HINDUSTAN
INSTITUTE OF TECHNOLOGY & SCIENCE
(DEEMED TO BE UNIVERSITY)

B. TECH. BIOTECHNOLOGY

(Duration: 4 Years)

REGULATION, CURRICULUM and SYLLABUS

(In line with NEP 2020)

Applicable for Students admitted from Year 2022 onwards

DEPARTMENT OF BIOTECHNOLOGY

SCHOOL OF ENGINEERING AND TECHNOLOGY

HINDUSTAN INSTITUTE OF TECHNOLOGY AND SCIENCE

VISION AND MISSION OF THE INSTITUTE

Motto:

To Make Every Man a Success and No Man a Failure

Vision:

To be an International Institute of Excellence, providing a conducive environment for education with a strong emphasis on innovation, quality, research and strategic partnership blended with values and commitment to society.

Mission:

- *To create an ecosystem that promotes learning and world class research.*
- *To nurture creativity and innovation.*
- *To instil highest ethical standards and values.*
- *To pursue activities for the development of the Society.*
- *To develop national and international collaborations with institutes and industries of eminence.*
- *To enable graduates to become future leaders and innovators.*

Value Statement

Integrity, Innovation, Internationalization

VISION, MISSION OF THE DEPARTMENT

Vision

To achieve the pinnacle of success through quality education, research and entrepreneurship in emerging areas of Chemical Engineering and Biotechnology.

Mission

- *To provide innovative education empowered with excellent technical and leadership skills*
- *To create state-of-the-art infrastructure for research and training, promote scientific discovery and development by fostering relationship with research organizations and industries.*

B. Tech Biotechnology

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

PEO1 : *Apply the knowledge in the field of engineering biotechnology to pursue higher studies and careers in industries, consultancies and research institutions.*

PEO2 : *Design, develop and provide solutions for product/processes/technology development*

PEO3 : *Apply modern computational, analytical tools and techniques in biotechnology to address environmental challenges.*

PROGRAMME OUTCOMES (PO's)

Engineering Graduates will be able to:

PO1 : **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 : **Problem Analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 : **Design Development of Solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 : **Conduct Investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 : **Modern Tool Usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6 : The Engineer & Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7 : Environment & Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8 : Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9 : Individual & Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 : Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11 : Project Management & Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12 : Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSO's)

Graduates of B.Tech Biotechnology students will be able to

PSO1: *Understand the mechanism and functions of cellular metabolism using biotechnological methods.*

PSO2: *Optimizing the performance and tools in genetic engineering for synthesizing plant and animal products.*

PSO3*:* *Designing a bioreactor using bioprocess engineering methods*

PEOs and POs:

B.Tech Biotechnology Program Outcomes (POs) leading to the achievements of the objectives (PEOs) are summarised in the following table.

Programme Educational Objectives (PEOs)	Programme Outcomes (POs)														
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
I	3	3	3	3	2	2	2	1	1	1	1	1	2	2	2
II	3	3	3	3	3	3	2	2	2	2	1	1	2	2	2
III	3	3	3	2	2	2	3	3	3	1	1	1	3	3	3

B. TECH BIOTECHNOLOGY

FRAMEWORK OF CURRICULUM 2022 A (in line with NEP 2020)									
SEMESTER – I									
S NO	**COURSE CATEGORY**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	BS	EMA51001	Matrices and Calculus	3	0	2	4	2	5
2	BS	**Any One Course to be Opted**		3	0	2	4	2	5
		EPH51001	Engineering Physics						
		ECT51001	Engineering Materials						
3	HS	**Any One Course to be Opted**		2	0	1	2	1	3
		GLS51001	Communication Skills						
		GLS51002	Personality Development and Soft Skills						
4	ES	**Any One Course to be Opted**		2	0	2	3	2	4
		ECS51009	Programming Fundamentals using C						
		ECS51010	Programming in Python						
		OR							
		EME51001	Engineering Graphics and Computer Aided Design						
5	ES	EGE51002	Design Thinking	2	0	2	3	2	4
6	ES	**Any One Course to be Opted**		0	0	4	2	2	4
		EGE51406	Engineering Practices Lab						
		EGE51408	Fab Lab for Core Engineering						
7	HS	**Any One Course to be Opted**		0	0	2	1	4	2
		GGE51401	Outreach (NCC) – Level I #						
		GGE51402	Outreach (NSS, Y's Men, Rotaract) – Level I #						
8	HS	**Any One Course to be Opted (Indian/Foreign Language)**		2	0	0	2	2	2
		GLS51008	Tamil						
		GLS51009	Hindi						
		GLS51010	Telugu						
		GLS51011	French						

