understand the theory behind the experiment, and operate the relevant equipment safely.
4. Ability to demonstrate good lab citizenry and the ability to work in team.
5. Ability to perform optimization techniques

LIST OF EXPERIMENTS:

1. Enzyme kinetics – Determination of Michaelis - Menten parameters
2. Enzyme inhibition kinetics
3. Enzyme immobilization – Gel entrapment
4. Growth of Bacteria – Estimation of Biomass, Calculation of Specific Growth Rate, Yield Coefficient
5. Optimization by Response Surface Methodology
6. Estimation of KLa – Sulphite Oxidation Method
7. Estimation of Overall Heat Transfer Coefficient
8. Batch Sterilization kinetics
9. Residence time distribution
10. Fed batch cultivation and Total cell retention cultivation

TOTAL: 30 PERIODS

Equipment Needed for 20 Students

Autoclave 1
Hot Air Oven 1
Incubators 2
Light Microscopes 2
Incubator Shaker 1
Colorimeter 2
Laminar Flow Chamber 1
Glassware, Chemicals, Media as required


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19BTC24 CHEMICAL REACTION ENGINEERING LABORATORY

L T P C
0 0 3

1

COURSE OBJECTIVES:

- To provide students an exposure to flow measurement equipments.
- To understand the pressure drop flow through pipes.
- To gain a preliminary understanding in pumps
- To enhance awareness of filtration
- To develop rudimentary ability to heat exchangers

COURSE OUTCOMES:

1. Ability to differentiate the types of flow measurement equipments.
2. Ability to assess pressure drop flow through pipes.
3. Ability to analyze the centrifugal pumps
4. Ability to emphasize the awareness on filtration
5. Ability to analyze the heat exchangers.

LIST OF EXPERIMENTS:

- 1 Flow measurement - Orifice meter
- 2 Flow measurement - Venturimeter,
- 3 Flow measurement - Rotameter
- 4 Pressure drop in flow through pipes
- 5 Pressure drop in flow through packed column
- 6 Pressure drop in flow through fluidized beds
- 7 Characteristics of centrifuge pump
- 8 Filtration through plate and frame filter press
- 9 Filtration in leaf filter
- 10 Heat transfer characteristics in heat exchanger
- 11 Simple and steam distillation

Total Hours 30



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19BTC25

BIOINFORMATICS LABORATORY

L T P C
0 0 3 1

COURSE OBJECTIVES:

- To provide students an exposure to sequence retrieval from databases.
- To ensure that students begin to pair wise sequence alignment
- To gain a preliminary understanding of multiple sequence alignment
- To develop rudimentary ability to phylogenetic analysis
- To gain knowledge on 3D structure of proteins.

COURSE OUTCOMES:

1. Ability to retrieve the sequence for databases.
2. Ability to align the sequence by pair wise alignment.
3. Ability to align the sequence by multiple sequence alignment
4. Ability to identify the phylogenetic analysis
5. Ability to emphasize the protein structures.

LIST OF EXPERIMENTS:

1. Retrieving files and information from biological databases (NCBI, PDB, PubChem)
2. Sequence alignment -BLAST
3. Sequence alignment -FASTA
4. Sequence alignment -Clustal Omega
5. Multiple Sequence alignment
6. Protein 3D structure visualization
7. Molecular phylogenetic analysis
8. Gene annotation and gene finding
9. Molecular modeling of protein and its visualization
10. Computer aided drug design with online tools

Total Hours 30



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19BTC26

DOWNSTREAM PROCESSING LABORATORY

L T P C
0 0 3 1

COURSE OBJECTIVES:

- To provide students an exposure to separation of whole cells.
- To ensure that students begin to understand the cell disruption techniques
- To gain a preliminary understanding of extraction and evaporation
- To develop rudimentary ability to respond to filtration techniques
- To gain knowledge on chromatographic techniques.

COURSE OUTCOMES:

6. Acquired knowledge for the separation of whole cells and other insoluble ingredients from the culture broth.
7. Learned cell disruption techniques to release intracellular products
8. Learned various techniques like evaporation, extraction, precipitation, membrane separation for concentrating biological products
9. Learned the basic principles and techniques of chromatography to purify the biological products and formulate the products for different end uses.
10. Ability to emphasize the filtration techniques

LIST OF EXPERIMENTS:

- 1 Solid liquid separation – centrifugation.
- 2 Solid liquid separation - microfiltration
- 3 Cell disruption techniques – ultrasonication or French pressure cell or Dyno mill
- 4 Precipitation – ammonium sulphite precipitation
- 5 Ultra filtration separation
- 6 Aqueous two phase extraction of biologicals
- 7 High resolution purification – affinity chromatography
- 8 High resolution purification – ion exchange chromatography
- 9 Product polishing – spray drying or freeze drying
- 10 Size exclusion chromatography

Total Hours 30

List of Equipment for 30 students

Centrifuge 1
Cross flow filtration set up 1
Sonicator or French press or Dynamill 1



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19BTC27

IMMUNOLOGY LABORATORY

L T P C
0 0 3 1

COURSE OBJECTIVES:

- To provide students an exposure to immune system cells and tissues.
- To ensure that students begin to understand immunological test
- To gain a preliminary understanding of lymphocytes and monocytes
- To enhance awareness of various immune systems
- To develop rudimentary ability to immune cells

COURSE OUTCOMES:

1. Ability to aware of immune system cells and tissues.
2. Ability to have knowledge on immunological /clinical tests.
3. Ability to isolate lymphocytes and monocytes.
4. Ability to identify various immune system cells.
5. Ability to differentiate the immune cells

LIST OF EXPERIMENTS

1. Identification of immune cells in a blood smear
2. Identification of blood group
3. Testing for typhoid antigens by Widal test
4. Immunodiffusion – Ouchterlony Double Diffusion
5. Immunoelectrophoresis – Rocket or Counter Current immunoelectrophoresis
6. Enzyme Linked ImmunoSorbent Assay (ELISA)
7. Isolation of peripheral blood mononuclear cells
8. Isolation of monocytes from blood
9. Immunofluorescence
10. Identification of t cells by T-cell rosetting using sheep RBC.

TOTAL: 30 PERIODS

List of Equipments for 30 students

Elisa reader 1
Microscopes 3
Microwave oven 1
Hot plate 4
Vortex mixer 4
Table top refrigerated Centrifuge 1


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PROFESSIONAL ELECTIVE

(PE)



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COURSE OBJECTIVES:

- To acquire knowledge about food and energy
- To know about the general aspects in food.
- To gain knowledge about the production of food products
- To know the fundamentals of preservation methods.
- To know different packing materials for the preservation of foods.

COURSE OUTCOMES:

1. Ability to differentiate the constituents present in food
2. Ability to understand the processing methods
3. Ability to distinguish the production and utilization of food.
4. Ability to know the preservation methods
5. Ability to understand the concept of food packing materials.

UNIT I FOOD CONSTITUENTS AND DERIVATIVE FACTORS

9

Constituents of food – carbohydrates, lipids, proteins, vitamins and minerals, food additives; deteriorative factors and their control.

UNIT II GENERAL ENGINEERING ASPECTS AND PROCESSING METHODS

9

Preliminary processing methods; conversion and preservation operations

UNIT III PRODUCTION AND UTILISATION OF FOOD PRODUCTS

9

Cereal grains; pulses; vegetables; fruits; spices; fats and oils; bakery; confectionery and chocolate products; soft and alcoholic beverages; dairy products; meat; poultry and fish products.

UNIT IV PRESERVATION METHODS

9

Preservation by heat and cold; Dehydration; Frying; Drying; Irradiation; Microwave heating sterilization and pasteurization; fermentation and pickling

UNIT V FOOD PACKAGING

9

Basic packaging materials, types of packaging materials used for different kinds of foods, HACCP Introduction and Principles, Introduction to Food Labeling.

Total Hours

45

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	B. Sivasanker	Food Processing & Preservation	Prentice-Hall Of India Pvt. Ltd.	2002
2.	Potter N.N.	Food Science	The AVI Publishing Co., Westport	2006

REFERENCE BOOKS:


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Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	W.C. Frazier & D.C. Westhoff	Food Microbiology	Mcgraw-Hill Book Co.,	1988
2.	J.M. Jay	Modern Food Microbiology	Cbs Publications	1987
3.	Barbosa-Canovas, G. V., & Ibarz, A	Introduction to food process engineering	CRC Press	2014
4.	Sahu, J. K	Introduction to advanced food process engineering	CRC Press	2014
5.	P. Coultate	Food – The Chemistry Of Its Components	Royal Society, London	1992

WEB URLs

1. www.fao.org/wairdocs/x5434e/x5434e00.htm
2. <https://www.mooclist.com/course/food-security-and-sustainability-crop-production-edx?static=true>
3. <https://www.mooclist.com/course/nutrition-and-health-part-3-food-safety-edx?static=true>
4. <https://www.youtube.com/watch?v=1JbnRA-Hpww>
5. <https://www.youtube.com/watch?v=fr1nzF9AMXs>


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COURSE OBJECTIVES:

- To provide the fundamentals of animal cell culture
- To gain knowledge in animal diseases
- To know the fundamental therapies for animal diseases
- To offer the knowledge about the micromanipulation
- To provide the basics of transgenic animals

COURSE OUTCOMES:

1. Ability to understand the animal cell culture
2. Ability to know the animal diseases and its diagnosis
3. Ability to gain the knowledge for therapy of animal infections
4. Ability to know the concepts of micromanipulation technology and transgenic animal technology
5. Ability to use the knowledge gained in this section to apply in the field of clinical research

