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

(AN AUTONOMOUS INSTITUTE)

NIET
Greater Noida
Estd.2001
Get Future Ready
Autonomous Institute

Affiliated to

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

Evaluation Scheme & Syllabus

For

Bachelor of Technology

Biotechnology

Second Year

(Effective from the Session: 2024-25)

Noida Institute of Engineering and Technology, Greater Noida
(An Autonomous Institute)
Bachelor of Technology
Biotechnology
EVALUATION SCHEME
SEMESTER-III

Sl. No.	Subject Codes	Subject	Types of Subjects	Periods			Evaluation Schemes				End Semester		Total	Credit
				L	T	P	CT	TA	TOTAL	PS	TE	PE		
1	BBT0304	Biophysics and Bioinstrumentation	Mandatory	3	1	0	30	20	50		100		150	4
2	BBT0301	Biochemistry	Mandatory	3	1	0	30	20	50		100		150	4
3	BBT0302	Microbiology	Mandatory	3	0	0	30	20	50		100		150	3
4	BBT0303	Genetics and Molecular Biology	Mandatory	3	0	0	30	20	50		100		150	3
5	BBT0306	Plant and Animal Science	Mandatory	3	0	0	30	20	50		100		150	3
6	BBT0355	Bioinformatics	Mandatory	0	0	6				50		100	150	3
7	BBT0352	Biochemistry & Microbiology Lab	Mandatory	0	0	4				50		50	100	2
8	BBT0353	Genetics & Molecular Biology Lab	Mandatory	0	0	2				25		25	50	1
9	BBT0359	Internship Assessment	Mandatory	0	0	2				50			50	1
10	BNC0302/ BNC0301	Environmental Science/ AI & Cyber Ethics	Compulsory Audit	2	0	0	30	20	50		50		100	NA
		*Massive Open Online Courses (For B.Tech. Hons. Degree)	*MOOCs											
		TOTAL											**1100**	**24**

*** List of MOOCs Based Recommended Courses for Second year (Semester-III) B. Tech Students**

S. No.	Subject Code	Course Name	University / Industry Partner Name	No of Hours	Credits
1	BMC0035	Microsoft Excel 2016	Infosys Wingspan (Infosys Springboard)	10 h 7 m	0.5
2	BMC0009	Probability and Statistics using Python	Infosys Wingspan (Infosys Springboard)	16 h	1

PLEASE NOTE: -

- **A 3-4 weeks Internship shall be conducted during summer break after semester-II and will be assessed during semester-III**
- **Compulsory Audit (CA) Courses (Non-Credit - BNC0301/BNC0302)**
  - All Compulsory Audit Courses (a qualifying exam) do not require any credit.
  - The total and obtained marks are not added in the grand total.

Abbreviation Used:

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

Noida Institute of Engineering and Technology, Greater Noida
(An Autonomous Institute)
Bachelor of Technology
Biotechnology
EVALUATION SCHEME
SEMESTER-IV

Sl. No.	Subject Codes	Subject	Types of Subjects	Periods		Evaluation Schemes				End Semester		Total		Credit
				L	T	P	CT	TA	Total	PS	TE	PE		
1	BBT0403	Fermentation Engineering	Mandatory	3	1	0	30	20	50		100		150	4
2	BASL0401	Technical Communication	Mandatory	2	1	0	30	20	50		50		100	3
3	BBT0404	Green Biotechnology and Pollution Abetment	Mandatory	3	0	0	30	20	50		100		150	3
4	BBT0402	Immunology & Immunotechnology	Mandatory	3	0	0	30	20	50		100		150	3
5	BBT0401	Analytical Techniques	Mandatory	2	0	0	30	20	50		50		100	2
6	BBT0455	Structural and Computational Biology	Mandatory	0	0	6				50		100	150	3
7	BBT0452	Immunology & Immunotechnology Lab	Mandatory	0	0	4				50		50	100	2
8	BBT0451	Analytical Techniques Lab	Mandatory	0	0	4				50		50	100	2
9	BASL0451	Technical Communication Lab	Mandatory	0	0	2				25		25	50	1
10	BBT0459	Mini Project	Mandatory	0	0	2				50			50	1
11	BNC0401/ BNC0402	AI & Cyber Ethics/ Environmental Science	Compulsory Audit	2	0	0	30	20	50		50		100	NA
		*Massive Open Online Courses (For B.Tech. Hons. Degree)	*MOOCs											
		TOTAL											1100	24

*** List of MOOCs Based Recommended Courses for Second year (Semester-IV) B. Tech Students**

S. No.	Subject Code	Course Name	University / Industry Partner Name	No of Hours	Credits
1	BMC0036	Minitab - Data Analytics	Infosys Wingspan (Infosys Springboard)	5h 25m	0.5
2	BMC0037	Financial Modelling - Biotech Company	Infosys Wingspan (Infosys Springboard)	20h 18m	1.5

PLEASE NOTE: -

- **A 3-4 weeks Internship shall be conducted during summer break after semester-IV and will be assessed during Semester-V**
- **Compulsory Audit (CA) Courses (Non-Credit - BNC0401/BNC0402)**
  - All Compulsory Audit Courses (a qualifying exam) do not require any credit.
  - The Total and obtained marks are not added in the Grand Total.

Abbreviation Used:

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

.

NIET Greater Noida Autonomous Institute	**NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY** **GREATER NOIDA-201306** **(An Autonomous Institute)** **School of Biotechnology**

Subject Name: Biophysics and Bioinstrumentation	**L-T-P [3-1-0]**
Subject Code: BBT0304	**Applicable in Department: Biotechnology**
Pre-requisite of Subject: Students should know about the basics of biology.	
Course Objective: The course provides the students with a comprehensive understanding of the principles and techniques used in the study of biological systems at molecular and cellular levels.	

Course Outcomes (CO)

Course outcome: After completion of this course students will be able to:		**Bloom's Knowledge Level(KL)**
CO 1	Learn about the phenomena of water transport across cellular membranes.	K1
CO2	Understand the concept of electrical phenomena in excitable cells.	K1, K2
CO3	Explore the general principles of signal transduction pathways involved in a wide range of physiological processes.	K1, K2, K3
CO4	Understand the thermodynamics and kinetics of macromolecules	K1, K2
CO5	Explore the application of electrophysiological methods in cellular physiology	K1, K2, K3

Syllabus

Unit No	**Module Name**	**Topic covered**	**Pedagogy**	**Lecture Required (L+P)**	**Practical/ Assignment/ Lab Nos**	**CO Mapping**
1	**Water transport across cell membranes**	Overview of biophysics as an interdisciplinary field, Structure, function and proteins of biological membranes, Membrane transport mechanisms (diffusion, facilitated diffusion, Osmosis, active transport, tonicity, hydrostatic pressure, dialysis),	Theoretical concepts, and interactive learning	8	PBL: Demonstrations of membrane transport experiments using	CO1

