NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA, G.B. NAGAR
(AN AUTONOMOUS INSTITUTE)

Affiliated to

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

Evaluation Scheme & Syllabus

For

Bachelor of Technology

Biotechnology (BT)

Fourth Year

(Effective from the Session: 2023-24)

NOIDA INSTITUTE OF ENGINEERING & TECHNOLOGY, GREATER NOIDA
(AN AUTONOMOUS INSTITUTE)

Bachelor of Technology
Biotechnology
Evaluation Scheme
SEMESTER VII

Sl. No.	Subject Codes	Subject Name	Periods			Evaluation Schemes				End Semester		Total	Credit
			L	T	P	CT	TA	TOTAL	PS	TE	PE		
WEEKS COMPULSORY INDUCTION PROGRAM													
1	ABT0701	Gene Expression and Transgenic	3	0	0	30	20	50		100		150	3
2		Departmental Elective V	3	0	0	30	20	50		100		150	3
3		Open Elective II	3	0	0	30	20	50		100		150	3
4		Open elective III	3	0	0	30	20	50		100		150	3
5	ABT0751	Gene Expression and Transgenic Lab- I	0	0	2				25		25	50	1
6	ABT0759	Internship Assessment	0	0	2				50			50	1
7		MOOCs (Essential for Hons. Degree)											
		TOTAL										**700**	**14**

List of MOOCs Based Recommended Courses for fourth year B. Tech Students

S. No.	Subject Code	Course Name	University/ Industry Partner Name	N. of Hours	Credits
1.	AMC0159	Excel Basics for Data Analysis	IBM	11	0.5
2.	AMC0022	Data Analysis with Python	IBM	14	1

PLEASE NOTE:-

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

List of Department Elective (if any):-

S.No.	Subject Code	Subject Name	Branch	Semester
1	ABT0711	Waste management and Upscaling	BT	7
2	ABT0712	Application of Machine learning in Biotechnology	BT	7

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.

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Bachelor of Technology
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Evaluation Scheme
SEMESTER - VIII

Sl. No.	Subject Codes	Subject Name	Periods			Evaluation Schemes				End Semester		Total	Credit
			L	T	P	CT	TA	TOTAL	PS	TE	PE		
1		Open Elective-IV	2	0	0	30	20	50		100		150	2
2	ABT0859	Capstone Project/ Industrial Internship	0	0	20				200		300	500	10
3		MOOCs (For B.Tech. Hons. Degree)											
		TOTAL										**650**	**12**

List of MOOCs (Coursera) Based Recommended Courses for Fourth Year (Semester-VIII) B. Tech Students

S. No.	Subject Code	Course Name	University/ Industry Partner Name	N. of Hours	Credits
1.	AMC0201	Understanding and visualizing data with Python	University of Michigan	18	1
2.	AMC0186	Exploratory Data Analysis with MATLAB	Mathworks	19	1.5

Abbreviation Used: -

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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 Coursera 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 Coursera 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.

B.TECH FOURTH YEAR			
Course Code	**ABT0701**	**L T P**	**Credit**
Course Title	**Gene Expression and Transgenic**	**3 0 0**	**3**

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.

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

Course Contents / Syllabus

UNIT-I	**Recombinant Protein Expression Vectors and Promoters**	**8 hours**

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-II	**Overexpression of Integral Membrane Proteins in Various Expression Systems**	**8 hours**

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-III	**Single Cell Protein Expression and Cell-Free Protein Expression**	**8 hours**

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

UNIT-IV	**Transgenic Animals: Creation, Safety, and Ethics**	**8 hours**

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-V	**Applications of Transgenic Animals in Medical Research and Various Industries**	**8 hours**

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.

Course outcome: After completion of this course students will be able to

CO 1	Understand the various type of protein vector and their application	K2
CO 2	Analyze the protein expression in bacteria	K4
CO 3	Identify and compare the process of protein purification	K1 K2
CO 4	Correlate the development of transgenic animals	K4, K6
CO 5	Appraise the application of transgenic animals	K5

Text books

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:	
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.	
Link:	
Unit 1	https://www.youtube.com/watch?v=BrZTmnDy4zQ
Unit 2	https://www.youtube.com/watch?v=c7fRYDlqqco
Unit 3	https://www.youtube.com/watch?v=gXjaeZ2pIM0
Unit 4	https://www.youtube.com/watch?v=Fu9tX0RzCN4
Unit 5	https://www.youtube.com/watch?v=5S90Vy44cac

B.TECH FOURTH YEAR			
Course Code	**ABT0711**	**L T P**	**Credit**
Course Title	**Waste Management and Upscaling**	**3 0 0**	**3**

Course objective: Basic knowledge of pollutants and its sources

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.	K1, K2, K3, K4, K5

Pre-requisites: Students should know about the basic environmental technology.