UNIT I ANIMAL CELL CULTURE

9

Introduction to basic tissue culture techniques; chemically defined and serum free media; animal cell cultures, their maintenance and preservation; various types of cultures suspension cultures, continuous flow cultures, immobilized cultures; somatic cell fusion; cell cultures as a source of valuable products; organ cultures

UNIT II ANIMAL DISEASES AND THEIR DIAGNOSIS

9

Bacterial and viral diseases in animals; monoclonal antibodies and their use in diagnosis; molecular diagnostic techniques like PCR, in-situ hybridization; northern and southern blotting; RFLP

UNIT III THERAPY OF ANIMAL DISEASES

9

Recombinant cytokines and their use in the treatment of animal infections; monoclonal antibodies in therapy; vaccines and their applications in animal infections; gene therapy for animal diseases

UNIT IV MICROMANIPULATION OF EMBRYO'S

9

What is micromanipulation technology; equipments used in micromanipulation; enrichment of x and y bearing sperms from semen samples of animals; artificial insemination and germ cell manipulations; in vitro fertilization and embryo transfer; micromanipulation technology and breeding of farm animals

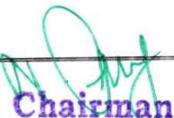
UNIT V TRANSGENIC ANIMALS

9

Concepts of transgenic animal technology; strategies for the production of transgenic animals and their importance in biotechnology; stem cell cultures in the production of transgenic animals.

Total Hours

45



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Basipuram, Namakkal Dist. - 637 003.

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	RangaM.M	Animal Biotechnology	Agrobios India Limited	2002
2.	Ramadass P, Meera Rani S	Text Book Of Animal Biotechnology	Akshara Printers	1997

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Masters J.R. W	Animal Cell Culture: Practical Approach	Oxford University Press	2000
2.	Freshney R I	Culture of Animal Cells	Wiley-Liss	2005
3.	Spier RE and Griffiths JB	Animal Cell Biotechnology	Academic Press	1988
4.	Channarayappa	Molecular Biotechnology: Principles and Practices	University Press (India) Pvt. Ltd	2006
5.	Murray Moo-Young	Animal Biotechnology	Pergamon Press	1989

WEB URLs

1. <http://link.springer.com/book/10.1385%2F0896035476>
2. <http://store.elsevier.com/Animal-Biotechnology/isbn-9780124160026/>
3. <http://ocw.mit.edu/courses/biology/7-342-developmental-andmolecular-biology-of-regeneration-spring-2008/#>
4. https://www.youtube.com/watch?v=OBagQf8_IzM&list=PLpAtEo7BAHrlqWLECZwRW0wAGVpXwokTM
5. <https://www.youtube.com/watch?v=Mktxmj41cR8&list=PLLA34Ra3DpcxPYYEhf3db5Nvlv3ZlYdXY>


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Rasipuram, Namakkal Dist - 637 003.

COURSE OBJECTIVES:

- To impart comprehensive understanding of the chemical basis of drug action including physicochemical and steric properties of drug.
- To gain knowledge about the drugs acting on central nervous system
- To study the classification, chemical nomenclature, generic names and synthesis of various medicinal agents.
- To understand the structure activity relationship, biochemical / molecular basis of mechanism of action and uses of drug.
- To gain knowledge about the drugs acting on cardiovascular system

COURSE OUTCOMES:

1. Ability to gain an appreciation of importance of the physical properties of drugs with respect to the ionization, solubility and efficacy of drugs
2. Ability to understand how changes in the chemical structure of drugs affect efficacy.
3. Ability to obtain a working knowledge of chemical structures and nomenclature
4. Ability to develop the ability to suggest suitable techniques to synthesis different drug molecules.
5. Ability to understand how current drugs were developed and demonstrate the importance of chemistry in the development and application of therapeutic drugs.

UNIT I PRINCIPLES OF MEDICINAL CHEMISTRY

9

Physicochemical properties in relation to biological action: Ionization, Drug distribution and pKa values and their relation to drug transport, hydrogen bonding, redox potential, surface activity and chelation. Steric properties of drugs: optical and geometrical isomerism. Functional group and their effects of on drug action: steric effect, concept of isosterism, bioisosterism, homologs and analogs.

UNIT II DRUGS ACTING ON SYNAPTIC AND NEURO-EFFECTOR JUNCTION SITES

9

Classification, biochemical/molecular basis of mechanism of action, structure activity relationship including stereo chemical aspects, physiochemical properties and synthesis of selected drugs belonging to the class of Cholinergics, Anticholinergics, Anticholinesterases and Adrenergics

UNIT III DRUGS ACTING ON THE CENTRAL NERVOUS SYSTEM

9

Classification, biochemical/molecular basis of mechanism of action, structure activity relationship and synthesis of Hypnotics and Sedatives, Opioid analgesics, Anticonvulsants and Psychopharmacological agents (neuroleptics, antidepressants, anxiolytics).

UNIT IV DRUGS ACTING ON CARDIOVASCULAR SYSTEM

9

Structural basis of mechanism of action, structure activity relationship including stereo chemical aspects, physiochemical properties, and synthesis of selected drugs belonging to the class of anti- anginal, vasodilators, calcium channel blockers and cardiac glycosides.

UNIT V AUTOCOIDS

9


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Salem, Namakkal Dist - 637 408.

Synthetic procedures, mode of action, uses, structure activity relationship including physicochemical properties of the following classes of drugs Antihistamines, Eicosanoids, Analgesic-antipyretics, Anti-inflammatory (non-steroidal) agents.

Total Hours

45

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Ashutosh Kar	Medicinal Chemistry	New Age International (P) Ltd.	2015
2.	Graham L. Patrick	An introduction to Medicinal Chemistry	Oxford University Press	2017

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Ilango, K. and Valentina, P	Text book of Medicinal Chemistry	Keerthi Publishers	2007
2.	Donald J. Abraham, Burger's	Medicinal Chemistry and Drug Discovery	John Wiley and Sons	2003
3.	Oliver Kayser and Heribert Warzecha	Pharmaceutical Biotechnology: Drug Discovery and Clinical Applications	John Wiley and Sons	2012
4.	Gary Walsh	Biopharmaceutical technology- biochemistry and biotechnology	John Wiley and Sons	2005
5.	Remington	Pharmaceutical sciences	Mack publishing and Co	2000

WEB URLs

1. <http://onlinelibrary.wiley.com/book/10.1002/9780470259818>
2. <https://ocw.mit.edu/courses/health-sciences-and-technology/hst-151-principles-of-pharmacology-spring-2005/lecture-notes/>
3. <https://www.youtube.com/watch?v=IUxkcEoGkVg>
4. <https://www.youtube.com/watch?v=RY7uS9bm3Zk>
5. <https://www.youtube.com/watch?v=IOf-z0D1mHk>


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COURSE OBJECTIVES:

- To understand different types of diseases caused by life style
- To acquire in depth knowledge about cancer
- To know about the cardiovascular diseases
- To understand about diabetes and obesity
- To familiarize about respiratory disease

COURSE OUTCOMES:

1. Ability to explain about the diseases caused by life style
2. Ability to identify the types of cancer
3. Ability to describe about the cardiovascular diseases
4. Ability to explain about diabetes and obesity
5. Ability to identify the respiratory diseases

UNIT I INTRODUCTION

9

Lifestyle diseases – Definition ; Risk factors – Eating, smoking, drinking, stress, physical activity, illicit drug use ; Obesity, diabetes, cardiovascular diseases, respiratory diseases, cancer; Prevention – Diet and exercise.

UNIT II CANCER

9

Types - Lung cancer, Mouth cancer, Skin cancer, Cervical cancer, Carcinoma oesophagus; Causes Tobacco usage, Diagnosis – Biomarkers, Treatment

UNIT III CARDIOVASCULAR DISEASES

9

Coronary atherosclerosis – Coronary artery disease; Causes -Fat and lipids, Alcohol abuse – Diagnosis - Electrocardiograph, echocardiograph, Treatment, Exercise and Cardiac rehabilitation

UNIT IV DIABETES AND OBESITY

9

Types of Diabetes mellitus; Blood glucose regulation; Complications of diabetes – Paediatric and adolescent obesity – Weight control and BMI

UNIT V RESPIRATORY DISEASES

9

Chronic lung disease, Asthma, COPD; Causes - Breathing pattern (Nasal vs mouth), Smoking – Diagnosis - Pulmonary function testing

Total Hours

45

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	R.Kumar and Meenal Kumar	Guide to Prevention of Lifestyle Diseases	Deep & Deep Publications	2003
2.	Gary Eggar	Lifestyle Medicine	Academic Press	2017


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 Rasipuram, Namakkal Dist - 637 408.