		Aquaporins: Structure, function and clinical significance, Water transport in artificial membranes and biomimetic systems	activities.		models	
2	**Electrical Phenomena**	Electrically Excitable Cells and their functions, Concept of Electrical Phenomena in Excitable Cells, Membrane Potential, The Ionic Hypothesis and Rules of Ionic Electricity (Nernst Equation and Goldmann-Hodgkin-Katz Equation), Generation of Action Potential, Transmission of Nerve Impulses (Electrical Synapse and Chemical Synapse), Conduction disorders.	Theoretical concepts and interactive learning activities.	8	ABL: Problem-solving session where students calculate equilibrium potentials for different ions using the equations.	CO2
3	**Ion Channels & Transporters**	Ligands and Receptors, General Principles of signal transduction, Intracellular Receptors, Cell Surface receptors (Ion channel linked receptors, G-protein coupled receptors and Enzyme linked receptors), Ion pumping (Sodium Potassium Pump), Transport ATPase, Glucose transporter, Rhodopsin and their function in vision.	Theoretical concepts, and interactive learning activities.	8	ABL: Role-playing activity where students act as ion channels and participate in the sequential opening and closing during action potential generation.	CO3
4	**Proteins and Nucleic acids**	Hierarchical Structure of Proteins, Structure of Nucleotides, Sugar Pucker, Torsional angles in proteins and nucleic acids, Ramachandran Plot, Protein stability and folding: thermodynamics and kinetics, A B and Z DNA, The Biophysics of RNA, Functional Design of Proteins, Molecular Chaperons (Heat Shock Proteins), Characterization of secondary structure using CD spectroscopy and X-ray crystallography.	Theoretical concepts, and interactive learning activities.	10	ABL: Group discussion on the structural features and functions of each DNA form, followed by a comparison of their properties.	CO4
5	**Cell Dynamics and Electrophysiological Methods**	Molecular Motors: Actin, Myosin, Kinesin, Dynein, Intracellular movement, Cell migration: Types and mechanism, Mechanobiology and its importance in human health, Biophysics of Medical Imaging (computed tomography (CT), magnetic resonance imaging (MRI), Positron Emission Tomography (PET), Single neuron recording, patch-clamp recording, ECG, Brain activity recording	Theoretical concepts, and interactive learning activities.	10	ABL: Discuss the interpretation of ECG signals and their clinical relevance in diagnosing cardiac conditions.	CO5
Total				**44**		

Textbooks

Sr No	Book Details
1.	Introduction to Biophysics by Pranab Kumar Banerjee, S. Chand Publishing, 2008
Reference Books	
Sr No	**Book Details**
1.	Principles of Biochemistry: A.L. Lehninger, 8th edition, Nelson and Cox, McMillan Worth Publishers.
2.	Basic Neurochemistry: Molecular, Cellular and Medical Aspects. 8th edition. Siegel GJ, Agranoff BW, Albers RW, et al., editors. Philadelphia: Lippincott-Raven; 1999.
3.	Molecular Biology of the Cell. 7th edition. Alberts B, Johnson A, Lewis J, et al. New York: Garland Science; 2002.
4.	Molecular Cell Biology. 9th edition. Lodish H, Berk A, Zipursky SL, et al. New York: W. H. Freeman; 2000.
5.	Neuroscience. 7th edition.Purves D, Augustine GJ, Fitzpatrick D, et al., editors. Sunderland (MA): Sinauer Associates; 2001.
Links (Only Verified links should be pasted here)	
https://www.youtu.be/eHV1s2g4s4o https://www.youtube.com/watch?v=J5pWH1r3pgU https://youtu.be/oxX2fq2DBBo?si=V5xVcAlJGq8IbXho https://www.youtube.com/watch?v=iWp9FVN7RIQ https://www.youtube.com/watch?v=Pl7nzXaVqak https://www.youtube.com/watch?v=Y5JOW2eApUI https://www.youtube.com/watch?v=wQID2zmeWTQ	

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY
GREATER NOIDA-201306
(An Autonomous Institute)
School of Biotechnology

Subject Name: Biochemistry	**L-T-P [3-1-0]**
Subject Code: BBT0301	**Applicable in Department: Biotechnology**
Pre-requisite of Subject: Basics of Biology and chemistry	
Course Objective: The objective of this course is to understand the biochemical, molecular and mechanistic basis of cellular constituents viz, carbohydrates, proteins, lipids and nucleic acids.	

Course Outcomes (CO)

Course outcome: After completion of this course students will be able to:		**Bloom's Knowledge Level(KL)**
CO1	Comprehend the role and importance of water, pH and buffers in biological processes	K1
CO2	Explain and associate the chemistry with carbohydrates, their function and metabolism in the body and understand the biochemical basis of metabolic diseases.	K2
CO3	Explain and associate the chemistry of fatty acids, their function and metabolism in the body and to understand the biochemical basis of metabolic diseases.	K2
CO4	Learn the basics of amino acids and protein structure and metabolism; and interpret the acquired knowledge in understanding and working with the associated techniques in research and industrial level.	K2
CO5	Identify and explain the structure and metabolism of nucleic acid and elaborate associated research problems with the help of acquired learning.	K2

Syllabus

Unit No	**Module Name**	**Topic covered**	**Pedagogy**	**Lecture Required (L+P)**	**Practical/ Assignment/ Lab Nos**	**CO Mapping**
1	**Water, Buffers and Biochemical interactions:**	Structure and properties of water, Ionization of water, pH and buffers, buffering mechanism, Henderson-Hasselbalch equation, Buffering against pH Changes in Biological	Student oriented learning	6	-	CO1

		Systems: Phosphate buffer, Bicarbonate buffer, Chemical Bonds in biochemistry and their role in biological processes.				
2	**Carbohydrates**	Classification of carbohydrates, Glycosidic bonds, Structure and function of carbohydrates, Ring structure and mutarotation. Glucose metabolism: Glycolysis & oxidation of Pyruvate, TCA cycle, Gluconeogenesis, Pentose Phosphate Pathway. Etiology of Diabetes.	Assignment assessments, Visualizing using videos	8	-	CO2
3	**Fatty acids and lipids**	Structure and classification of fatty acids and lipids, nomenclature of lipids, Metabolism: Oxidation of fatty acids (beta oxidation, omega oxidation, alpha oxidation), carnitine shuttle, Biosynthesis of fatty acids. Electron transport chain and Oxidative phosphorylation. Etiology of Obesity.	Use of videos (digital learning)	8	-	CO3
4	**Amino acids and peptides**	Structure and classification, pKa and pI values of amino acids, Peptide bond, torsional angles in proteins-omega, phi and psi angle, Secondary structures: Alpha helix, beta sheets, Beta turns and Random coils, Ramachandran plot, Protein metabolism and function: Catabolism of proteins in body deamination, transamination, Urea cycle, Glucose Alanine cycle; Overview of amino acid biosynthesis- Role of Glutamine.	Case studies	6	-	CO4
5	**Nucleic acids**	Purines and pyrimidines, Structure of nucleotides, Phosphodiester bond, Deoxyribonucleotides and ribonucleotides. Metabolism of Nucleotides: Purines & Pyrimidines synthesis: de Novo & salvage pathway, Conversion of nucleoside monophosphates to nucleoside triphosphates, Formation of deoxyribonucleotides. Catabolism & salvage of Purine and Pyrimidine nucleotides.	Visualizations using videos	6	-	CO5
Total				**34**		

Textbooks	
Sr No	**Book Details**
1.	Principles of Biochemistry: A.L. Lehninger, Nelson and Cox, McMillan Worth Publishers.

2	Harper’s Biochemistry-Rober K. Murray, Daryl K. Grammer, McGraw Hill, Lange Medical Books. 25th edition.
3	Biochemistry : S.C. Rastogi – Third Edition ; Tata McGraw Hill Education Pvt. Ltd. New Delhi.
Reference Books	
Sr No	**Book Details**
1	Biochemistry: Stryer, W. H. Freeman
2	Biochemistry: Voet and Voet, John Wiley and Sons, Inc. USA
Links (Only Verified links should be pasted here)	

- https://www.youtube.com/watch?v=WhLrKCXxp08
- https://www.youtube.com/watch?v=OOc3zEgLLtk
- https://nptel.ac.in/courses/102/105/102105034/
- https://nptel.ac.in/courses/104/103/104103121/

NIET Greater Noida Autonomous Institute	**NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY** **GREATER NOIDA-201306** **(An Autonomous Institute)** **School of Biotechnology**

Subject Name: Microbiology	**L-T-P [3-0-0]**
Subject Code: BBT0302	**Applicable in Department: Biotechnology**
Pre-requisite of Subject: Basic Biology and Cell Biology	
Course Objective: The course provides the students both conceptual and experimental background in the broad discipline of microbiology. The students will be having fundamental understanding of the microbial world, basic structure and functions of microbes, metabolism, nutrition, their diversity, physiology and relationship to environment and human health. To impart practical skills of isolation and manipulating conditions for their propagation.	

