NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA, GAUTAM BUDDH NAGAR

(An Autonomous Institute)

Affiliated to

DR. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY, UTTAR PRADESH LUCKNOW

Evaluation Scheme & Syllabus

For

B.Tech in Biotechnology (BT)

Fourth Year

(Effective from the Session: 2026-27)

NOIDA INSTITUTE OF ENGINEERING & TECHNOLOGY, GREATER NOIDA
(An Autonomous Institute)

B. TECH (BT)
Evaluation Scheme
SEMESTER VII

Sl. No.	Subject Codes	Subject Name	Types of Subjects	Periods			Evaluation Schemes				Semester		Total	Credit
				L	T	P	CT	TA	TOTAL	PS	TE	PE		
1	BBT0701	Gene Expression and Transgenic	Mandatory	3	0	0	30	20	50		100		150	3
2		Departmental Elective V	Departmental Elective	3	0	0	30	20	50		100		150	3
3		Open Elective II	Open Elective	3	0	0	30	20	50		100		150	3
4		Open elective III	Open Elective	3	0	0	30	20	50		100		150	3
5	BBT0751	Gene Expression and Transgenic Lab	Mandatory	0	0	2				25		25	50	1
6	BBT0759	Summer Internship Assessment	Mandatory	0	0	2				50			50	1
7	BBT0758	Capstone Project-I	Mandatory	0	0	4				50		50	100	2
		*Massive Open Online Courses (For B.Tech. Hons.Degree)	*MOOCs											
		TOTAL		**12**	**0**	**8**			**200**	**125**	**400**	**75**	**800**	**16**

*** List of Recommended MOOCs (Massive Open Online Courses) for Final Year B. Tech Students (Semester-VII)**

S. No.	Subject Code	Course Name	University/ Industry Partner Name	N. of Hours	Credits
1	BMC0023	Internet of Things 201	Infosys Wingspan (Infosys Springboard)	15h 59m	1
2	BMC0082	Introduction to AI & ML	Infosys Wingspan (Infosys Springboard)	64 h 13 min	4

List of Department Elective (if any):-

S. No.	Subject Code	Subject Name	Bucket Name	Branch	Semester
1	BBT0711	Waste management and Upscaling	Bioprocess	BT	7
2	BBT0712	Application of Machine learning in Biotechnology	Computational	BT	7

PLEASE NOTE: -
Internship (3-4 weeks) shall be conducted during summer break after semester-VI and will be assessed during Semester-VII

Abbreviation Used:

L: Lecture, T: Tutorial, P: Practical, CT: Class Test, TA: Teacher Assessment, PS: Practical Sessional, TE: Theory End Semester Exam., PE: Practical End Semester Exam, CE: Core Elective, OE: Open Elective, DE: Departmental Elective, CA: Compulsory Audit, MOOCs: Massive Open Online Courses.

NOIDA INSTITUTE OF ENGINEERING & TECHNOLOGY, GREATER NOIDA
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B. TECH (BT)
Evaluation Scheme
SEMESTER VIII

Sl. No.	Subject Codes	Subject Name	Types of Subjects	Periods			Evaluation Schemes				End Semester		Total	Credit
				L	T	P	CT	TA	TOTAL	PS	TE	PE		
1		Open Elective - IV	Open Elective	2	0	0	30	20	50		50		100	2
2	BBT0858/ BBT0859	Capstone Project-II / Industrial Internship	Mandatory	0	0	16				200		200	400	8
3		*MOOCs Courses (For B.Tech. Hons. Degree)	*MOOCs											
		TOTAL		**2**	**0**	**16**			**50**	**200**	**50**	**200**	**500**	**10**

*** List of Recommended MOOCs (Massive Open Online Courses) for Final Year B. Tech Students (Semester-VII)**

S. No.	Subject Code	Course Name	University/ Industry Partner Name	N. of H	Credits
1	BMC0073	Cyber Security and Applied Ethical Hacking	IIHT	12h 59m	1
2	BMC0121	Introduction to Data Preprocessing	Infosys Wingspan (Infosys Springboard)	16h	1

Abbreviation Used:

L: Lecture, T: Tutorial, P: Practical, CT: Class Test, TA: Teacher Assessment, PS: Practical Sessional, TE: Theory End Semester Exam., PE: Practical End Semester Exam, CE: Core Elective, OE: Open Elective, DE: Departmental Elective, CA: Compulsory Audit, MOOCs: Massive Open Online Courses.