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Akira Miyazaki	New Frontiers in Lifestyle-Related Disease	Springer	2008
2.	William O Foye, Thomas L Lemke, David A Williams Foye's	Principles of Medicinal Chemistry	Wolters Kluwer Health Adis (ESP) Publisher	2012
3.	James M.R	Lifestyle Medicine	CRC Press	2006
4.	David E. B, Edward R. A. and Carl A. B	Fundamentals of Molecular Diagnostics	Saunders Group	2007
5.	Betty A. F., Daniel F. S., Alice S. W. and Ernest A. T	Bailey & Scott's Diagnostic Microbiology	Mosby Inc	2007

WEB URLs

1. <https://www.sciencedirect.com/topics/medicine-and-dentistry/molecular-diagnostics>
2. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1214554/>
3. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4375750/>
4. https://www.youtube.com/watch?v=NY_JNh_duKc
5. <https://www.youtube.com/watch?v=LB9SAPsCH14>



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COURSE OBJECTIVES:

- To understand the basics of IPR
- To acquire in depth in registration of IPR
- To know the agreements and legislations
- To develop skills about digital products and law
- To familiarize about enforcement of IPR

COURSE OUTCOMES:

1. Ability to explain about IPR
2. Ability to identify the registration of IPR
3. Ability to describe about agreements and legislations
4. Ability to explain about digital products
5. Ability to describe about enforcement of IPR

UNIT I INTRODUCTION

9

Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

UNIT II REGISTRATION OF IPRs

9

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad.

UNIT III AGREEMENTS AND LEGISLATIONS

9

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

UNIT IV DIGITAL PRODUCTS AND LAW

9

Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies.

UNIT V ENFORCEMENT OF IPRs

9

Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies

Total Hours

45

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	V. Scople Vinod	Managing Intellectual Property	Prentice Hall of India pvt Ltd	2012


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 Department of Biotechnology
 Muthayammal Engineering College (Autonomous)
 Esapuram, Namakkal Dist - 637 408.

2.	S. V. Satakar	Intellectual Property Rights and Copy Rights	Ess Ess Publications	2002
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REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Deborah E. Bouchoux	Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets	Cengage Learning	2012
2.	Prabuddha Ganguli	Intellectual Property Rights: Unleashing the Knowledge Economy	McGraw Hill Education	2011
3.	Derek Bosworth and Elizabeth	The Management of Intellectual Property	Edward Elgar Publishing Ltd	2013
4.	Singh. K	Intellectual Property Rights in Biotechnology	BCLI, New Delhi	2010
5.	Deepa Goel and Shomini Parashar	IPR, Biosafety and Bioethics	Pearson Education publisher	2013

WEB URLs

1. <http://ces.iisc.ernet.in/hpg/cesmg/iprdoc.html>
2. <http://www.who.int/csr/resources/publications/biosafety/Biosafety>
3. <https://www.youtube.com/watch?v=qGPwcm4yAAs>
4. <https://www.youtube.com/watch?v=BGSgZIJ8-yQ>
5. <https://www.youtube.com/watch?v=hHQWCFE0J84>



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 Rasipuram, Tirupattur District - 621 003.

COURSE OBJECTIVES:

- To gain knowledge about the biofuels
- To understand the production process of biodiesel
- To acquire knowledge about bioethanol
- To familiarize the concepts of biomethane and biohydrogen
- To gain knowledge about modern biofuels

COURSE OUTCOMES:

1. Ability to explain about the need of biofuels
2. Ability to describe about the production of biodiesel
3. Ability to demonstrate about bioethanol
4. Ability to explain the biomethane and biohydrogen
5. Ability to describe about the modern biofuels

UNIT I OVERVIEW OF BIOFUELS

9

Generation of biofuels – Development of biological conversion technologies – Integration of biofuels into biorefineries – Energy security and supply – Environmental sustainability of biofuels – Economic sustainability of biofuels.

UNIT II BIODIESEL

9

Biodiesel – Microorganisms and raw materials used for microbial Oil production – Treatment of the feedstocks prior to production of the Biodiesel – Current technologies of biodiesel production – Purification of biodiesel; Industrial production of biodiesel – Biodiesel production from single cell oil.

UNIT III BIOETHANOL

9

Bioethanol – Properties – Feedstocks – Process technology – Pilot plant for ethanol production from lignocellulosic feedstock – Environmental aspects of ethanol as a biofuel.

UNIT IV BIOMETHANE AND BIOHYDROGEN

9

Biomethanol – Principles, materials and feedstocks – Process technologies and techniques – Advantages and limitations – Biological hydrogen production methods – Fermentative hydrogen production – Hydrogen economy – Advantages and limitations.

UNIT V OTHER BIOFUELS

9

Biobutanol production – Principles, materials and feedstocks – Process technologies – Biopropanol – Bioglycerol – Production of bio-oils via catalytic pyrolysis – Life-Cycle environmental impacts of biofuels and Co-products.

Total Hours

45

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
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1.	Sunggyu Lee and Y T Shah	Biofuels and Bioenergy- Process and Technology	CRC Press	2014
2.	Caye M. Drapcho, N.P. Nhuan and T. H. Walker	Biofuels Engineering Process Technology	Mc Graw Hill Publishers	2008

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Luque, R., Campelo, J.& Clark, J	Handbook of biofuels production	Woodhead Pub Limited	2011
2.	Gupta, V, K. and Tuohy, M, G	Biofuel Technologies	Springer	2013
3.	Moheimani, N. R., Boer, M, P, M, K, ParisaA. And Bahri	Biofuel and refining Technologies	Springer	2015
4.	Eckert, C, A. and Trinh, C	Biotechnology for Biofuel Production and Optimization	Elsevier	2016
5.	Bernardes, M	Biofuel production – recent developments and prospects	InTech	2011

WEB URLs

1. <https://www.energy.gov/eere/bioenergy/biofuels-basics>
2. <https://www.greenfacts.org/en/biofuels/1-2/1-definition.htm>
3. <https://www.renewableenergyworld.com/types-of-renewable-energy/tech/biofuels/>
4. <https://www.youtube.com/watch?v=ZGmwtDffc74>
5. <https://www.youtube.com/watch?v=v2ZxmdYwk1E>


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 Department of Biotechnology
 Muthayammal Engineering College (Autonomous)
 Rasipuram, Namakkal Dist - 637 408.

COURSE OBJECTIVES:

- To learn about basis of nanomaterial science
- To gain knowledge in nano material preparation method
- To familiarize with nano materials
- To acquire knowledge about nanomaterial characterization
- To learn about various applications of nano science.

COURSE OUTCOMES:

1. Ability to familiarize about the science of nanomaterials
2. Ability to demonstrate the preparation of nanomaterials
3. Ability to develop knowledge in characteristic nanomaterials
4. Ability to explain about nano material characterization
5. Ability to demonstrate about applications of nano science

UNIT I INTRODUCTION

9

Nano scale Science and Technology - Implications for Physics, Chemistry, Biology and Engineering- Classifications of nano structured materials- nano particles- quantum dots, nano wires-ultra-thin films-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT II GENERAL METHODS OF PREPARATION

9

Bottom-up Synthesis -Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III NANOMATERIALS

9

Nanofoms of Carbon - Buckminster fullerene- graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc- growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications- Nanometal oxides-ZnO, TiO₂, MgO, ZrO₂, NiO, nanoalumina, CaO, AgTiO₂, Ferrites, Nanoclays- functionalization and applications-Quantum wires, Quantum dots-preparation, properties and applications

UNIT IV CHARACTERIZATION TECHNIQUES

9

X- ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS- Nanoindentation

UNIT V APPLICATIONS

9

NanoInfoTech: Information storage- nanocomputer, molecular switch, super chip, nanocrystal, Nanobiotechnology: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targetted drug delivery, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nanosensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sunbarrier products - In Photostat, printing, solar cell, battery.

Total Hours

45


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TEXT BOOKS:

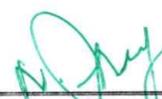
Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Niemeyer, C. M., and CA Mirkin, C. A	NanoBiotechnology II – More concepts and applications	Wiley –VCH publications	2010
2.	Rosenthal, S.J. and Wright, D.W	Nanobiotechnology Protocols	Humana Press	2010

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Oded shoseyov and Ilan Levy	Nanobiotechnology – Bioinspired and materials of the future	Humana press	2008
2.	Jain, K. K	NanoBiotechnology in molecular diagnostics – current technique and applications	Taylor and Francis	2006
3.	S. Edelstein and R.C. Cammearata	Nanomaterials: Synthesis, Propertiesand Applications	Institute of Physics Publishing, Bristol and Philadelphia	1996
4.	N JohnDinardo	Nanoscale Charecterisation of surfaces & Interfaces	Weinheim Cambridge, Wiley- VCH	2000
5.	G Timp	Nanotechnology	AIP press/Springer	1999

WEB URLs

1. <http://www.understandingnano.com>
2. <https://libguides.alfaisal.edu/mnt520>
3. <https://www.youtube.com/channel/UCbln6q0a-uXWhYVFofOPobw>
4. <https://www.youtube.com/watch?v=qPHOv5RUxUQ>
5. <https://www.youtube.com/watch?v=ItuBwC7CiLA>



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COURSE OBJECTIVES:

- To give the details of plant cells and its functions
- To provide the basics of agro bacterium and applications of plant biotechnology
- To introduce students to the principles, practices and application of plant tissue culture and transformation in science, agriculture and industry.
- To acquaint students with experimental design and analysis of plant biotechnology experiments.
- To give students hands-on experience and training in representative plant tissue culture and genetic engineering techniques.

COURSE OUTCOMES:

1. Ability to explain the fundamentals of plant cells, structure and functions
2. Ability to demonstrate the nitrogen fixation mechanism
3. Ability to familiarize about viral vectors
4. Ability to describe about the plant tissue culture and transgenic plants
5. Ability to explain the development of therapeutic products

UNIT I ORGANIZATION OF GENETIC MATERIAL 9

Genetic material of plant cells – nucleosome structure and its biological significance; junk and repeat sequences; outline of transcription and translation

UNIT II CHLOROPLAST & MITOCHONDRIA 9

Structure, function and genetic material; rubisco synthesis and assembly, coordination, regulation and transport of proteins. Mitochondria: Genome, cytoplasmic male sterility and import of proteins

UNIT III NITROGEN FIXATION 9

Nitrogenase activity, nod genes, nif genes, bacteroids.