Course Outcomes (CO)

Course outcome: After completion of this course students will be able to:		**Bloom's Knowledge Level(KL)**
CO1	Define the science of microbiology, its development and importance in human welfare.	K1
CO2	Describe some of the general methods used in the study of microorganisms.	K1
CO3	Understand the nutritional and physical importance of autotrophs, heterotrophs and chemotrophs	K1
CO4	Recognize and illustratu structure and function of microbes and factors affecting microbial growth.	K2, K3
CO5	Explain the role of microorganism in the Environment, Industry and Healthcare.	K2

Syllabus

Unit No	**Module Name**	**Topic covered**	**Pedagogy**	**Lecture Required (L+P)**	**Practical/ Assignment/ Lab Nos**	**CO Mapping**
1	**History and scope of**	Introduction to microbiology: history and scope of microbiology, major contribution and events in microbiology.	Motivation and	6	Activity 1: Microscope-Based	CO1

	microbiology	Classification and identification of microorganisms. Prokaryotes and eukaryotes, bacterial diversity	Direction of activity		Microbial Classification and Identification	
2	**Morphology and fine structure of microorganisms:**	Morphology features, bacterial cell structures, Gram positive and Gram negative bacteria, characteristics of cellular (bacteria, fungi, algae, protozoa) and acellular (viruses) organisms, Identification of microorganisms on the basis of colony morphology.	Direction of activity	6	Activity 2: Microbial Colony Morphology Identification	CO2
3	**Microbial requirements**	Nutritional and physical requirements of autotrophs, heterotrophs, chemotrophs and lithotrophs, types of culture media, enumeration of microbial populations, pure culture and cultural characteristics.	Direction of activity and incidental Learning	8	Activity 3: Culturing and Enumerating Microbial Populations	CO3
4	**Microbial Growth and Microbial Control**	Physical and chemical agents for control of microbial growth, their mode of action, sterilization, disinfectants and antiseptics, chemotherapeutic agents, Maintenance and preservation of microbial cultures and its importance, culture banks.	Content based and Incidental Learning.	8	Activity 4: Testing the Efficacy of Disinfectants and Antiseptics	CO4
5	**Environmental, industrial and medical microorganisms**	Water microbiology- Sewage Treatment Plant, Microbiology of food- Single Cell Proteins, Cheese, Wine, Beer, probiotics. Bioremediation. Biofertilizer Major diseases caused by different microorganism, Methods for the determination of antimicrobial efficacy of natural products	Augmentation and Computational Learning	7	Activity 5: Microbial Analysis of Water and Food Samples	CO5
Total				**35**		

Textbooks	
Sr No	**Book Details**
1.	Microbiology: Pelczar, Michael J. (Michael Joseph) 5th Edition.

Reference Books	
Sr No	**Book Details**

Links (Only Verified links should be pasted here)	
• Unit 1: https://www.youtube.com/watch?v=IiqpUJ4j_bs • Unit 2: https://www.youtube.com/watch?v=FZyDZ3PLZ-4 • Unit 3: https://www.youtube.com/watch?v=U_7vjo5pJXQ • Unit 4: https://www.youtube.com/watch?v=L5_6kAQBN5E • Unit 5: https://www.youtube.com/watch?v=t2cQXfnwLQ0	

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY
GREATER NOIDA-201306
(An Autonomous Institute)
School of Biotechnology

Subject Name: Genetics and Molecular Biology	**L-T-P [3-0-0]**
Subject Code:BBT0303	**Applicable in Department: Biotechnology**
Pre-requisite of Subject: Basics of Biology, Biochemistry.	
Course Objective: To provide students the knowledge about fundamentals of genetics, mutations, repair mechanism, evaluate genetic and allelic frequencies and get insight the chemistry of nucleic acids and genetic materials, Process and mechanism of replication, transcription, translation and molecular basis of gene regulations.	

Course Outcomes (CO)

Course outcome: After completion of this course students will be able to:		**Bloom's Knowledge Level(KL)**
CO1	Learn the fundamental principles of genetics and evaluate the genetic and allelic frequencies assumptions of Hardy-Weinberg equilibrium.	K1
CO2	Understanding the process of mutation types, and techniques to detect mutations, DNA repair mechanism.	K3
CO3	Get insight into the genetic materials, replication process in genetic materials in prokaryotes and eukaryotes.	K4
CO4	Get insight into the transcription, mRNA processing and translations.	K4
CO5	Evaluate the gene expression and its regulation mechanism in detail.	K4

Syllabus

Unit No	**Module Name**	**Topic covered**	**Pedagogy**	**Lecture Required (L+P)**	**Practical/ Assignment/ Lab Nos**	**CO Mapping**
1	**Qualitative and Quantitative Genetics**	Fundamental principles of genetics, chi square test, gene interaction, multiple alleles, sex determination, sex linked inheritance, sex limited and sex, influenced inheritance, extra-chromosomal inheritance, Linkage, crossing over, recombination, gene mapping, two-point, three-point test crosses. Introduction to quantitative genetics, genotypic & allelic frequencies, calculating genotypic and allelic frequencies, Hardy-Weinberg equilibrium	Interactive lectures Hands-on activities Data analysis exercises	12	ABL: Understanding the numerical exercises and knowledge of chi-Squire test.	CO1

2	**Chromosomes and Mutations**	Chromosomes structures and functions, chromosome analysis, karyotyping, chromosomal microarray analysis, fluorescence in situ hybridization (FISH), genetic counselling, chromosomal disorders. Mutation, Types of mutations, Techniques to detect mutations, DNA repair mechanism.	Inquiry-Based Learning	10	ABL: To learn how cytogeneticists use karyotyping to detect and understand chromosomal abnormalities.	CO2
3	**Genetic Material and DNA Replication**	Chemistry of Genetic Material, Discovery of DNA as genetic material, Experiments of Griffith; Avery, McCleod and; McCarthy, and Harshey and Chase. RNA as genetic material- Experiment of Fraenkel and Singer; Nucleic acids: structure of DNA, RNA, and Proteins, DNA Replication in prokaryotes and eukaryotes, PCR amplification of DNA.	Differentiated Instruction	8	ABL: DNA replication mechanism through Simulation Game	CO3
4	**Transcription, Translation and Genetic Code**	Transcription in prokaryotes and eukaryotes, Genetic code: Brief account, RNA processing, Translation in prokaryotes and eukaryotes.	Technology Integration	8	PBL: Polyacrylamide gel electrophoresis and estimation of molecular weight of proteins.	CO4
5	**Gene Expression and Gene regulation**	Gene regulation, positive regulation, negative regulation, attenuation, post-transcriptional regulation; Eukaryotic transcription factors, enhancers, silencers, insulators, Post-translational modification and protein stability.	Visual Aids and Demonstrations	8	ABL: Gene Regulation mechanism through Simulation Game	CO5
Total						

Textbooks	
Sr No	**Book Details**
1.	Molecular Biology of the Cell 7th ed. 2022: Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walte; 6th edition New York: Garland Science.
2	Cell and Molecular Biology-Concepts and Experiments 8th ed. 2015 :Gerald Karp et al. John Wiley.
3	Lewin's GENES XII, 12th ed. 2023 by Jocelyn E. Krebs Elliott S. Goldstein and Stephen T. Kilpatrick
Reference Books	
Sr No	**Book Details**
1	Molecular Cell Biology, 8th ed. 2016 by Harvey Lodish, Arnold Berk, Chris A. Kaiser, Monty Krieger, Anthony Bretscher, HiddePloegh, Angelika Amon and Kelsey C. Martin
2	Genetics a conceptual approach, 6th ed. 2017 Benjamin A. Pierc WH freeman and, company, New York. Publisher