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AICTE Guidelines in Model Curriculum:

A student will be eligible to get Under Graduate degree with Honours only, if he/she completes the additional MOOCs courses such as Infosys Springboard/NASSCOM/CISCO (as applicable) certifications, or any other online courses recommended by the Institute (Equivalent to 20 credits). During Complete B.Tech. Program Guidelines for credit calculations are as follows.

1. For 6 to 12 Hours =0.5 Credit
2. For 13 to18 =1 Credit
3. For 19 to 24 =1.5 Credit
4. For 25 to 30 =2 Credit
5. For 31 to 35 =2.5 Credit
6. For 36 to 41 =3 Credit
7. For 42 to 47 =3.5 Credit
8. For 48 and above =4 Credit

For registration to MOOCs Courses, the students shall follow Infosys Springboard/NASSCOM/CISCO (as applicable) registration details as per the assigned login and password by the Institute these courses may be cleared during the B. Tech degree program (as per the list provided). After successful completion of these MOOCs courses, the students shall provide their successful completion status/certificates to the Controller of Examination (COE) of the Institute through their coordinators/Mentors only.

The students shall be awarded Honours Degree as per following criterion.

i. If he / she secures 7.50 as above CGPA.
ii. Passed each subject of that degree program in the single attempt without any grace.
iii. Successful completion of MOOCs based 20 credits

Subject Code: BBT0701	Subject Name: Gene Expression and Transgenic	L	T	P	C
		3	0	0	3

Applicable in Department: Biotechnology

Pre-requisite: Genetics and Molecular biology, r-DNA technology, and Tissue Culture techniques

Course Objective:

Understand recombinant protein expression and promoters, over-express integral membrane proteins, learn plant single cell expression, and use transgenic animals in research. Design and optimize protein expression systems and understand ethical considerations.

Course Outcomes (CO)

Course outcome: After completion of this course students will be able to:		Bloom's Level
CO1	Understand the various type of protein vector and their application	K2
CO2	Analyze the protein expression in bacteria	K4
CO3	Identify and compare the process of protein purification	K4
CO4	Correlate the development of transgenic animals	K4
CO5	Appraise the application of transgenic animals	K4

Syllabus

Unit 1	Recombinant Protein Expression Vectors and Promoters	10 Hrs

Overview of recombinant protein expression vectors and promoters: Vectors with tags His, GST, MBP, GFP. Cleavable tag and non-cleavable tags. Vectors for tag free protein expressions

Unit 2	Overexpression of Integral Membrane Proteins in Various Expression Systems	8 Hrs

Over-expression of integral membrane proteins. Overexpression in E. coli, B. subtilis, Corynebacterium, Pseudomonas fluorescens, yeasts like S. cerevisiae and Pichia pastoris, insect cell lines like Sf21, Sf9 and BTI-TN- 5B1-4, Mammalian cell line like Chinese Hamster ovary (CHO) and Human embryonic kidney (HEK).

Unit 3	Single Cell Protein Expression and Cell-Free Protein Expression	8 Hrs

Plant single cell. Chloroplast transformation and protein expression in chloroplasts. Cell free protein Expression-Cell free extracts from E. coli, rabbit, wheat germ, and insects. Purification of tagged and tag-free proteins. GMP and GLP requirements.

Unit 4	Transgenic Animals: Creation, Safety, and Ethics	9 Hrs

Use of transgenic animals. History, safety and ethics of transgenic animals. Methods for creation of transgenic animals-DNA microinjection, Embryonic stem cell-mediated gene transfer, Retrovirus-mediated gene transfer.		
Unit 5	**Applications of Transgenic Animals in Medical Research and Various Industries**	**10 Hrs**
Use transgenic animals in medical research, in toxicology, in mammalian developmental genetics, in molecular biology in the pharmaceutical industry, in biotechnology, in aquaculture and in xenografting. Humanised animal model.		
	Total	**45 Hrs**

Textbooks

Sr No	**Book Details**
1	Gene Expression Systems, Using Nature for the Art of Expression. Edited by Joseph M. Fernandez and James P. Hoeffler.
2	Regulation of Gene Expression, By Perdew, Gary H., VandenHeuvel, Jack P., Peters, Jeffrey M. Springer.
3	Prokaryotic Gene Expression. Edited by Simon Baumberg. Oxford Press

Reference Books

Sr No	**Book Details**
1.	Transgenic Animal Technology,3rd Edition, A Laboratory Handbook by Carl Pinkert. Elsevier.
2.	Ethical Use of Transgenic Animals (English, Paperback, Shah Krunal V). Lambert
3.	Transgenic Animals as Model Systems for Human Diseases. Edited E. F. Wagner F. Theuring. Springer.