UNIT IV AGROBACTERIUM & VIRAL VECTORS 9

Pathogenesis, crown gall disease, genes involved in the pathogenesis, Ti plasmid – t-DNA, importance in genetic engineering. Viral Vectors: Gemini virus, cauliflower mosaic virus, viral vectors and its benefits

UNIT V APPLICATION OF PLANT BIOTECHNOLOGY 9

Outline of plant tissue culture, transgenic plants, herbicide and pest resistant plants, molecular pharming, therapeutic products.

Total Hours 45

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
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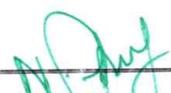
1.	M. K. Razdon	Introduction to Plant Tissue Culture	Oxford & IBH Publishing Company	2006
2.	S. Narayanaswamy	Plant Cell & Tissue Culture	Tata Mc Graw-Hill	2008

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	A. Slater, N. Scott and M	Fowler, Plant Biotechnology: The genetic manipulation of plants	Oxford University Press	2003
2.	Gamburg OL, Philips GC	Plant Tissue & Organ Culture fundamental Methods	Narosa Publications	1995
3.	Singh BD	Text Book of Biotechnology	Kalyani Publishers	1998
4.	Heldt HW	Plant Biochemistry & Molecular Biology	Oxford University Press	1997
5.	Ignacimuthu .S	Applied Plant Biotechnology	Tata McGraw Hill	1996

WEB URLs

1. <https://www.etipbioenergy.eu/value-chains/feedstocks/plant-biotechnology>
2. <https://www.frontiersin.org/journals/plant-science/sections/plant-biotechnology>
3. <https://www.youtube.com/watch?v=EDReGW95EGk>
4. <https://www.youtube.com/watch?v=HHYDmfj4ojk>
5. <https://www.youtube.com/watch?v=zReRIJfMjsE&list=PLLA34Ra3DpcxTYUBTvVRCfVWxZNqm1Vk6>


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COURSE OBJECTIVES:

- To develop key concepts and techniques to design, process equipment in a process plant.
- To train the students to utilize these key concepts to make design and operating decisions.
- To develop key concepts and techniques to design a extractor, distillation and absorption tower in a process plant
- To acquire knowledge about pumps and seals
- To gain knowledge about piping

COURSE OUTCOMES:

1. Ability to explain the working principles of heat exchanger, condensers and evaporators and develop a datasheet
2. Ability to draw and design of storage vessel and pressure vessel as per ASME and ISI codes
3. Ability to demonstrate the construction and assembly drawing of extraction towers, distillation towers and absorption towers
4. Ability to explain the working principles, constructions, usage of various pump, seals , valves.
5. Ability to demonstrate about piping design

UNIT I HEAT EXCHANGERS, CONDENSERS, EVAPORATORS

9

Single and multi process exchangers, double pipe, U tube heat exchangers, combustion details supporting structure. Single and vertical tube evaporation, Single and multi effect evaporators, forced circulation evaporators

UNIT II STORAGE VESSEL FOR VOLATILE AND NON VOLATILE FLUIDS, PRESSURE VESSEL STRUCTURE

9

Design of the following equipments as per ASME, ISI codes, drawing according to scale; monoblock and multiplayer vessels, combustion details and supporting structure.

UNIT III EXTRACTOR, DISTILLATION AND ABSORPTION TOWER

9

Construction details and assembly drawing; Plate and Packed Extraction Towers; Plate and Packed absorption Towers; Plate and Packed Distillation Towers.

UNIT IV PUMPS, MECHANICAL SEALS, VALVES AND SWITCHES

9

Various types of pumps, Principle of working, construction, usages, advantages and disadvantages; Various types of seals, effectiveness, usages; Pneumatic Seals; Gate, Globe and Butterfly Valves, their material of construction; Pneumatically Controlled Valves.

UNIT V PIPING, PLANT LAY OUT AND DESIGN

9

Various types of Piping, material of construction, their usage; Pipe lay out; Modern Plant Design and case Studies.

Total Hours

45

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	M. V. Joshi and V.V.Mahajani	Process Equipment Design	Macmillan India Ltd	2000

M. V. Joshi
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 Muthayammal Engineering College (Autonomous)
 Rasipuram, Namakkal Dist - 637 408.

2.	Kern D.Q	Heat Transfer	McGraw Hill	1985
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REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	McCabe, W.L., J.C. Smith and P. Harriott	Unit Operations of Chemical Engineering	McGraw-Hill	2001
2.	Robert H. Perry and Don W. Green (eds.)	Perry's Chemical Engineers' Handbook	McGraw Hill	1997
3.	Michael R. Ladisch	Bioseparations Engineering: Principles, Practice and Economics	Wiley	2001
4.	Roger Harrison	Bioseparations Science and Engineering	Oxford University Press	2003
5.	Tapobrata Panda	Bioreactors: Analysis and Design	Tata McGraw Hill	2011

WEB URLs

1. <http://nptel.ac.in/courses/103103027/>
2. <https://online-learning.tudelft.nl/courses/industrial-biotechnology/>
3. <http://nptel.ac.in/courses/102106022/16>
4. <https://www.youtube.com/watch?v=7ETk7HzUuJ4>
5. <https://www.youtube.com/watch?v=BzPTGWKLP7c>



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Rasipuram, Namakkal Dist. 637 408.

COURSE OBJECTIVES:

- To know the general organization of brain and physiological and cognitive processes.
- To apply the molecular, cellular, and cognitive bases of learning and memory.
- To learn about the neuroanatomy and neurophysiology
- To understand the concept of synaptic transmission and mechanism of action of neurotransmitters
- To gain insight into the mechanism of sensations and disorders related to nervous system

COURSE OUTCOMES:

1. Ability to explain the anatomy and organization of nervous systems.
2. Ability to demonstrate the function of nervous systems.
3. Ability to analyze how drugs affect cellular function in the nervous system.
4. Ability to describe the basic mechanisms associated with behavioral science.
5. Ability to evaluate mechanism of sensations and skeletal muscle contraction.

UNIT I NEUROANATOMY

9

What are central and peripheral nervous systems; Structure and function of neurons; types of neurons; Synapses; Glial cells; myelination; Blood Brain barrier; Neuronal differentiation; Characterization of neuronal cells; Meninges and Cerebrospinal fluid; Spinal Cord.

UNIT II NEUROPHYSIOLOGY

9

Resting and action potentials; Mechanism of action potential conduction; Voltage dependent channels; nodes of Ranvier; Chemical and electrical synaptic transmission; information representation and coding by neurons.

UNIT III NEUROPHARMACOLOGY

9

Synaptic transmission, neurotransmitters and their release; fast and slow neuro transmission; characteristics of neurites; hormones and their effect on neuronal function.

UNIT IV APPLIED NEUROBIOLOGY

9

Basic mechanisms of sensations like touch, pain, smell and taste; neurological mechanisms of vision and audition; skeletal muscle contraction.

UNIT V BEHAVIOUR SCIENCE

9

Basic mechanisms associated with motivation; control of feeding, sleep, hearing and memory; Disorders associated with the nervous system.

Total Hours

45

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Striedter, G. F	Neurobiology: a functional approach	Oxford University Press	2015


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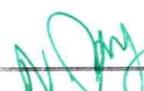
2.	Squire, L., Berg, D., Bloom, F.E., du Lac, S., Ghosh, A., Spitzer, N.C	Fundamental Neuroscience	UK: Academic Press	2012
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REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Abel, L. & Sylvester, E.V	Handbook of Neurochemistry and Molecular Neurobiology: Neurotransmitter systems	Springer	2008
2.	Bear, M., Connors, B., & Paradiso, M	Neuroscience – Exploring the Brain	Lippincott Williams & Wilkins	2006
3.	Mathews G G	Neurobiology: Molecules, cells and systems	Blackwell Science	2000
4.	Nelson, Charles A., Kathleen M. Thomas, and Michelle de Haan.. Hoboken, NJ	Neuroscience of Cognitive Development: The Role of Experience and the Developing Brain	John Wiley & Sons	2006
5.	Mason P	Medical Neurobiology	Oxford University Press	2011

WEB URLS

1. <https://ocw.mit.edu/courses/brain-and-cognitive-sciences/9-01-introduction-to-neuroscience-fall-2007/lecture-notes/>
2. <https://ocw.mit.edu/courses/brain-and-cognitive-sciences/9-01-neuroscience-and-behavior-fall-2003/study-materials/>
3. <https://www.youtube.com/watch?v=dKLkXQEN9XU>
4. https://www.youtube.com/watch?v=mb0cQFJdQ5Y&list=PLAXSVuGaw0Kz_FW4VzH9eKJiNE26_J0HV
5. <https://www.youtube.com/watch?v=oV5LTOPO7rc>



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COURSE OBJECTIVES:

- To make the student gain knowledge in stem cell basics.
- To learn growing of ES cells in lab
- To understand the basic concept behind tissue engineering focusing on biomaterials and its applications
- To learn the fundamentals of tissue engineering and tissue repairing and differentiation of stem cells and application of stem cells
- To acquire knowledge on clinical applications of tissue engineering

COURSE OUTCOMES:

1. Ability to explain the concept of tissue engineering application for regenerative medicines
2. Ability to demonstrate the process carried out for tissue engineering application
3. Ability to know the techniques used for tissue engineering
4. Ability to grow ES in lab
5. Ability to explain the fundamentals of tissue repairing

UNIT I INTRODUCTION

9

Introduction to tissue engineering: Basic definition; current scope of development; use in therapeutics, cells as therapeutic agents, cell numbers and growth rates, measurement of cell characteristics morphology, number viability, motility and functions. Measurement of tissue characteristics, appearance, cellular component, ECM component, mechanical measurements and physical properties.