3	Latest/classic research articles and reviews relevant to various topics of Genetics and Molecular Biology.

Links (Only Verified links should be pasted here)

- https://www.youtube.com/watch?v=WhLrKCXxp08
- https://www.youtube.com/watch?v=OOc3zEgLLtk
- https://nptel.ac.in/courses/102/105/102105034/
- https://nptel.ac.in/courses/104/103/104103121/

NIET Greater Noida Autonomous Institute	**NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY** **GREATER NOIDA-201306** **(An Autonomous Institute)** **School of Biotechnology**

Subject Name: Plant and Animal Science				**L-T-P [3-0-0]**		
Subject Code: BBT0306				**Applicable in Department: Biotechnology**		
Pre-requisite of Subject: Basic knowledge of biology.						
Course Objective: The objective of this course is to understand plant structure, its development, physiology and metabolism in plants, plant development and their interaction with other organisms, human physiology and human reproduction.						
Course Outcomes (CO)						
Course outcome: After completion of this course students will be able to:						**Bloom's Knowledge Level(KL)**
CO1	Describe and explain the concept of plant structure, organogenesis, morphogenesis, apoptosis and necrosis					K1,K2
CO2	Learn and understand the different aspects of plant physiology and plant breeding technology.					K1,K2
CO3	Understand and explain the different types of plant metabolisms and plant pathology					K1,K2
CO4	Explain and understand human physiological process.					K1, K2
CO5	Learn and understand the reproduction in animals and in plants.					K1, K2
Syllabus						
Unit No	**Module Name**	**Topic covered**	**Pedagogy**	**Lecture Required (L+P)**	**Practical/ Assignment/ Lab Nos**	**CO Mapping**
1	**Plant structure and Development**	Structural organization and function of plant cell, Growth and Division of the Cell, Organogenesis in plants, Types and applications of organogenesis, Morphogenesis and factors affecting morphogenesis in plants, Apoptosis—Types, causes, pathways and functions of apoptosis. Plant responses to environmental signals	Smart board, PPTS, Reference Books,	8	ABL- Understand the internal and external structure of a plant. Identify different	CO1

					leaf structures and venation patterns.	
2	**Plant physiology**	Photosynthesis, Respiration and photorespiration, Plant hormones, Sensory photobiology, Solute transport and photo assimilate translocation, Stress physiology, Primary and Secondary metabolites, Role and classification of secondary metabolites. Plant Hormones and Signaling	Smart board, PPTS, Reference Books, and textbooks	8	Abl- Observe the process of photosynthesis and understand the role of light.	CO2
3	**Plant metabolism and plant pathology**	Control of metabolic pathways. Carbon assimilation: photosynthesis, photorespiration and sucrose transport; Non-photosynthetic generation of energy and precursors. Storage of carbon. Metabolism in plastids. Nitrogen, phosphorus, sulfur and iron assimilation; Movement of water and minerals. Plant-Microbe Interactions_ beneficial symbionts (e.g., mycorrhizal fungi and nitrogen-fixing bacteria) and pathogens (e.g., bacteria, fungi, viruses). Introduction and symptoms of Plant Diseases, Disease Management and Epidemiology	Smart board, PPTS, Reference Books, and textbooks	8	ABL- Observe the effects of mycorrhizal fungi on plant growth.	CO3
4	**Human physiology**	Digestion-Alimentary canal and digestive glands, role of digestive enzymes, Breathing and respiration-Respiratory organs in animals, respiratory systems and mechanism of breathing and its regulations. Body fluids and circulation in animals. Excretory products and their elimination in animals. Chemical coordination and regulation in animals: Hormone synthesis, secretion, action, endocrine disorders and their treatment.	Smart board, PPTS, Reference Books and text books	8	ABL- Visualize the digestive process. 2. Measure and compare lung capacities.	CO4
5	**Developmental Biology**	Pre fertilization (Gametogenesis) and post fertilization events in animals and plants, Seed formation and seed germination, Embryo development in animals and plants, life history of model organisms like Drosophila, House fly, Mosquito.	Smart board,PPTS, Reference Books and text books	8	ABL- Understand asexual reproduction in plants. 2. Observe the stages of seed germination.	CO5
Total				**40**		

Textbooks	
Sr No	**Book Details**
1.	Plant Science - by G. Pothiraj A. Elangovan

2	Botany: An Introduction to Plant Biology, James D. Mauseth.
3	Biology of Plants by Peter H. Raven, Ray F. Evert, Susan E. Eichhorn, Hardcover: 875 pages, Publisher: W. H. Freeman
Reference Books	
Sr No	**Book Details**
1	Plant Biology (with InfoTrac) by Thomas L. Rost, Michael G. Barbour, C. Ralph Stocking, Terence M. Murphy, Paperback: 568 pages, Publisher: Brooks Cole
2	Introductory Plant Biology by Kingsley R Stern, Jim Bidlack, Shelley Jansky, Hardcover: 640 pages, Publisher: McGraw-Hill Science/Engineering/Math
3	Introductory Botany: Plants, People, and the Environment by Linda R. Berg, Hardcover: 466 pages, Publisher: Brooks Cole
Links (Only Verified links should be pasted here)	

- Unit 1 https://www.youtube.com/watch?v=9UvlqAVCoqY
- Unit 2 https://www.youtube.com/watch?v=RT-w2xHVl_E&list=PLs7Y2nGwfz4FL4ZJgONHsl1qpAZPr3tJ
- Unit 3 https://www.youtube.com/watch?v=IWgNA9ynfGs
- Unit 4 https://www.youtube.com/watch?v=X3TAROotFfM https://www.youtube.com/watch?v=X3TAROo
- Unit 5 https://www.youtube.com/watch?v=SFzpZu-znCc, https://www.youtube.com/watch?v=3nB2RKW7oRs, https://www.youtube.com/watch?v=83AabzOGAZ4

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY
GREATER NOIDA-201306
(An Autonomous Institute)
School of Biotechnology

Subject Name: Bioinformatics	**L-T-P [0-0-6]**
Subject Code: BBT0355	**Applicable in Department: Biotechnology**
Pre-requisite of Subject: Basics of Biology, Molecular Biology, Biochemistry.	
Course Objective: To understand the basic concept of Bioinformatics, databases and sequence analysis. To provide knowledge of scoring matrix, phylogenetic analysis and to learn the protein structure prediction and application of bioinformatics in drug designing.	

Course Outcomes (CO)

Course outcome: After completion of this course students will be able to:		**Bloom's Knowledge Level(KL)**
CO1	Understand the theoretical basis behind bioinformatics and concept of Biological Databases	K1, K2
CO2	Search databases accessible on the internet for literature relating to Molecular Biology and Biotechnology	K1, K2, K3
CO3	Understand scoring matrices and its types including PAM , BLOSUM series and matrices for nucleic acid and protein sequences	K1, K2
CO4	Apply phylogeny and its concepts in molecular evolution and different methods of Phylogenetic tree construction	K1, K2, K3
CO5	Query biological data, interpret and model biological information and apply this to the solution of biological problems in any arena involving molecular data	K1, K2, K3

Syllabus

Unit No	**Module Name**	**Topic covered**	**Pedagogy**	**Lecture Required (L+P)**	**Practical/ Assignment/ Lab Nos**	**CO Mapping**
1	**General Introduction**	Exercise 1: Introduction to Bioinformatics; Human Genome Project Exercise 2: Biological databases: Nucleotide databases, Protein databases, Specialized databases	Encourage students to explore freely	12	PBL: 1. Perform a BLAST search with	CO1