		GLS51012	German						
		GLS51013	Spanish						
		GLS51014	Korean						
		GLS51015	Mandarin						
		GLS51016	Japanese						
		OR							
		GGE51001	Universal Human Values						
9	HS	GLS51017	Tamil Culture and Technology	1	0	0	1	2	1
			Total	**15**	**0**	**15**	**22**	**19**	**30**

SEMESTER – II									
S NO	**COURSE CATEGORY**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	BS	EMA51002	Analytical Mathematics	3	0	2	4	2	5
2	BS	**Any One Course to be Opted**		3	0	2	4	2	5
		EPH51001	Engineering Physics						
		ECT51001	Engineering Materials						
3	HS	**Any One Course to be Opted**		2	0	1	2	1	3
		GLS51001	Communication Skills						
		GLS51002	Personality Development and Soft Skills						
4	PC	EBT51001	Cell Biotechnology	3	0	2	4	2	5
5	ES	**Any One Course to be Opted**		2	0	2	3	2	4
		ECS51009	Programming Fundamentals using C						
		ECS51010	Programming in Python						
		OR							
		EME51001	Engineering Graphics and Computer Aided Design						
6	ES	**Any One Course to be Opted**		0	0	4	2	2	4
		EGE51406	Engineering Practices Lab						
		EGE51408	Fab Lab for Core Engineering						
7	HS	**Any One Course to be Opted**		0	0	2	1	4	2
		GGE51403	Outreach (NCC) – Level II #						

		GGE51404	Outreach (NSS, Y's Men, Rotaract) – Level II #						
8	HS	**Any One Course to be Opted (Indian/Foreign Language)**		2	0	0	2	2	2
		GLS51008	Tamil						
		GLS51009	Hindi						
		GLS51010	Telugu						
		GLS51011	French						
		GLS51012	German						
		GLS51013	Spanish						
		GLS51014	Korean						
		GLS51015	Mandarin						
		GLS51016	Japanese						
		OR							
		GGE51001	Universal Human Values						
9	MC	********	Mandatory Course #1 Mandatory Course I is a Non-credit course (Student shall select one course from the list given under Mandatory Course I)	3	0	0	*	2	3
			Total	**18**	**0**	**15**	**22**	**19**	**33**

 # Students should choose Level I and Level II of same outreach course in the semester 1 and 2 respectively.

*** Non-Credit Course**

SEMESTER – III									
S NO	**COURSE CATEGORY**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	BS	EMA51003	Partial Differential Equations and Transforms	3	1	0	4	2	4
2	HS	GLS51003	Advanced Academic Writing	1	0	1	1	1	2
3	PC	EBT51002	Biochemistry in Metabolism	3	0	2	4	2	5
4	PC	EBT51003	General Microbiology	2	0	2	3	2	4
5	PC	EBT51004	Protein Engineering	2	1	0	3	2	4
6	DE	EBT51XXX	DE – 1	2	0	2	3	2	3

7	EEC	EBT51800	Design Project – 1	0	0	2	1	6	2
8	ES	GGE51003	Environmental Science and Sustainable Development	2	0	0	2	2	2
9	EEC	EBT51801	Internship -1# (To be carried out in summer after 2nd semester and evaluated in 3rd semester)	#			1	2	0
10	MC	********	Mandatory Course #2 | Mandatory Course I is a Non-credit course (Student shall select one course from the list given under Mandatory Course I)	3	0	0	*	2	3
		Total		**18**	**2**	**9**	**22**	**23**	**29**
SEMESTER – IV									
S NO	**COURSE CATEGORY**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	BS	EMA51009	Numerical Methods	3	1	0	4	2	4
2	HS	GLS51004	Professional Editing and Project Writing	1	0	1	1	1	2
3	PC	EBT51005	Molecular Biology	3	0	2	4	2	5
4	PC	EBT51006	Chemical Process Heat Transfer	2	1	0	3	2	3
5	PC	EBT51007	Bioinformatics (Industry Collaborated Course)	2	0	2	3	2	4
6	DE	EBT51XXX	DE 2	2	0	2	3	2	4
7	NE	EBT51XXX	NE 1	2	0	2	3	2	4
8	EEC	EBT51802	Design Project – 2	0	0	2	1	6	2
9	MC	********	Mandatory Course #3 Mandatory Course I is a Non-credit course (Student shall select one course from the list given under Mandatory Course I)	3	0	0	*	2	3
		Total		**18**	**2**	**11**	**22**	**21**	**31**