UNIT II TISSUE ARCHITECTURE

9

Tissue types and Tissue components, Tissue repair, Engineering wound healing and sequence of events. Basic wound healing Applications of growth factors: VEGF/angiogenesis, Basic properties, Cell-Matrix & Cell-Cell Interactions, telomeres and Self-renewal, Control of cell migration in tissue engineering.

UNIT III BIOMATERIALS

9

Biomaterials: Properties of biomaterials, Surface, bulk, mechanical and biological properties. Scaffolds & tissue engineering, Types of biomaterials, biological and synthetic materials, Biopolymers, Applications of biomaterials, Modifications of Biomaterials, Role of Nanotechnology.

UNIT IV BASIC BIOLOGY OF STEM CELLS

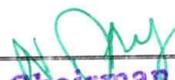
9

Stem Cells: Introduction, hematopoietic differentiation pathway Potency and plasticity of stem cells, sources, embryonic stem cells, hematopoietic and mesenchymal stem cells, Stem Cell markers, FACS analysis, Differentiation, Stem cell systems- Liver, neuronal stem cells, Types & sources of stem cell with characteristics: embryonic, adult, haematopoietic, fetal, cord blood, placenta, bone marrow, primordial germ cells, cancer stem cells induced pluripotent stem cells.

UNIT V CLINICAL APPLICATIONS

9

Stem cell therapy, Molecular therapy, In vitro organogenesis, Neurodegenerative diseases, spinal cord injury, heart disease, diabetes, burns and skin ulcers, muscular dystrophy, orthopedic applications, Stem cells and Gene therapy Physiological models, tissue engineered


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therapies, product characterization, components, safety, efficacy. Preservation –freezing and drying. Patent protection and regulation of of tissue-engineered products, ethical issues.

Total Hours

45

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	D. Shi	Biomaterials and Tissue Engineering	Springer	2004
2.	Bernhard O. Palsson, Sangeeta N. Bhatia	Tissue Engineering	Pearson Publishers	2009

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	B. Joon Park, D.B. Joseph and Boca Ration	Biomaterials: principles and applications	CRC, press	2003
2.	L. Hench and J. Jones	Biomaterials, Artificial Organs and Tissue Engineering	Woodhead Publishing in Materials	2002
3.	Ratner, B. D	Biomaterials Science: An Introduction to Materials in Medicine	Academic Press	2004
4.	Bernard N. Kennedy	Stem cell transplantation, cancer applications	Nova Science	2008
5.	J B Park	Biomaterials - Science and Engineering	Plenum Press	1984

WEB URLs

1. <http://nptel.ac.in/syllabus/syllabus.php?subjectId=113104009>
2. <http://nptel.ac.in/syllabus/syllabus.php?subjectId=102106036>
3. <https://www.class-central.com/mooc/494/coursera-introduction-to-tissue-engineering>
4. <http://oyc.yale.edu/biomedical-engineering/beng-100/lecture-22>
5. <http://genome.tugraz.at/biomaterials.shtml>


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COURSE OBJECTIVES:

- To get acquainted to the principles of Biosafety and gain knowledge on laboratory safety
- To be aware of research guidelines and quality checks
- To gain knowledge about risk analysis
- To get familiarize with safety audits
- To acquire knowledge on hazardous operations

COURSE OUTCOMES:

1. Ability to describe various risk assessments and associated biosafety practices at industrial level.
2. Ability to demonstrate quality checks
3. Ability to elucidate various risk analysis.
4. Ability to assess safety audits
5. Ability to acquire knowledge on hazardous operations.

UNIT I INTRODUCTION

9

Need for safety in industries; Safety Programmes – components and realization; Potential hazards –extreme operating conditions, toxic chemicals; safe handling

UNIT II QUALITY CHECKS

9

Implementation of safety procedures – periodic inspection and replacement; Accidents – identification and prevention; promotion of industrial safety.

UNIT III RISK ANALYSIS

9

Overall risk analysis--emergency planning-on site & off site emergency planning, risk management ISO 14000, EMS models case studies. Quantitative risk assessment – rapid and comprehensive risk analysis; Risk due to Radiation, explosion due to over pressure, jet fire-fire ball.

UNIT IV SAFETY AUDITS

9

Hazard identification safety audits, checklist, what if analysis, vulnerability models event tree analysis fault tree analysis, Hazan past accident analysis Fix borough-Mexico-Madras- Vizag Bopal analysis.

UNIT V HAZARDOUS OPERATIONS

9

Hazop-guide words, parameters, derivation-causes-consequences-recommendation-coarse Hazop study-case studies-pumping system-reactor-mass transfer system.

Total Hours

45

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Deepa Goel and Ms.Shomini Parashar	IPR, Biosafety and Bioethics	Pearson Education	2013


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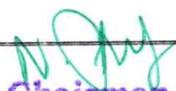
2.	Sateesh, M. K	Bioethics and biosafety	IK International Pvt Ltd	2010
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REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Fleming, D.A., Hunt, D.L	Biological safety Principles and practices	ASM Press, Washington	2000
2.	Fawatt, H.H. and Wood, W.S	Safety and Accident Prevention in Chemical Operation	Wiley Inter science	1965
3.	Marcel, V.C	Major Chemical Hazard	Ellis Harwood Ltd., Chi Chester	1987
4.	Handley, W	Industrial Safety Hand Book	McGraw-Hill Book Company	1969
5.	Heinrich, H.W. Dan Peterson, P.E. and Rood	Industrial Accident Prevention	McGraw-Hill Book Company	1980

WEB URLs

1. <http://blink.ucsd.edu/safety/research-lab/biosafety/>
2. <http://ces.iisc.ernet.in/hpg/cesmg/iprdoc.html>
3. <https://www.fic.nih.gov/RESEARCHTOPICS/BIOETHICS/Pages/teachers-students.aspx>
4. <https://www.omicsonline.org/open-access/biosafety-issues-of-genetically-modified-organisms-2167-0331.1000e150.php?aid=27764&view=mobile>
5. <http://www.who.int/csr/resources/publications/biosafety/Biosafety>


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COURSE OBJECTIVES:

- To gain knowledge on the basics of stem cells and their origin
- To learn the methods of stem cell identification and various sources
- To give way to the therapeutic treatment using stem cells
- To acquire knowledge about stem cell differentiation
- To gain knowledge about the ethical issues

COURSE OUTCOMES:

1. Ability to compare the characteristics of different types of stem cells and their origin
2. Ability to analyze the differentiation process of premature stem cells
3. Ability to compare the characteristic features of Embryonic and adult stem cells
4. Ability to evaluate the methods of stem cell identification and various sources
5. Ability to implement the therapeutic applications of stem cells in human diseases

UNIT I STEM CELLS AND TYPES

9

Stem cells: Definition, Classification, Sources and Properties –Types of stem cells: methods of isolation, study of stem cells and their viability IPSC, embryonic stem cells, cancer stem cells. – Preservations of Stem cell. Embryonic stem cell: Isolation, Culturing, Differentiation, Properties – Adult stem cell: Isolation, Culturing, Differentiation, Trans-differentiation, Plasticity, and Properties.

UNIT II STEM CELLS IN PLANTS AND ANIMALS

9

Stem cell and founder zones in plants –particularly their roots – stem cells of shoot meristems of higher plants. Skeletal muscle stem cell – Mammary stem cells – intestinal stem cells – keratinocyte stem cells of cornea – skin and hair follicles –tumour stem cells.

UNIT III STEM CELLS DIFFERENTIATION

9

Factors influencing proliferation, physical, chemical and molecular methods for differentiation of stem cells – hormonal role in differentiation.

UNIT IV REGENERATION AND EXPERIMENTAL METHODS

9

Germ cells, hematopoietic organs, and kidney, cord blood transplantation, donor selection, HLA matching, patient selection, peripheral blood and bone marrow transplantation, - Stem cell Techniques: fluorescence activated cell sorting (FACS), time lapse video, green fluorescent protein tagging.

UNIT V APPLICATION AND ETHICAL ISSUES

9

Stem cell Therapy for neuro degenerative diseases, spinal cord injury, heart disease, diabetes, burns, skin ulcers, muscular dystrophy and orthopaedic applications. Stem cell policy and ethics, stem cell research: Hype, hope and controversy.