		Exercise 3: Laboratory data submission and data retrieval tools. Exercise 4: Various file formats for biomolecular sequences: GenBank, EMBL, FASTA, GCG, MSF, nbrf-pir etc. Exercise 5: Basic concepts of sequence similarity: identity and homology Exercise 6: Definitions of homologues, orthologues, paralogues Exercise 7: Sequence patterns Exercise 8: Sequence profiles	available bioinformatics databases, tools, and resources to gain practical experience.		a given nucleotide or protein sequence. 2. Analyze the output, focusing on identity, E-value, and alignment scores. 3. Identify homologues, orthologues, and paralogues in the results.	
2	**Database searching**	Exercise 9 Sequence Alignment Exercise 10: Database Searching: Introduction, Evolutionary Basis of Sequence Alignment Exercise 11: Database similarity searching: FASTA, BLAST Exercise 12: Various versions of basic BLAST and FASTA, Exercise 13: Advance version of BLAST: PHI-BLAST and profile-based database searches using PSIBLAST Exercise 14: Multiple sequence alignment: progressive method and Iterative method Exercise 15: Applications of pairwise and multiple sequence alignment Exercise 16: Tools for multiple sequence alignment: CLUSTAL ω and Pileup (Algorithmic concepts)	Practical examples, and hands-on exercises to engage learners and reinforce their understanding.	12	PBL: Perform and analyze multiple sequence alignments to identify conserved regions and evolutionary relationships.	CO2
3	**Scoring Matrices**	Exercise 17: Basic concept of a scoring matrix, Similarity and distance matrix Exercise 18: Substitution matrices: Matrices for nucleic acid and proteins sequences, PAM and BLOSUM series Exercise 19: Principles based on which these matrices are derived Exercise 20: Gap Penalty, concept of Gap opening and extension penalty.	Numerical approach	12	PBL: Constructing and Interpreting Similarity and Distance Matrices	CO3
4	**Phylogenetic analysis**	Exercise 21: Phylogeny and concepts in molecular evolution; nature of data used in taxonomy and phylogeny Exercise 22: Definition and description of Phylogenetic trees Exercise 23: Various types of Phylogenetic trees Exercise 24: Phylogenetic tree construction through UPGMA Exercise 25: Phylogenetic tree construction through Fitch-Margoliash Algorithm	Practical examples, hands-on	12	PBL: Constructing Phylogenetic Trees Using UPGMA and Fitch-Margoliash Algorithms	CO4

		Exercise 26: case studies in phylogenetic sequence analysis				
5	**Applications of Bioinformatics**	Exercise 27: Protein identification based on composition, Physical properties based on sequence, Motif and pattern Exercise 28: Secondary structure (Statistical method: Chou Fasman and GOR method, Neural Network and Nearest neighbor method) and folding classes, specialized structure or features Exercise 29: Tertiary structures (Homology Modeling); Structure visualization methods (RASMOL, CHIME etc.) Exercise 30: Protein Structure alignment and analysis. Application of bioinformatics in drug discovery and drug designing.	Hands-on exercises to engage learners and reinforce their understanding	12	PBL: Use statistical methods and computational tools to predict secondary structures.	CO5
Total				**60**		

Textbooks	
Sr No	**Book Details**
1.	Bioinformatics: Sequence and Genome Analysis by David W. Mount, 2ND EDITION
2.	Bioinformatics for Dummies by Jean-Michel Claverie and Cedric Notredame, 2ND EDITION
3.	Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins
Reference Books	
Sr No	**Book Details**
1.	Bioinformatics for High Throughput Sequencing by Naiara Rodríguez-Ezpeleta, Michael Hackenberg, Ana M. Aransay
2.	Bioinformatics and Functional Genomics, 3rd Edition by Jonathan Pevsner.
3.	Bioinformatics: Principles and Applications by Bibekanand Mallick and Zhumur Ghosh
Links (Only Verified links should be pasted here)	
http://apps.iasri.res.in/ebook/win_school_aa/notes/Biological_Databases.pdf https://microbenotes.com/biological-databases-types-and-importance/ https://www.slideshare.net/sarfaraznasri/biological-databases-55931798 https://www.slideshare.net/prasanthperceptron/biological-databases https://guides.library.queensu.ca/patents/databases https://www.slideshare.net/PallaviBelkar/patent-database-14579304	

NIET Greater Noida Autonomous Institute	**NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY** **GREATER NOIDA-201306** **(An Autonomous Institute)** **School of Biotechnology**

Subject Name: Biochemistry & Microbiology Lab	**L-T-P [0-0-4]**
Subject Code: BBT0352	**Applicable in Department: Biotechnology**

Lab Experiments

Course Objective: The course aims to equip students with practical skills and theoretical knowledge in microbial techniques, biosafety practices, and the identification and analysis of microorganisms using various methods.

Course Outcomes (CO)

Course outcome: After completion of this course students will be able to:		**Bloom's Knowledge Level (KL)**
CO1	Demonstrate proficiency in microbial good laboratory practices and biosafety protocols.	K1
CO2	Identify microorganisms based on colony morphology and Gram staining techniques.	K6
CO3	Prepare, sterilize, and inoculate culture media, and enumerate microbes from environmental samples.	K6
CO4	Cultivate and isolate microorganisms using various microbiological techniques, and analyze microbial samples from soil and to analyze protein, amino acids and sugars in samples	

List of Practicals

Sr No	**Program Title**	**CO Mapping**
1.	Microbial good lab practices and biosafety. (CO1)	CO1
2.	Identification of microbial colony on the basis of microbial morphology. (CO2)	CO1
3.	Preparation of nutrient agar plate, slant nutrient broth and their sterilization. (Heating oven, autoclave, laminar air hood) (CO3)	CO2
4.	Inoculation of agar slant, plate and nutrient broth. (Incubator, laminar air hood) (CO3)	CO2

5.	Culture of microorganisms using various techniques. (Spread-plate method, pore-plate method, streaking method) (CO4)	CO2
6.	Enumeration of microbes from given soil sample. (CO3)	CO3
7.	Isolation and identification (on the basis of colony morphology) of microorganisms from soil sample. (CO4)	CO3
8.	To identify given microorganism on the basis of gram staining. (CO2)	CO3
9.	To study the anti-microbial efficacy of plant extract. (CO5)	CO3
10.	To study estimation of coliform bacteria in water by MPN test. (CO5)	CO3
11.	Identification of the microbes on the basis of biochemical tests.	CO4
12.	Analysis of starch in the given sample.	CO4
13.	Estimation of protein in the given sample.	CO4
14.	To separate amino acids using paper/thin layer chromatography	CO4

NIET Greater Noida	**NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY** **GREATER NOIDA-201306** **(An Autonomous Institute)** **School of Biotechnology**

Subject Name: Genetics & Molecular Biology Lab	**L-T-P [0-0-2]**
Subject Code: BBT0353	**Applicable in Department: Biotechnology**

Lab Experiments

Course Objective: To provide students the knowledge and skill about analysing the genotypic and allelic frequencies, linkage, gene mapping, DNA and RNA extraction, techniques of DNA, RNA and Protein separations, regulation of gene expression and DNA microarray techniques.

Course Outcomes (CO)

Course outcome: After completion of this course students will be able to:		**Bloom's Knowledge Level (KL)**
CO 1	Students able to calculate genotypic and allelic frequencies and demonstrate the linkage, crossing over, and gene mapping in Drosophila melanogaster.	K1
CO2	Students able to perform of polytene chromosome from insect salivary gland and design their study with drosophila mutants	K6
CO3	Students will have enhanced their knowledge for doing extraction of genomic DNA and extraction of RNA from animal and plant tissues	K6
	Students evaluate and calculate molecular weight of proteins and concentrations of DNA.	
	Students will have enhanced their knowledge in gene expression, regulation of gene expression and gene expression using DNA microarray.	