Self-Study Content Links:		**Duration (in Hrs)**
MOOCs	https://nptel.ac.in/courses/104108056 https://nptel.ac.in/courses/102103041	36-48 Hrs 36-48 Hrs
Video Lectures		
Web References		

Subject Code: BBT0711	Subject Name: Waste Management and Upscaling	L	T	P	C
		3	0	0	3
Applicable in Department: Biotechnology					
Pre-requisite: Basic knowledge of pollutants and its sources					

Course Objective:

The course will provide technical details about the sources of waste technologies used for waste treatment and the disposal systems. The course will discuss various health considerations, advances in waste recycling and their transformation to value added products along with the upscaling of these waste treatment processes.

Course Outcomes (CO)

Course outcome: After completion of this course students will be able to:		Bloom's Level
CO1	Identify various sources of waste, their segregation, management, and disposal systems.	K2
CO2	Understand various technologies for waste treatment.	K2
CO3	Illustrate the health considerations and implement the advances in waste recycling	K3
CO4	Analyze the waste and resource management and perform the life cycle analysis	K4
CO5	Evaluate water up and down cycling and experimenting technologies for sustainable waste management.	K5

Syllabus

Unit 1	**Sources of waste, it's management, treatment and disposal systems**	**10 Hrs**

Waste management: The definition of waste, and its classification in the context of EU legislation, policy and other drivers for change, including the planning and permitting regime for the delivery of waste management solutions

Liquid waste collection, treatment and disposal systems: Segregation and mixing schemes; Pre- treatment and its role in the industrial wastewater management; Overview of wastewater treatment technologies and development of wastewater treatment schemes; Operation and maintenance of effluent treatment plants; and Case study of an industrial wastewater management system.

Air Pollution management and treatment: Overview of industrial emissions; Air pollution control

systems and overview of air pollution control technologies; Development of schemes for the collection, treatment and discharge industrial emissions.		
Unit 2	**Technologies for Waste treatment technologies**	**10 Hrs**
Waste incineration and energy from waste, pyrolysis and gasification, anaerobic digestion, composting and mechanical biological treatment of wastes, managing biomedical waste.		
Unit 3	**Health considerations and advances in waste recycling**	**9 Hrs**
Health considerations in the context of operation of facilities, handling of materials and impact of outputs on the environment; Advances in waste recycling and recovery technologies to deliver added value products; Landfill engineering and the management of landfill leachate and the mining of old landfills.		
Unit 4	**Waste and resource management**	**9 Hrs**
Interface of waste and resource management and civil engineering in the context of sustainable waste management in global cities and developing countries; and Use of decision support tools including multi-criteria analysis, carbon foot-printing and lifecycle analysis, as appropriate.		
Unit 5	**Upscaling and sustainable waste management**	**9 Hrs**
Waster Upcycling, waste reuse, Waste down cycling, waste upcycling a social enterprise, Case study in each area. Innovative technologies for sustainable waste management.		
	Total	**45 Hrs**

Textbooks

Sr No	Book Details
1	O.P. Gupta, “Elements of Solid & Hazardous Waste Management”, Khanna Publishing House, New Delhi, 2019.
2	George Tchobanoglous et.al., “Integrated Solid Waste Management”, McGraw-Hill Publishers, 1993.
3	B.Bilitewski, G.HardHe, K.Marek, A.Weissbach, and H.Boeddicker, “Waste Management”, Springer, 1994

Reference Books

Sr No	Book Details

1.	"Assessment of Wastewater Management, Treatment Technology, and Associated Costs for Abatement of PCBs Concentrations in Industrial Effluents Task 2" by U S Environmental Protection Agency	
2.	"Effluent Treatment Techniques (Technical Guidance Note (Abatement))" by European Environment Agency	
3.	"Advances in Water Treatment and Pollution Prevention" by Sanjay K Sharma and Rashmi Sanghi	
Self-Study Content Links:		**Duration (in Hrs)**
MOOCs	https://nptel.ac.in/courses/105103205 https://nptel.ac.in/courses/105106056	**36-48 Hrs** **36-48 Hrs**
Video Lectures		
Web References	https://www.youtube.com/watch?v=_dTtvtlct9k https://www.youtube.com/watch?v=IGPEP9EZU3Y https://www.youtube.com/watch?v=3N2JDdclECM https://www.youtube.com/watch?v=8HAZazFRdX4 https://www.youtube.com/watch?v=6QMMkyuO0PU	

Subject Code: BBT0712	Subject Name: Application of Machine Learning in Biotechnology	L	T	P
		3	0	0