Total Hours

45

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
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1.	C.S Potten	Stem cells	Elsevier	2006
2.	Robert Lanza., fourth edition	Essentials of Stem Cell Biology	Elsevier	2014

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Peter Quesenberry., First Edition	Stem cell biology and Gene Therapy	Wiley-Liss	1998
2.	Kursad Turksen	Embryonic Stem cells – Protocols	Humana Press	2002
3.	Ariff Bongso, Eng Hin Lee	Stem Cells: From Bench to Bedside	World Scientific Publishing Company	2005
4.	Ali Gholam rezanezhad	Stem cells in clinic and Research	Intech	2013
5.	MD. Steward Sell	Stem cells	Human Press Inc	2004

WEB URLs

1. <https://www.mayoclinic.org/tests-procedures/bone-marrow-transplant/in-depth/stem-cells/art-20048117>
2. <https://www.yourgenome.org/facts/what-is-a-stem-cell>
3. <https://www.closerlookatstemcells.org/learn-about-stem-cells/types-of-stem-cells/>
4. <https://www.youtube.com/watch?v=i2pyDBMgIfM>
5. <https://www.youtube.com/watch?v=-8xHWhg6YQA>


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COURSE OBJECTIVES

- To gain structural knowledge of biological systems.
- To understand transport and dynamic properties of biological systems.
- To expose students to the basics of membrane biophysics and molecular electrophysiology
- To learn the mechanism involved in activation and inactivation of ion channels
- To make students learn about the patch clamping technique

COURSE OUTCOMES:

1. Ability to analyze the various forces responsible for biological molecular structure.
2. Ability to be familiar with different levels of conformation in nucleic acids
3. Ability to explain about the levels of conformation in proteins.
4. Ability to gain the knowledge of cellular permeability and ion transport.
5. Ability to understand the dynamics of biological systems.

UNIT I MOLECULAR STRUCTURE OF BIOLOGICAL SYSTEMS 9

Intra molecular bonds – covalent – ionic and hydrogen bonds – biological structures – general features – water structure – hydration – interfacial phenomena and membranes – self assembly and molecular structure of membranes.

UNIT II CONFORMATION OF NUCLEIC ACIDS 9

Primary structure – the bases – sugars and the phosphodiester bonds- double helical structure – the a b and z forms–properties of circular DNA–topology–polymorphism and flexibility of DNA - structure of ribonucleic acids – hydration of nucleicacids.

UNIT III CONFORMATION OF PROTEINS 9

Conformation of the peptide bond – secondary structures – Ramachandran plots – use of potential functions – tertiary structure – folding – hydration of proteins – hydrophathy index.

UNIT IV CELLULAR PERMEABILITY AND ION –TRANSPORT 9

Ionic conductivity – transport across ion channels – mechanism - ion pumps- proton transfer – nerve conduction – techniques of studying ion transport and models.

UNIT V ENERGETICS & DYNAMICS OF BIOLOGICAL SYSTEMS 9

Concepts in thermodynamics – force and motion – entropy and stability – analyses of fluxes – diffusion potential – basic properties of fluids and biomaterials – laminar and turbulent flows.

Total Hours 45

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Andrey B. Rubin	Fundamental of Biophysics	Scrivener publishing	2014
2.	Raymond A. Serway and John	Physics for scientists and engineers	Thomson books	2008


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W. Jewett, Jr			
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REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Cantor R. and Schimmel P.R	Biophysical Chemistry	W. H. Freeman and Company	1980
2.	R. Glaser	Biophysics	Springer Verlag	2000
3.	R. Duane	Biophysics: Molecules In Motion	Academic Press	1999
4.	Creighton, Freeman N	Proteins – Structure & Molecular Properties	Springer Verlag	1997
5.	Rodney Cotterill	Biophysics – An Introduction	Wiley Student Edition	2003

WEB URLs

1. <http://nptel.ac.in/courses/102107028/>
2. <http://nptel.ac.in/courses/102103044/>
3. <https://0b9411cb7057497b22db0cd9f69e827bce11ede8.googleusercontent.com/host/0B5XjjBGDoIrhNIFVcVhQWjA2a1k/Biophysical-Techniques-Iain-Campbell-ebook-51iBvNTIHhL.pdf>
4. <https://www.youtube.com/watch?v=jFZHlPhmNTs&list=PLFn7fvIP7CbMun4daH24AZzX3r7ETT6aD>
5. <https://www.youtube.com/watch?v=V20prBPihF4>



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COURSE OBJECTIVES

- To deliver the knowledge of spectroscopic techniques and its functions
- To provide the technical information of spectroscopy for biological applications.
- To learn the various spectroscopic techniques, the physical principles, experimental and instrumentation techniques
- To use the various atomic and molecular spectroscopic techniques to estimate and analyze the structure and dynamics of biomacromolecules
- To learn the applications of X-ray crystallography, x-ray spectroscopy, mass spectrometry, electron spectroscopy etc in analysis of chemical and crystalline structure, molecular weight of biomolecules.

COURSE OUTCOMES:

1. Ability to explain the basics of optical rotary dispersion methods
2. Ability to describe the types nuclear magnetic resonance
3. Ability to explain principles and applications of mass spectrometry and X-ray diffraction
4. Ability to demonstrate microscopic techniques and its applications
5. Ability to describe spectroscopic techniques for various biological applications

UNIT I OPTICAL ROTATORY DISPERSION

9

Polarized light – optical rotation – circular dichroism – circular dichroism of nucleic acids and proteins.

UNIT II TYPES OF NUCLEAR MAGNETIC RESONANCE

9

Chemical shifts – spin – spin coupling – relaxation mechanisms – nuclear over hauser effect – ESR multi dimensional NMR spectroscopy – determination of macromolecular structure by NMR – magnetic resonance imaging.

UNIT III TYPES OF MASS SPECTROMETRY

9

Ion sources sample introduction – mass analyzers and ion detectors – bimolecular mass spectrometry – peptide and protein analysis – carbohydrates and small molecules – specific applications.

UNIT IV X-RAY DIFFRACTION

9

Scattering by x- rays – diffraction by a crystal – measuring diffraction pattern – Bragg reflection – unit cell – phase problem – anomalous diffraction – determination of crystal structure – electron and neutron diffraction.

UNIT V SPECIAL TOPICS AND APPLICATIONS

9

Electron microscopy – transmission and scanning electron microscopy – scanning Tunneling and atomic force microscopy – combinatorial chemistry and high throughput screening methods.

Total Hours

45


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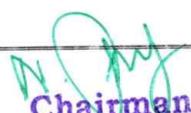
Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Banwell, Colin N. and E.M. McCash	Fundamentals of Molecular Spectroscopy	Tata McGraw-Hill	2017
2.	Aruldas, G	Molecular Structure and Spectroscopy	Prentice Hall of India	2007

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Pavia, D.L., G.M. Lampman and G.S. Kriz	Introduction to Spectroscopy	Thomson, Brooks/ Cole	2001
2.	Siuzdak, Gary	Mass Spectrometry for Biotechnology	Academic Press /Elsevier	1996
3.	Atkins P.W	Physical Chemistry	Oxford University Press India	2014
4.	Hammes, Gordon G	Spectroscopy for the Biological Sciences	John Wiley	2005
5.	Campbell I.D and Dwek R.A	Biological Spectroscopy	Benjamin Cummins and Company	1986

WEB URLs

1. <https://www.isa.au.dk/research/bio-research.asp>
2. https://serc.carleton.edu/research_education/geochemsheets/techniques/XRD.html
3. <https://www.youtube.com/watch?v=MW4PwJxxyt0>
4. <https://www.youtube.com/watch?v=kHZbkty8YBo>
5. <https://www.youtube.com/watch?v=t5stvnKNXbg>


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Course Objectives:

- To deliver the knowledge about marketing and its functions.
- To Identify the problems in ownership and economy wise processes.
- To learn about the factors, attributes and indicators of bio-entrepreneurship.
- To learn the business strategies and technology transfer in biotech companies.
- To study the various concepts on creativity, innovation, product development and technology transfer

COURSE OUTCOMES:

1. Ability to learn about the factors, attributes and indicators of bio-entrepreneurship.
2. Ability to learn business strategies and technology transfer in biotech companies.
3. Ability to illustrate the components of biotechnology companies
4. Ability to impart the knowledge on Creativity, Innovation and New product development.
5. Ability to inculcate novel strategies on identifying market demands, establishing market niche.

UNIT I	9
Should You Become an Entrepreneur? What Skills Do Entrepreneurs Need?	
<ul style="list-style-type: none"> • Identify and Meet a Market Need • Entrepreneurs in a Market Economy • Select a Type of Ownership. 	
UNIT II	9
<ul style="list-style-type: none"> • Develop a Business Plan 	
UNIT III	9
<ul style="list-style-type: none"> • Choose Your Location and Set Up for Business • Market Your Business • Hire and Manage a Staff 	
UNIT IV	9
<ul style="list-style-type: none"> • Finance, Protect and Insure Your Business • Record Keeping and Accounting • Financial Management 	
UNIT V	9
<ul style="list-style-type: none"> • Meet Your Legal, Ethical, Social Obligations • Growth in Today's Marketplace. 	
Total Hours	45

TEXT BOOKS:

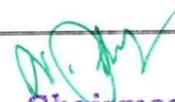
Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Jogdand, S.N	Entrepreneurship and Business of Biotechnology	Himalaya Publishing Home	2007
2.	Branson R	Business Stripped Bare: Adventures of a Global Entrepreneur	Virgin Books	2009

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	S.S. Khanka	Entrepreneurship Development	S.Chand & Co	2006
2.	Robers Lusier	Management Fundamentals - Concepts, Application, Skill Development	Cengage Learning	1996
3.	Poornima M Charanthimath	Entrepreneurship Development	Pearson Education	2006
4.	Shashi k Gupta	Entrepreneurship and management	Kalyani publishers	2005
5.	Stephen P Robbins, Timothy A. Judge, Neharika Vohra	Organizational behaviour	Pearson	2012

WEB URLs

1. <http://www.rishibiotech.com/bioentrepreneurship>
2. <https://birac.nic.in/webcontent/jk.pdf>
3. <https://www.nationalbioentrepreneurship.in/>
4. <https://www.youtube.com/watch?v=tL8nbKjPi3c>
5. <https://www.youtube.com/watch?v=VOJ8cOh6mQ0>


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COURSE OBJECTIVES:

- To enable the students to create an awareness on Engineering Ethics and Human Values,
- To instill Moral and Social Values and Loyalty and to appreciate the rights of others.
- To understand Human Values and ethical theory.
- To understand codes of ethics, work place responsibilities, rights, engineering experimentation, global issues and contemporary ethical issues.
- To understand personal ethics, legal ethics, cultural ethics and engineers responsibility.