List of Practicals

Sr No	**Program Title**	**CO Mapping**
1.	To understand and calculate the genotypic and allelic frequencies in a given population using the Hardy-Weinberg equilibrium principle.	CO1
2.	Study on linkage, crossing over, and gene mapping in *Drosophila melanogaster*.	CO1

3.	Study of polytene chromosome from insect salivary gland.	CO2
4.	Study and Observation of mutants in Drosophila.	CO2
5.	Extraction of genomic DNA from Drosophila/ animal cell.	CO3
6.	To understand the principles and applications of Polymerase Chain Reaction (PCR) amplification and gel electrophoresis in molecular biology.	CO3
7.	Estimation of size in bp of DNA using agarose gel electrophoresis.	CO4
8.	Polyacrylamide gel electrophoresis and estimation of MW of proteins.	CO4
9.	Demonstration of gene expression, regulation of gene expression by using a digital platform.	CO5
10.	Demonstration of gene expression using DNA microarray by using a digital platform	CO5

NIET Greater Noida Autonomous Institute	**NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY** **GREATER NOIDA-201306** **(An Autonomous Institute)** **School of Biotechnology**

Subject Name Environmental Science	**L-T-P [2-0-0]**
Subject Code ANC 0302/0402	**Applicable in Department: All Department**
Pre-requisite of Subject: Environmental science is an interdisciplinary field that requires a solid foundation in various subjects to fully understand the complex interactions within the environment. Building a strong foundation in subjects like physics, chemistry, biology,maths,geography,economics will equip students with the knowledge and skills necessary to tackle complex environmental challenges and contribute to sustainable solutions.	
Course Objective: To help the students in realizing the inter-relationship between man and environment and help the students in acquiring basic knowledge about environment.	

Course Outcomes (CO)

	Course outcome: After completion of this course students will be able to:	**Bloom's Knowledge Level(KL)**
CO 1	Understand the basic principles of ecology and environment. Ecosystem: Basic concepts, components of ecosystem, food chains and food webs. Ecological pyramids	K1
CO2	Understand the different types of natural recourses like food, forest, Minerals and energy and their conservation	K1,K2
CO3	Understand the importance of biodiversity, Threats of biodiversity and different methods of biodiversity conservation.	K1,K2
CO4	Understand the different types of pollution, pollutants, their sources, effects and their control methods.	K1,K2
CO5	Understand the basic concepts of sustainable development, Environmental Impact Assessment (EIA) and different acts related to environment	K1,K2

Syllabus

Unit No	**Module Name**	**Topic covered**	**Pedagogy**	**Lecture Required (L+P)**	**Practical/ Assignment/ Lab Nos**	**CO Mapping**
1	**Basic Principle of Ecology**	Definition, Scope and basic principles of ecology and environment. Ecosystem: Basic concepts, components of ecosystem. Food chains and food	Smart board,	4(L)	NA	CO1

		webs. Ecological pyramids, Energy flow in ecological systems, Characteristics of different ecosystems. Biogeochemical Cycles: Importance, gaseous and sedimentary cycles. Carbon, Nitrogen, Phosphorus and Sulphur Cycles. Basic concepts of sustainable development, SDGs, Ecosystem services, UN Decade for Eco restoration	PPTS, Reference Books,			
2	**Natural Resources and Associated Problems**	Natural resources and associated problems. Forest resources: Use and over-exploitation, deforestation. Timber extraction, mining, dams and their effects on forest and tribal people. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources. Food resources: World food problems, changes caused by agriculture and over-grazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity. Land resources: Land as a resource, land degradation, man induced landslides. Equitable use of resources for sustainable lifestyles. Non-Renewable Energy Resources: Fossil fuels and their reserves, Nuclear energy, types, uses and effects, Renewable Energy Resources: hydropower, Solar energy, geothermal, tidal and wind energy, Biomass energy, biogas and its advantages.	Smart board, PPTS, Reference Books,	4(L)	NA	CO2
3	**Biodiversity Succession and Non-Renewable Energy Resources**	Biodiversity and their importance, Threats to biodiversity, major causes, extinction's, vulnerability of species to extinction, IUCN threat categories, Red data book. Strategies for biodiversity conservation, principles of biodiversity conservation in-situ and ex-situ conservation strategies Mega diversity zones and Hot spots, concepts, distribution and importance. Succession: Concepts of succession, Types of Succession. Trends in succession. Climax and stability.	Smart board, PPTS, Reference Books	4(L)	NA	CO3
4	**Pollution and Solid Waste Management**	Air pollution: sources of air pollution, Primary and secondary air pollutants. Origin and effects of SOX, NOX, Cox,CFC, Hydrocarbon, control of air pollution. Water pollution: sources and types of water pollution, Effects of water pollution, Eutrophication, Soil pollution: Causes of soil pollution, Effects of soil pollution, Major sources of and effects of noise pollution on health, Radioactive and thermal pollution sources and their effects on surrounding environment. Solid waste disposal and its effects on surrounding environment, Climate change, global warming, acid rain, ozone layer depletion.	Smart board, PPTS, Reference Books	4(L)	NA	CO4
5	**Role of Community and Environmental Protection Acts**	Role of community, women and NGOs in environmental protection, Bio indicators and their role, Natural hazards, Chemical accidents and disasters risk management, Environmental Impact Assessment (EIA), Salient features	Smart board, PPTS,	4(L)	NA	CO5

		of following Acts: a. Environmental Protection Act, 1986, Wildlife (Protection) Act, 1972.b. Water (Prevention and control of pollution) Act, 1974.c. Air (Prevention and control of pollution) Act, 1981. Forest (Conservation) Act, 1980.d. Wetlands (Conservation and Management) Rules, 2017; e. Chemical safety and Disaster Management law.F. District Environmental Action Plan. Climate action plans.	Reference Books			
Total				**20**		

Textbooks	
Sr No	**Book Details**
1.	Brady, N.C. 1990. The nature and properties of Soils, Tenth Edition. Mac Millan Publishing Co., New York.
2	Botkin, D.B and Kodler E.A., 2000, Environmental Studies : The earth as a living planet. John Wiley and Sons Inc.Environmental studies and Environmental engineering –By Dr. H.H
3	Environmental Studies By Dr B.S.Chauhan
Reference Books	
Sr No	**Book Details**
1	Rao M.N. and H.V.N. Rao, 1989 : Air Pollution, Tata McGraw Hill Publishing Co. Ltd., New Delhi
2	A Text Book of environmental Science By Shashi Chawla
3	Environmental studies- R, Rajagopalan -Oxford Pubtiotion20051
Links (Only Verified links should be pasted here)	

- Ecosystems and Biomes | Classroom Learning Video - YouTube
- Environmental Science EVS Unit 3 Natural Resources Land Resources AEC semester 1/2 DU SOL NCWEB P -1 (youtube.com)
- 'Biodiversity & its Conservation' In Just 24 Minutes🔥| Ultimate Revision Series | Neet 2022 (youtube.com)
- Air Pollution | What Causes Air Pollution? | The Dr Binocs Show | Kids Learning Videos Peekaboo Kidz (youtube.com)
- Environmental Pollution - Environment and Ecology for UPSC IAS Part 2 (youtube.com)

NIET Greater Noida Autonomous Institute	**NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY** **GREATER NOIDA-201306** **(An Autonomous Institute)** **School of Biotechnology**

Branch- B.TECH. (CSE/IT/CSE(R)/AI/AIML/DS/CYS/IOT/CS/EC/ME/BT)/M. Tech (Int.)	
Subject Code- BNC0301/BNC0401	**L - T – P** **2 – 0 - 0**
Subject Name- Artificial Intelligence and Cyber Ethics	**No. of hours- 30**

Pre-requisite of Subject: Basic understanding of computer systems and ethics.

Course Objective- The course aims to foster critical thinking about ethical issues, promote responsible use of technology, and ensure students can identify, analyze, and address ethical dilemmas in AI and cyber domains.