* Non-Credit Course # No Hours for L-T-P

SEMESTER- V									
SL. NO	**COURSE**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	HS	GLS51005	Public Speaking	1	0	1	1	1	2
2	PC	EBT51008	Recombinant DNA Technology	3	0	2	4	2	5
3	PC	EBT51009	Chemical Reaction Engineering	2	1	0	3	2	3
4	PC	EBT51010	Mass Transfer	2	0	2	3	2	4
5	DE	EBT51XXX	DE 3	2	0	2	3	2	4
6	NE	E**51XXX	NE 2	2	0	2	3	2	4
7	EEC	EBT51803	Design Project – 3	0	0	2	1	6	2
8	ES	EGE51004	Entrepreneurship	2	0	0	2	6	2
9	EEC	EBT51804	Internship-2 (to be evaluated in 5th semester. To be carried out in summer after 4th semester)	#			1	0	0
			Total	**14**	**1**	**11**	**21**	**23**	**26**

SEMESTER- VI									
SL. NO	**COURSE**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	HS	GLS51006	English for Competitive Examinations	1	0	1	1	1	2
2	PC	EBT51011	Plant Biotechnology	3	0	2	4	2	5
3	PC	EBT51012	Metabolic Engineering	2	1	0	3	2	3
4	PC	EBT51013	Animal Biotechnology	2	0	2	3	2	4
5	DE	EBT51XXX	DE 4	2	0	2	3	2	4
6	NE	EBT51XXX	NE 3	2	0	2	3	2	4
7	PC	EBT51014	Bioreactor Design and Development	2	0	2	3	6	4
8	EEC	EBT51805	Design Project – 4	0	0	2	1	6	2
			Total	**14**	**1**	**13**	**21**	**23**	**28**

No hours for L-T-P

SEMESTER – VII									
S NO	**COURSE CATEGORY**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	HS	GLS51007	Verbal Reasoning and Interview Skills	1	0	1	1	1	2
2	PC	EBT51015	Immunology	3	0	2	4	2	5
3	PC	EBT51016	Industrial Biotechnology	2	1	0	3	2	3
4	PC	EBT51017	Bioprocess Engineering	2	0	2	3	2	4
5	DE	EBT51XXX	DE 5	2	0	2	3	2	4
6	NE	EBT51XXX	NE 4	2	0	2	3	2	4
7	ES	EGE51005	Research Methodology & IPR	2	0	0	2	2	2
8	EEC	EBT51806	Project Phase 1	0	0	6	3	6	6
Total				**14**	**1**	**15**	**22**	**19**	**30**
SEMESTER – VIII									
S NO	**COURSE CATEGORY**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	EEC	EBT51807	Project Phase 2	0	0	26	13	10	26
Total				**0**	**0**	**26**	**13**	**10**	**26**
Total Credits for the Program							**165**		