COURSE OUTCOMES:

1. Articulate engineering ethics theory with sustained lifelong learning.
2. Adopt a good character and follow high professional ethical life.
3. Contribute to shape a better character by following ethical actions.
4. Confront and resolve moral issues occurred during technological activities.
5. Resolve moral and ethical problems through exploration and assessment by established experiments.

UNIT I HUMAN VALUES

9

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

UNIT II ENGINEERING ETHICS

9

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

UNIT III ENGINEERING ASSOCIAL EXPERIMENTATION

9

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS

9

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime– Professional Rights–Employee Rights–Intellectual Property Rights(IPR) - Discrimination.

UNIT V GLOBAL ISSUES

9

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility.

Total Hours

45

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Mike W. Martin and Roland	Ethics in Engineering	Tata McGraw Hill, New Delhi	2003



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	Schinzinger			
2.	M Govindarajan, S Natarajan and V S Senthil Kumar	Engineering Ethics	PHI Learning Private Ltd, New Delhi	2012

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Charles B. Fleddermann	Engineering Ethics	Pearson Prentice Hall, New Jersey	2004
2.	Charles E. Harris, Michael S. Pritchard and Michael J. Rabins	Engineering Ethics– Concepts and Cases	Cengage Learning	2009
3.	John R Boatright	Ethics and the Conduct of Business	Pearson Education, New Delhi	2003
4.	Edmund G Seebauer and Robert L Barry	Fundamentals of Ethics for Scientists and Engineers	Oxford University Press, Oxford	2001
5.	R S Naagarazan	A text book on professional ethics and human values	New age international (P)limited, New Delhi	2006

WEB URLs

1. www.slideworld.org/slidestag.aspx/human-values-and-Professional-ethics
2. <https://courses.lumenlearning.com/atd-epcc-introethics-1/chapter/professional-ethics/>
3. https://www.tutorialspoint.com/professional_ethics/ethics_in_profession.htm
4. <https://www.youtube.com/watch?v=O-e6-bV3oCY>
5. https://www.youtube.com/watch?v=SMTjf_D4Crw


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COURSE OBJECTIVES:

- To understand the economically important marine animals and their potency as toxins and drugs.
- To learn the knowledge on the degradation process for discharged wastes.
- To know the diseases of aquaculture animals and its management.
- To acquire knowledge about marine pharmacology
- To understand about aquaculture technology

COURSE OUTCOMES:

1. Ability to explain the biology of marine micro-macro flora and fauna.
2. Ability to describe the techniques for detection of marine organism and bio-augmentation.
3. Ability to comprehend on the marine food processing, product and safety.
4. Ability to screening and purification of bioactive compounds from marine flora and fauna.
5. Ability to demonstrate aqua culture technology

UNIT I INTRODUCTION TO MARINE ENVIRONMENT 9

World oceans and seas – ocean currents – physical and chemical properties of sea water – abiotic and biotic factors of the sea – ecological divisions of the sea – history of marine biology – biogeochemical cycles – food chain and food web.

UNIT II IMPORTANT MARINE ORGANISMS 9

Phytoplanktons – zooplanktons – nektons – benthos – marine mammals – marine algae – mangroves – coral reefs – deep sea animals and adaptation – intertidal zone – fauna and flora.

UNIT III MARINE ENVIRONMENTAL BIOTECHNOLOGY 9

Marine pollution – biology indicators (marine micro, algae) – biodegradation and bioremediation – marine fouling and corrosion.

UNIT IV MARINE PHARMACOLOGY 9

Medicinal compound from marine flora and fauna – marine toxins, antiviral and antimicrobial agents.

UNIT V AQUACULTURE TECHNOLOGY 9

Important of coastal aquaculture – marine fishery resources – common fishing crafts and gears – aquafarm design and construction.

Total Hours 45

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	M. Fingerman, R. Nagabhusanam Mary –	Recent advances in marine biotechnology volume 3	Frances Thomson	2008
2.	Powers D.A	New frontiers in marine biotechnology: Opportunities for the 21st century	Marine Biotechnology in the	1993

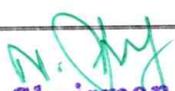
		Asian Pacific Region	
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REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Attaway D.H. and Zaborisky O.R	Marine Biotechnology: Volume I, Pharmaceuticals and Bioactive Natural Products	New York: Plenum	1993
2.	M. Fingerman, R. Nagabhusanam Mary	Recent advances marine biotechnology volume 2	Frances Thomson	2008
3.	Milton Fingerman and Rachakonda Nagabhusanam	Recent Advances in Marine Biotechnology (Series) Biomaterials and Bioprocessing	Science Publishers	2009
4.	Le Gal, Y., Ulber, R	Marine Biotechnology I & II: Advances in Biochemical Engineering/Biotechnology	Springer-Verlag Berlin Heidelberg	2005
5.	Rheinheimer, G	Aquatic Microbiology	Johnwiley & Sons	1980

WEB URLs

1. www.mooclist.com/course/marine-and-antarctic-science-open2study?static=true
2. <https://www.youtube.com/watch?v=hv1U19J3yfw>
3. https://www.youtube.com/watch?v=trg3_9IAKgk
4. https://www.youtube.com/watch?v=KTy_0dzLiu8
5. <https://www.youtube.com/watch?v=wVclGaBZW1A>


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COURSE OBJECTIVES:

- To provide a quantitative basis, based on thermodynamics, enzyme kinetics, for the understanding of metabolic networks in single cells and at the organ level.
- To enable the students to use organisms to produce valuable substances on an industrial scale in cost effective manner.
- To introduce the basic concepts of metabolic engineering
- To expose transport mechanisms and models to regulate enzymes
- To utilize the tools used for metabolic pathway manipulation

COURSE OUTCOMES:

1. Ability to apply cellular metabolism in growth regulation.
2. Ability to analyze the need and scope of metabolic engineering
3. Ability to analyze the scheme of regulatory pathways
4. Ability to evaluate the tools used in metabolic engineering
5. Ability to evaluate the strategies used in metabolic pathway manipulation

**UNIT I INTRODUCTION TO EXAMPLES OF PATHWAY MANIPULATION –
QUALITATIVE TREATMENT**

9

Enhancement of Product Yield and Productivity, Extension of substrate Range, Extension of Product spectrum and Novel products, Improvement of Cellular properties, Xenobiotic degradation.

UNIT II MATERIAL BALANCES AND DATA CONSISTENCY

9

Comprehensive models of cellular reactions; stoichiometry of cellular reactions, reaction rates, dynamic mass balances, yield coefficients and linear rate equations, analysis of over determined systems- identification of gross measurement errors. Introduction to MATLAB.

UNIT III METABOLIC FLUX ANALYSIS

9

Theory, over determined systems, underdetermined systems- linear programming, sensitivity analysis, methods for the experimental determination of metabolic fluxes by isotope labeling, applications of metabolic flux analysis.

UNIT IV METABOLIC CONTROL ANALYSIS

9

Fundamentals of Metabolic Control Analysis, control coefficients and the summation theorems, Determination of flux control coefficients, MCA of linear pathways, branched pathways, theory of large deviations.

UNIT V ANALYSIS OF METABOLIC NETWORKS

9

Control of flux distribution at a single branch point, Grouping of reactions, case studies, extension of control analysis to intermetabolite, optimization of flux amplifications, consistency tests and experimental validation.

Total Hours

45

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	G.N.	Metabolic Engineering.	Academic Press	1998


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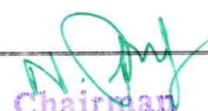
	Stephanopoulos, A.A. Aristidou, J. Nielsen	Principles and Methodologies		
2.	S. Y. Lee and E.T. Papoutsakis	Metabolic Engineering	Marcel Dekker, New York	1999

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	R.Heinrich and S. Schuster	The Regulation of Cellular Systems	Chapman & Hall	1996
2.	James E. Bailey and David F. Ollis	Biochemical Engineering Fundamentals	McGraw-Hill	1986
3.	Gregory N. Stephanopoulos, Aristos A. Aristidou, Jens Nielsen	Metabolic Engineering: Principles and Methodologies	Academic Press	1998
4.	Eberhard O. Voit	Computational Analysis of Biochemical Systems: A Practical Guide for Biochemists and Molecular Biologists	Cambridge University Press	2000
5.	Zoltan Szallasi, Jorg Stelling and Vipul Periwal MIT	Systems Modeling in Cellular Biology: From Concepts to Nuts and Bolts	Press Cambridge	2006

WEB URLs

1. <http://www.nptel.ac.in/syllabus/102103014/>
2. https://books.google.co.in/books/about/Metabolic_Engineering.html?id=9mGzks04NVQC
3. <https://www.youtube.com/watch?v=mL6NwbmEum4>
4. https://www.youtube.com/watch?v=R_Ir1X7hl-c
5. <https://www.youtube.com/watch?v=tHFp2mcaOtU>


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 Muthayammal Engineering College (Autonomous)
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COURSE OBJECTIVES:

- To gain knowledge about the human rights
- To understand the theories of human rights
- To acquire knowledge about UN laws
- To familiarize the concepts of human rights
- To gain knowledge about commission and judiciary

COURSE OUTCOMES:

1. Ability to explain about the need of human rights
2. Ability to describe about the evolution of human rights
3. Ability to demonstrate about UN laws
4. Ability to explain the constitutional provisions
5. Ability to describe about the commission and judiciary

UNIT I

9

Human Rights – Meaning, origin and Development. Notion and classification of Rights – Natural, Moral and Legal Rights. Civil and Political Rights, Economic, Social and Cultural Rights; collective / Solidarity Rights.