Course Outcome – After completion of this course students are able to:

CO1 - Learn key principles of AI ethics, summarizing ethical considerations and applications in AI development and deployment.

CO2- Apply policies and framework for Fairness in AI and Machine Learning.

CO3- Apply privacy and security concepts, risk management and regulatory compliance in the field of AI and Cyber Security.

CO4- Understand the nature of cybercrimes, the principles of intellectual property rights (IPR), and the legal measures necessary to address and prevent these issues.

CO5- Describe the impact of AI in Society, employment and workforce.

Course Content

Unit No	Module	Topics Covered	Pedagogy	Lecture Required (T=L+P)	Aligned Practical/Assignment/Lab	CO Mapping
1	**An overview to AI Ethics**	Definition of AI. Ethical principles in AI. Sources of AI data. Legal implications of AI security breaches, Privacy and AI regulations. Key Principles of responsible AI, transparency and accountability, Dual-use dilemma, Human-centric design. Introduction to Cyber Laws and Ethics, Historical development of cyber laws, Legal frameworks.	Lecture and Case studies	5	Assignment	**CO1**

2	**Fairness and Favoritism in Machine Learning**	Introduction to Fairness and Bias in AI, Types of Fairness and Bias. Impact of Bias and Fairness in AI, techniques for measuring Fairness and Bias. Techniques for mitigating bias. Current policies and frameworks for fairness in AI. Bias in data collection, Fairness in data processing. Generative AI, Types of Bias in Generative AI.	Lecture and Case studies	6	Assignment	**CO2**
3	**AI Ethics and Cybersecurity Principles**	Importance of privacy and security in AI, AI specific security tools and software, privacy-preserving machine learning (PPML) and privacy-preserving data mining (PPDM) Ethical considerations in phases of AI development life cycle, **Risk management**: Risk assessment and incident response **Regulatory compliance**: GDPR, HIPAA **Case studies:** Implementation of AI ethics guidelines and best practices in engineering projects, Ethical decision-making processes and tools for engineers working with AI technologies	Lecture and Case studies	8	Assignment	**CO3**
4	**Cybercrimes, IPR and Legal Measures**	Types of cybercrimes and their impact, Legal measures for cybercrime prevention and prosecution. IPR: Copyrights, trademarks, patents, and trade secrets, Ethical implications of intellectual property, Cyber security and privacy issues	Lecture and Case studies	5	Assignment	**CO4**
5	**AI Contribution to Social Evolution**	Positive and negative political impacts of AI, Role of AI in social media and communication platforms, AI-generated content and deepfakes, Applications of AI in addressing global challenges, Key technical stakeholders in AI deployment: developers, researchers, policymakers, Technical Impacts on Employment and Workforce: Automation technologies: robotic process automation (RPA), autonomous systems	Lecture and Case studies	6	Assignment	**CO5**

References-

Text Books:

1. Introduction to Information Security and Cyber Laws, Simplified Chinese Edition by Surya Prakash Tripathi, Ritendra Goel, 1 January ,2014

2. AI ETHICS: Paving the Path for Responsible Machine Learning, Shivanand Kumar, 2014

Reference Books:

1. AI ETHICS (The MIT Press Essential Knowledge series), by Mark Coeckelbergh, 2018

2. Computers, Internet and New Technology Laws by Karnika Seth – by Karnika

Links:
Unit 1 https://www.youtube.com/watch?v=VqFqWIqOB1g
Unit 2: https://www.youtube.com/watch?v=hVJqHgqF59A
Unit 3: https://www.youtube.com/watch?v=O5RX_T4Tg24
Unit 4: https://www.youtube.com/watch?v=RJZ0pxcZsSQ
Unit 5: https://www.youtube.com/watch?v=I9FOswjTSGg

NIET Greater Noida Autonomous Institute	**NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY** **GREATER NOIDA-201306** **(An Autonomous Institute)** **School of Biotechnology**

Subject Name: Fermentation Engineering			**L-T-P [3-1-0]**			
Subject Code: BBT0403			**Applicable in Department: Biotechnology**			
Pre-requisite of Subject: The students should know the basics of microbiology, genetics and molecular biology and biochemistry.						
Course Objective: The objective of the course is to understand the fundamental principles of fermentation, including microbial physiology, metabolism, and growth kinetics. They will also gain knowledge about different types of fermenters, fermentation media, and process parameters to become proficient in designing, optimizing, and managing fermentation processes for a wide range of applications.						
Course Outcomes (CO)						
Course outcome: After completion of this course students will be able to:						**Bloom's Knowledge Level (KL)**
CO 1	Understand sterilization techniques and determine sterilization time.					K1
CO2	Differentiate among Batch culture, Fed-Batch and continuous fermentation processes.					K2
CO3	Understand and demonstrate different regulatory mechanisms during product formation.					K2
CO4	Illustrate the production process of fermented food and dairy products.					K3
CO5	Explain the fermentation techniques for production of alcohols, antibiotics, and organic acids.					K2
Syllabus						
Unit No	**Module Name**	**Topic covered**	**Pedagogy**	**Lecture Required (L+P)**	**Practical/ Assignment/ Lab Nos**	**CO Mapping**

1	Introduction to fermentation technology	Significance of fermentation, Introduction to submerged and solid-state fermentation, Microbial culture selection for fermentation processes. Primary and Secondary metabolites, sterilization process, media for industrial fermentation	Smartboard/PPT/Textbook/ Reference Book/ Virtual demonstration	**8**	PBL: Understand the composition and function of fermentation media (nutrient sources, pH buffers, supplements).	CO 1
2	Type of fermentation processes	Batch, Fed-batch and Continuous fermentation processes, Construction of fermenters, Basic function of fermenters, Design, and operation, Scale up of fermentation, Instrumentation and control, Aeration and agitation, Introduction to bioreactors.	Smartboard/PPT/Textbook/ Reference Book/ Virtual demonstration	**8**	PBL: Understand the controlling and functioning of fermenter.	CO 2
3	Mechanisms behind metabolic reaction	Different regulatory mechanisms involved in controlling the catabolic and anabolic processes of microbes, Induction, Nutritional repression, Carbon catabolite repression, Crabtree effect, Feedback inhibition and feedback repression	Smartboard/PPT/Textbook/ Reference Book/ Virtual demonstration	**8**	ABL: Production of Ethanol by fermentation using *Saccharomyces cerevisiae*	CO 3
4	Fermentation and food	Raw material availability, quality, processes and pretreatment of raw materials. Alcoholic beverages and IMFL/distilled spirits. Mushroom cultivation, Oriented Fermented Products, fermented milk & dairy products (cheese, Tofu etc.), Fermented food products (Idli, Dosa, Dhokla, soy sauce, pickles etc.)	Smartboard/PPT/Textbook/ Reference Book/ Virtual demonstration	**8**	ABL: Production of fermented food products (Idli)	CO 4
5	Industrial production of fermented products	Details of the process, parameters and materials for industrial manufacture of antibiotics (β lactum), Solvents (acetone, ethanol) Amino acid (Lysine),	Smartboard/PPT/Textbook/ Reference Book/ Virtual demonstration	**8**	ABL: Citric acid production from whey with glucose as supplementary carbon	CO 5

		Organic acids (Citric acid), Ind. Enzymes (Protease/Amylase), Fermentation for APIs (Active Pharmaceutical Ingredients), Biopharmaceuticals (Insulin/Interferon etc.)			source by *Aspergillus niger*	
Total				**32**		