CREDIT COUNT

Semester	Credit Count
1	22
2	22
3	22
4	22
5	21
6	21
7	22
8	13
	165

LIST OF DEPARTMENTAL ELECTIVES									
THIRD SEMESTER									
S NO	**COURSE CATEGORY**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	DE	EBT51500	Essence of Biotechnology	2	0	2	3	2	4
2	DE	EBT51501	Enzyme Engineering and Technology	2	0	2	3	2	4
3	DE	EBT51502	Biotechnology and Biochemical Engineering	2	0	2	3	2	4
4	DE	EBT51503	Instrumental Analysis for Biotechnologists	2	0	2	3	2	4
5	DE	EBT51504	Stem Cells in Health Care	2	0	2	3	2	4
6	DE	EBT51505	Principles of nanotechnology	2	0	2	3	2	4
FOURTH SEMESTER									
S NO	**COURSE CATEGORY**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	DE	EBT51506	Food Biotechnology	2	0	2	3	2	4
2	DE	EBT51507	Proteomics	2	0	2	3	2	4
3	DE	EBT51508	Scale Up Methods	2	0	2	3	2	4
4	DE	EBT51509	Waste to Energy Conversion	2	0	2	3	2	4
5	DE	EBT51510	Genetic Engineering	2	0	2	3	2	4
6	DE	EBT51511	Bio separation Technology	2	0	2	3	2	4
FIFTH SEMESTER									
S NO	**COURSE CATEGORY**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	DE	EBT51512	Human Genomics	2	0	2	3	2	4
2	DE	EBT51513	Structural Biology	2	0	2	3	2	4
3	DE	EBT51514	Patenting in Biotechnology	2	0	2	3	2	4
4	DE	EBT51515	Genes and the Human Condition	2	0	2	3	2	4
5	DE	EBT51516	Regenerative Medicine	2	0	2	3	2	4
6	DE	EBT51517	Bio-nanotechnology	2	0	2	3	2	4
SIXTH SEMESTER									
S NO	**COURSE CATEGORY**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	DE	EBT51518	Vaccine Biotechnology	2	0	2	3	2	4
2	DE	EBT51519	Molecular Modeling and Drug Design	2	0	2	3	2	4
3	DE	EBT51520	Pharmaceutical innovations and Herbal Medicine	2	0	2	3	2	4

4	DE	EBT51521	Pulp and Paper Technology	2	0	2	3	2	4
5	DE	EBT51522	Clinical Research	2	0	2	3	2	4
6	DE	EBT51523	Environmental Biotechnology	2	0	2	3	2	4
SEVENTH SEMESTER									
S NO	**COURSE CATEGORY**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TC H**
1	DE	EBT51524	Bioethics, IPR and Patents	2	0	2	3	2	4
2	DE	EBT51525	Biopharmaceutical Technology	2	0	2	3	2	4
3	DE	EBT51526	Occupational Safety and Health in Bioengineering	2	0	2	3	2	4
4	DE	EBT51527	Bioinstrumentation	2	0	2	3	2	4
5	DE	EBT51528	Animal Therapeutics	2	1	0	3	2	3
6	DE	EBT51529	Marine Biotechnology	2	1	0	3	2	3

NDE - OFFERED BY DEPARTMENT OF BIOTECHNOLOGY									
FOURTH SEMESTER									
S. NO	**COURSE CATEGORY**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	NE	EBT51700	Environment Health & Safety (EHS)	2	0	2	3	2	4
2	NE	EBT51701	Water Science and Engineering	2	0	2	3	2	4
FIFTH SEMESTER									
S NO	**COURSE CATEGORY**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	NE	EBT51702	Food Processing	2	0	2	3	2	4
2	NE	EBT51703	Biomaterials and their Applications	2	0	2	3	2	4
SIXTH SEMESTER									
S NO	**COURSE CATEGORY**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	NE	EBT51704	Biotechnology in Alternate energy Resources	2	0	2	3	2	4
2	NE	EBT51705	Health care industry	2	0	2	3	2	4
SEVENTH SEMESTER									
S NO	**COURSE CATEGORY**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	NE	EBT51706	Bio entrepreneurship	2	0	2	3	2	4
2	NE	EBT51707	Biotechnology In Defense	2	0	2	3	2	4

Departmental Elective Courses: Verticals
COURSE FLOW DIAGRAM

SEM	COURSE CATEGORY	MOLECULAR ENGINEERING	BIO PROCESS ENGINEERING	MEDICAL BIO TECHNOLOGY
3	Department Elective 1	Essence of Biotechnology	Biotechnology and Biochemical Engineering	Stem Cells in Health Care
		Enzyme Engineering and Technology	Instrumental Analysis for Biotechnologists	Principles of nanotechnology
4	Department Elective 2	Food Biotechnology	Scale Up Methods	Genetic Engineering
		Proteomics	Waste to Energy Conversion	Bio separation Technology
5	Department Elective 3	Human Genomics	Patenting in Biotechnology	Regenerative Medicine
		Structural Biology	Genes and the Human Condition	Bio-nanotechnology
6	Department Elective 4	Vaccine Biotechnology	Pharmaceutical innovations and Herbal Medicine	Clinical Research
		Molecular Modeling and Drug Design	Pulp and Paper Technology	Environmental Biotechnology
7	Department Elective 5	Bioethics, IPR and Patents	Occupational Safety and Health in Bioengineering	Animal Therapeutics
		Biopharmaceutical Technology	Bioinstrumentation	Marine Biotechnology