Course Contents / Syllabus

UNIT-I	**Sources of waste, it's management, treatment and disposal systems**	**10 hours**

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-II	**Technologies for Waste treatment technologies**	**8 hours**

Waste incineration and energy from waste, pyrolysis and gasification, anaerobic digestion, composting and mechanical biological treatment of wastes, managing biomedical waste.

UNIT-III	**Health considerations and advances in waste recycling**	**8 hours**

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-IV	**Waste and resource management**	**8 hours**

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-V	**Upscaling and sustainable waste management**	**6 hours**

Waster Upcycling, waste reuse, Waste down cycling, waste upcycling a social enterprise, Case study in each area. Innovative technologies for sustainable waste management.

Course outcome: After completion of this course students will be able to

CO 1	Identify various sources of waste, their segregation, management, and disposal systems.	K1

CO 2	Comprehend various technologies for waste treatment.	K2
CO 3	Illustrate the health considerations and implement the advances in waste recycling and apply the knowledge on the landfill engineering.	K3
CO 4	Analyze the waste and resource management and perform the life cycle analysis	K4
CO 5	Evaluate water up and down cycling and experimenting technologies for sustainable waste management.	K5

Text books

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:

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

Link:

Unit 1	https://www.youtube.com/watch?v=_dTtvtlct9k
Unit 2	https://www.youtube.com/watch?v=IGPEP9EZU3Y
Unit 3	https://www.youtube.com/watch?v=3N2JDdclECM
Unit 4	https://www.youtube.com/watch?v=8HAZazFRdX4
Unit 5	https://www.youtube.com/watch?v=6QMMkyuO0PU

B.TECH FOURTH YEAR			
Course Code	**ABT0712**	**L T P**	**Credit**
Course Title	**Applying Machine Learning in Biotechnology**	**3 0 0**	**3**

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	K1,K2,K3

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

Course Contents / Syllabus

UNIT -I	**ML in Biotechnology**	**8 hours**
Drug discovery and development, Disease diagnosis and prognosis, Precision medicine, Potential impact of machine learning on biotechnology research and industry		
UNIT -II	**ML in Bioinformatics**	**8 hours**
Sequence analysis (DNA, RNA, protein), Gene expression analysis, Proteomics and metabolomics analysis, Systems biology, Network analysis, Structural biology		
UNIT -III	**ML in Healthcare**	**8 hours**
Predictive modeling for diagnosis and prognosis, Personalized medicine, Clinical decision support, Patient monitoring and early warning systems, Healthcare resource allocation and management		
UNIT -IV	**ML in Environmental Bioengineering**	**8 hours**
Environmental modeling and prediction, Water and air quality monitoring and management, Contaminant detection and remediation, Waste management and resource recovery, Sustainable energy systems		
UNIT -V	**Challenges and Perspectives of ML**	**8 hours**
Challenges associated with ML algorithms, Future perspectives, Hybrid modeling		

Course outcome: After completion of this course students will be able to

CO 1	Understand the application of ML in Biotechnology	K1
CO 2	Understand the implementation of ML in Bioinformatics	K2
CO 3	Understand the implementation of ML in Healthcare and disease diagnostics.	K2
CO 4	Understand the implementation of ML in Environment Bioengineering	K3
CO 5	Learn about the various challenges in ML applications	K3

Text books

Reference Books:

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
Link:

Unit 1	
Unit 2	
Unit 3	
Unit 4	
Unit 5	

B.TECH FOURTH YEAR			
Course Code	**ABT0751**	**LTP**	**Credit**
Course Title	**Gene Expression and Transgenic Lab**	**0 0 2**	1

List of Experiments

Sr. No.	**Name of Experiment**	CO
1	Isolation of total RNA from the given sample.	CO1
2	Qualitative estimation of RNA using formaldehyde agarose gel electrophoresis of RNA	CO1
3	To quantify the amount of RNA extracted from the sample using a spectrophotometer, and to calculate the concentration and purity of the RNA.	CO2
4	Isolation of plasmid from E. coli cells	CO1
5	Qualitative and Quantitative analysis of DNA	CO1
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.	CO3
10	Cloning of gene in bacterial system.	CO3

Lab Course Outcome:

CO 1	Analyze and evaluate molecular biology techniques for RNA and DNA isolation and analysis.	K3, K4
CO 2	Integrate protein analysis techniques such as SDS-PAGE and Western blotting for protein separation, visualization, and detection.	K3, K4
CO 3	Analyze the gene transfer method in plant system as well as cloning of gene in bacterial system.	K3, K4