Applicable in Department: Biotechnology

Pre-requisite: Basic understanding of data analysis and machine learning algorithms

Course Objective:

Students will be able to identifying the application of machine learning in Biotechnology, Bioinformatics, health care and environmental bioengineering and understand the challenges associated with Machine Learning

Course Outcomes (CO)

Course outcome: After completion of this course students will be able to:		Bloom's Level
CO1	Understand the application of ML in Biotechnology	K2
CO2	Understand the implementation of ML in Bioinformatics	K2
CO3	Understand the implementation of ML in Healthcare and disease diagnostics.	K2
CO4	Understand the implementation of ML in Environment Bioengineering	K2
CO5	Learn about the various challenges in ML applications.	K1

Syllabus

Unit 1	ML in Biotechnology	10 Hrs

Drug discovery and development, Disease diagnosis and prognosis, Precision medicine, Potential impact of machine learning on biotechnology research and industry

Unit 2	ML in Bioinformatics	9 Hrs

Sequence analysis (DNA, RNA, protein), Gene expression analysis, Proteomics and metabolomics analysis, Systems biology, Network analysis, Structural biology

Unit 3	ML in Healthcare	8 Hrs

Predictive modeling for diagnosis and prognosis, Personalized medicine, Clinical decision support, Patient monitoring and early warning systems, Healthcare resource allocation and management

Unit 4	**ML in Environmental Bioengineering**	**9 Hrs**
Environmental modeling and prediction, Water and air quality monitoring and management, Contaminant detection and remediation, Waste management and resource recovery, Sustainable energy systems.		
Unit 5	**Challenges and Perspectives of ML**	**9 Hrs**
Challenges associated with ML algorithms, Future perspectives, Hybrid modeling		
	Total	**45 Hrs**

Textbooks	
Sr No	Book Details
1	"Machine Learning for Bioinformatics" by Xindong Wu and Vipin Kumar

Reference Books	
Sr No	Book Details
1.	Ethem Alpaydin, ―Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series)‖, Third Edition, MIT Press, 2014
2.	Rajiv Chopra, - Machine Learning‖, Khanna Book Publishing Co. 2019
3.	Artificial Intelligence in Biotechnology, book by Preethi Kartan, Publisher: Arcler Education Incorporated, 2020

Self-Study Content Links:		**Duration (in Hrs)**
MOOCs	https://nptel.ac.in/courses/106106198 https://www.nptel.ac.in/courses/106105152	**36-48 Hrs** **36-48 Hrs**
Video Lectures		
Web References	https://www.youtube.com/shorts/5_heGtEJEWI https://www.youtube.com/shorts/4Qdh9c2tfrw	

	https://www.youtube.com/watch?v=j6EB9HO6acE https://www.youtube.com/watch?v=MtpxOdtS9KU&list=PL3qvHcrYGy1u2egw2tipHWODV6elVC2Gg https://www.youtube.com/watch?v=pWTxyhblC68	

Subject Code: BBT0751	Subject Name: Gene Expression and Transgenic Lab	L	T	P	C
		0	0	2	1

Applicable in Department: Biotechnology

Pre-requisite: Basics of Genetics and Molecular biology

Course Objective:

To impart practical skills in gene expression analysis and genetic transformation techniques for the development and evaluation of transgenic organisms.

Course Outcomes (CO)

Course outcome: After completion of this course students will be able to:		Bloom's Level
CO1	Apply recombinant DNA techniques including restriction digestion and ligation to construct and manipulate DNA molecules.	K3
CO2	Integrate protein analysis techniques such as SDS-PAGE and Western blotting for protein separation, visualization, and detection	K4
CO3	Analyze and evaluate molecular biology techniques for RNA and DNA isolation and analysis	K5

List of Practical

Sr No	Practical Title	CO Mapping
1.	Isolation of total RNA from the given sample.	CO3
2.	Qualitative estimation of RNA using formaldehyde agarose gel electrophoresis of RNA	CO3
3.	To quantify the amount of RNA extracted from the sample using a spectrophotometer, and to calculate the concentration and purity of the RNA.	CO3
4.	Isolation of plasmid from *E. coli* cells	CO3
5.	Qualitative and Quantitative analysis of DNA	CO3
6.	Restriction digestion and Ligation of DNA.	CO1
7.	To separate the expressed protein products by SDS-PAGE.	CO2
8.	To detect the protein of interest using Western blotting.	CO2

9.	Agrobacterium mediated gene transfer in plant system.	CO1
10.	Cloning of gene in bacterial system.	CO1
		Total H: 30 Hrs