UNIT II

9

Evolution of the concept of Human Rights Magna carta – Geneva convention of 1864. Universal Declaration of Human Rights, 1948. Theories of Human Rights.

UNIT III

9

Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

UNIT IV

9

Human Rights in India – Constitutional Provisions / Guarantees.

UNIT V

9

Human Rights of Disadvantaged People – Women, Children, Displaced persons and Disabled persons, including Aged and HIV Infected People. Implementation of Human Rights – National and State Human Rights Commission – Judiciary – Role of NGO's, Media, Educational Institutions, Social Movements.

Total Hours

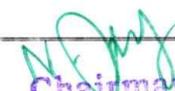
45

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Kapoor S.K	Human Rights under International law and Indian Laws	Central Law Agency, Allahabad	2014
2.	Chandra U	Human Rights	Allahabad Law Agency, Allahabad	2014

REFERENCE BOOKS:

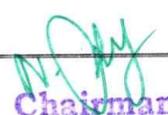
Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
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 Department of Biotechnology
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 637 003.

1.	Upendra Baxi, ,	The Future of Human Rights	Oxford University Press, New Delhi	2004
2.	Shubham Singles, Charles E. Haries	Constitution of India, Professional Ethics and Human Rights	Cengage Learning India	2018
3.	M. Govindarajan, S. Natarajan, V. S. Senthilkumar	Engineering Ethics	Prentice –Hall,	2004
4.	Alfred Basta	Cyber Security and Cyber Laws	Cengage Learning India	2018
5.	Durga Das Basu	Introduction to the Constitution of India	Prentice –Hall,	2008

WEB URLs

1. <https://www.un.org/en/sections/issues-depth/human-rights/>
2. <https://www.un.org/en/universal-declaration-human-rights/>
3. https://www.youtube.com/watch?v=6XXGF_V8_7M
4. <https://www.youtube.com/watch?v=mT1oavOmaYE>
5. <https://www.youtube.com/watch?v=nDgIVseTkuE>


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COURSE OBJECTIVES:

- To identify the importance of protein biomolecules.
- To realize the structure-function relationships in proteins
- To provide students with a basic understanding of classification, nomenclature, mechanism and specificity of enzyme-coenzyme action, extraction, purification and characterization of enzymes
- To understand enzyme immobilization methods , kinetics of free, immobilized and allosteric enzymes
- To learn the stability, dynamics, structure/function relationships, folding of proteins and rational drug design

COURSE OUTCOMES:

1. Ability to analyze the various interactions in protein makeup.
2. Ability to be familiar with different levels of protein structure.
3. Ability to apply the theoretical and practical aspects of enzyme kinetics for promoting research
4. Ability to analyze the tertiary and quaternary structure of proteins
5. Ability to practice the latest application of protein science in their research.

UNIT I BONDS, ENERGIES, BUILDING BLOCKS OF PROTEINS

9

Covalent, Ionic, Hydrogen, Coordinate, hydrophobic and Vander walls interactions in protein structure. Amino acids and their molecular properties (size, solubility, charge, pKa), Chemical reactivity in relation to post-translational modification.

UNIT II PROTEIN ARCHITECTURE

9

Primary structure: peptide mapping, peptide sequencing - automated Edman method & mass spec. High-throughput protein sequencing setup Secondary structure: Alpha, beta and loop structures and methods to determine Super-secondary structure: Alpha-turn-alpha, beta-turnbeta (hairpin), beta-sheets, alpha-beta-alpha, topology diagrams.

UNIT III TERTIARY STRUCTURE

9

Tertiary structure: Domains, folding, denaturation and renaturation, overview of methods to determine 3D structures. Quaternary structure: Modular nature, formation of complexes.

UNIT IV STRUCTURE-FUNCTION RELATIONSHIP

9

DNA-binding proteins: prokaryotic transcription factors, Helix-turn-Helix motif in DNA binding, Trp Repressor, Eukaryotic transcription factors, Zn fingers, helix-turn helix motifs in homeodomain, Leucine zippers. Membrane proteins: General characteristics, Transmembrane segments

UNIT V PROTEOMICS

9

Introduction to the concept of proteome, components of proteomics, proteomic analysis, importance of proteomics in biological functions, protein-protein interactions, protein arrays, cross linking methods, affinity methods, yeast hybrid systems.

Total Hours

45

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Branden C. and Tooze J	Introduction to Protein Structure	Garland Publishing	1999
2.	Creighton T.E	Proteins	W.H. Freeman	1993

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Pennington, S.R and M.J. Dunn	Proteomics: Protein Sequence to Function	Viva Books	2002
2.	Liebler	Introduction to Proteomics	Humana Press	2002
3.	Voet D. and Voet G	Biochemistry	John Wiley and Sons	2008
4.	Haggerty, Lauren M	Protein Structure: Protein Science and Engineering	Nova Science Publications	2011
5.	Williamson, Mike	How Proteins Work	Garland Science	2012

WEB URLs

1. <http://www.novozymes.com/en/about-us/our-business/what-areenzymes/Pages/default.aspx>
2. <https://nptel.ac.in/courses/104105076/7>
3. <https://www.youtube.com/channel/UC0wRhswnu-wnxbxGfN4FqAA>
4. <https://www.youtube.com/watch?v=UdZURJ1IXJg>
5. <https://www.youtube.com/watch?v=v3ucL72TPIg>


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Muthayammal Engineering College (Autonomous),
Rasipuram, Namakkal Dist. 637 408.

COURSE OBJECTIVES:

- To create awareness about IPR and Engineering ethics
- To follow professional ethics and practices in their careers
- To create awareness and responsibilities about the environment and society
- To understand the basics of patenting and IPR
- To develop entrepreneur skills.

COURSE OUTCOMES:

1. Ability to know the fundamental values, such as human dignity and the genetic integrity of humanity.
2. Ability to serve basic human needs such as human health, food and a safe environment,
3. Ability to raise human rights issues such as access to health and benefits from scientific progress
4. Ability to concerns over equitable access to the fruits of new technologies, the consent of those involved in research, and protection of the environment.
5. Ability to obtaining a clear information on the entrepreneurship and understand their economic values

UNIT I HISTORY OF BIOETHICS

9

Bioethics as a discipline – philosophical reflections on experimenting with human subjects – active and passive euthanasia; culture assumption in the history of Bioethics– medical ethics in India and America.

UNIT II METHODS OF ETHICAL ANALYSIS

9

Ethical reasoning- philosophical, clinical and cultural dimensions; challenge of ethical relativism; methods of philosophical theories and principles- Equality and its implications; methods of casuistry and methods of narrative approaches

UNIT III ETHICS IN BIOTECHNOLOGY

9

Ethics committee (hospital) – Inner working of an ethics committee; ethics consultation – skills, roles and training; Biosafety regulation- national and International guidelines; rDNA guidelines- guidelines for rDNA research activities, mechanism of implementation of biosafety guidelines

UNIT IV PATENTING, IPR AND APPLICATIONS

9

Introduction to Intellectual property rights, types: patents, copy right, trade mark, trade secret, geographical indications, importance of IPR, Patenting and non patenting life, TRIPS

UNIT V ENTREPRENEURSHIP IN BIOTECHNOLOGY

9

The Significance of the Biotechnology Entrepreneur; The Integration of Two Distinctly Different Disciplines; Biotechnology Entrepreneurship Versus General Entrepreneurship ; Entrepreneurship and Intrapreneurship; Essential Biotechnology Entrepreneurial Characteristics; Four Backgrounds of Biotechnology Entrepreneurs

Total Hours 45**TEXT BOOKS:**

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Nancy S. Jecker, Albert R. Jonsen, Robert A	Bioethics	Pearlman. Jones and Bartlett Publishers	2003


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2.	Singh K	Intellectual Property Rights on Biotechnology	BCIL, New Delhi	2001
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REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	M.K. Sateesh	Bioethics and Biosafety	I.K. International Publishing House Pvt. Ltd	2008
2.	Poornima. M. Charantimath	Entrepreneurship Development	Pearson Education	2006
3.	Sasson A	Biotechnologies and Development	UNESCO Publications	1998
4.	Sasson A	Biotechnologies in Developing countries present and future	UNESCO Publications	1993
5.	Fleming, D.A., Hunt, D.L	Biological safety Principles and practices	ASM Press, Washington	2000

WEB URLs

1. <http://blink.ucsd.edu/safety/research-lab/biosafety/>
2. <http://ces.iisc.ernet.in/hpg/cesmg/iprdoc.html>
3. <https://www.fic.nih.gov/RESEARCHTOPICS/BIOETHICS/Pages/teachers-students.aspx>
4. <https://www.omicsonline.org/open-access/biosafety-issues-of-genetically-modified-organisms-2167-0331.1000e150.php?aid=27764&view=mobile>
5. <http://www.who.int/csr/resources/publications/biosafety/Biosafety>

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