Textbooks	
Sr No	**Book Details**
1.	Microbes & Fermentation, A. Lel and Kotlers Richard J. Mickey, Oriffin Publication
	Microbes & Fermentation, A. Lel and Kotlers Richard J. Mickey, Oriffin Publication
	Industrial Fermentations- Leland, N. Y. Chemical Publishers
Reference Books	
Sr No	**Book Details**
	P. F. Stanbury and A.Whittaker, 'Principles of fermentation technology
	F. Kargi and Michael L. Shuker, 'Bioprocess Engineering: Basic Concepts
	K M Richard and S R Durbia, 'fermentation and biochemical engineering' VOL 2
Links (Only Verified links should be pasted here)	
Unit-1 https://youtu.be/eLYsGuw5Ofk https://youtu.be/K2HfqV3sAx0 https://youtu.be/ZgM3h0xTUfM https://youtu.be/LwIe275w1Jc https://youtu.be/0XUVqZcz2N8 https://youtu.be/SqXjhI9lsUg Unit-2 https://youtu.be/EILSfuqqUJc https://youtu.be/lMSE7XYcCrM https://youtu.be/fWBENdo1R1U	

https://youtu.be/LwIe275w1Jc
https://youtu.be/JPcap80yvxE
https://youtu.be/1ZBRCFZJR2Q
https://youtu.be/sMBBzLrZgRw

Unit-3
https://youtu.be/cOesDqGqM0Y
https://youtu.be/IWgNA9ynfGs
https://youtu.be/InFB28KII0c
https://youtu.be/Fq3B4mU7_YA

Unit-4
https://youtu.be/XvWlZttdbHk
https://youtu.be/_g-aUX1Jg9g
https://youtu.be/TVkL9gZpQ0o

Unit-5
https://youtu.be/IU-15iYOOxE
https://youtu.be/5zJZ-JFAdS0
https://youtu.be/Y7_KdQF9saM
https://youtu.be/LiO7xX6CAx8
https://youtu.be/-NZ3MSJbdi8
https://youtu.be/QBnaYrXOR1w
https://youtu.be/4Zf3bUVKd-k

NIET Greater Noida Autonomous Institute	**NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY** **GREATER NOIDA-201306** **(An Autonomous Institute)** **Department of Biotechnology**

Subject Name: Technical Communication				**L-T-P [2-1-0]**		
Subject Code: BASL0401 **Applicable in Department:** CSE, CSE (R), IT, DS, IoT, AI, AIML, CS, BT, EC, CYS, & ME						**Sem. IV**
Pre-requisite of Subject: B2 (CEFR level) in the Core Skills test; B1/B2 in the Speaking and Writing tests						
Course Objective: To develop communication and critical thinking skills necessary for succeeding in the diverse and ever-changing workplace of the twenty first century and help the students communicate effectively, creatively, accurately, and appropriately.						
Course Outcomes (CO)						
Course outcome: After completion of this course students will be able to:						**Bloom's Knowledge Level(KL)**
CO 1	Comprehend the principles and functions of technical communication.					K2
CO2	Write for a specific audience and purpose to fulfil the provided brief.					K5
CO3	Identify and produce different kinds of technical documents.					K2, K3
CO4	Apply effective speaking skills to efficiently carry out official discourses.					K3
CO5	Demonstrate understanding of communication through digital media.					K5
Syllabus						
Unit No	**Module Name**	**Topic covered**		**Pedagogy**	**Lecture Required (L+P)**	**Practical/ Assignment/ Lab Nos**	**CO Mapping**
1	**Introduction to Technical Communication**	• Definition, Process, Types, Levels, Flow and Barriers to Technical Communication with emphasis on cultural differences and gender sensitivity. Gender-neutral language.		Interactive & Flipped classroom method	5	Assignment 1	CO1

		• Need for and Importance of Technical Communication - Significance of audience in technical communication • Tone- Formality and Informality				
2	**Technical Writing 1**	• Technical writing and technical vocabulary • Business letters/emails a) Types and format, Content Organization b) Cultural Variety, Tone, and Intention c) Bad news message, good news message d) Advertisements, Editorial press releases • Notices, agenda, and minutes of meeting • Job application, CV, and Resume'	Interactive & Flipped classroom method	10	Assignment 2	CO2
3	**Technical Writing 2**	• Technical reports – types & formats • Structure of a report (short & long) • Ethical Writing – Copy Editing, Referencing and Plagiarism • Technical Proposal - structure and types • Technical/ Scientific paper writing	PPT, Activities	5	Assignment 3	CO3
4	**Public Speaking**	• Components of effective speaking • Seminar and conference presentation • Conducting/ participating in meetings • Appearing for a job interview	Interactive sessions, activities, mock interviews	8	Assignment 4	CO4
5	**Virtual/Remote Communication**	• Understanding remote work – using different online platforms • Virtual etiquette- email ids, usernames • Developing online written correspondence- blogs, WhatsApp, LinkedIn. What not to write on social media. • Participating in online Conferences/seminars/meetings • Mobile Etiquette	Interactive sessions, activities	8	Assignment 5	CO5
Total				**36**		

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY
GREATER NOIDA-201306
(An Autonomous Institute)
School of Biotechnology

Subject Name: Green Biotechnology and Pollution Abetment	**L-T-P [3-0-0]**
Subject Code: BBT0404	**Applicable in Department: Biotechnology**
Pre-requisite of Subject: Basic knowledge of environmental science and biology.	
Course Objective: The course content is designed to help students grasp the role of biotechnology in monitoring and mitigating pollutants, biological degradation of xenobiotic compounds, usage of enzyme and its importance in waste treatment, various biological processes for remediation of pollutant and these advancements aim to reduce the harmful effects of pollutants, ultimately fostering a healthier environment for our planet.	

Course Outcomes (CO)

Course outcome: After completion of this course students will be able to:		**Bloom's Knowledge Level(KL)**
CO 1	Learn and explain the different aspects of various waste treatment processes.	K1
CO2	Describe and explain the biotechnological processes to handle xenobiotic compounds.	K1, K2
CO3	Understands and explains the process of bio transformation, importance of enzymes and their utilization in waste treatment.	K1, K2
CO4	Understand and analyze the bioremediation processes, in situ and ex situ bioremediation,phytoremediation to protect the environment.	K1, K4
CO5	Understand and describes the potential biomass sources for renewable energy generation and eco-friendly products from renewable resources.	K1

Syllabus

Unit No	**Module Name**	**Topic covered**	**Pedagogy**	**Lecture Required (L+P)**	**Practical/ Assignment/ Lab Nos**	**CO Mapping**
1	Biological Waste Treatment	Biological Waste Treatment: Biological wastewater treatment: Principles and design aspects of various waste treatment methods with advanced bioreactor configuration: Solid waste management: landfills, recycling and processing of organic	PPI, Smart board, short films, videos,	8	ABL- understand the concepts and processes involved in	CO1

		residues, Basic concepts on water quality analytic parameters (Physical, temperature, color, chemical: pH, DO, BOD, COD, TS, TDS, TSS).	Hands out, hands-on models, Reference books and textbooks		biological waste treatment.	
2	Biodegradation of Xenobiotic Compounds	Definition of Xenobiotic compounds, their examples and sources. Introduction to Microbial Diversity and Xenobiotic Biodegradation, Effect of chemical structure on biodegradation, recalcitrance, co metabolism and biotransformation. Factors affecting biodegradation, microbial degradation of hydrocarbons,	PPI, Smart board, short films, video hands out, hands-on models. Reference books and textbooks	8	ABL- Understand the concept of biodegradation of xenobiotic compounds through interactive and hands-on activities..	CO2
3	Biotransformation'and Biocatalysts	Basic organic reactions mechanism-Common prejudices against enzymes, advantages and disadvantages of biocatalysts,isolatedenzymes versus whole cell systems, Biocatalytic application, catalytic antibodies, stoichiometry. Green Chemistry Applications: Role of biocatalysis in sustainable chemical synthesis. Enzymatic reactions for green solvents and chemicals.	PPI, Smart board, short films, videos, Reference books and textbooks,	8	ABL- Exploring Enzyme Activity 2.Microbial biotransformation	CO 3
4	Bioremediation & Biorestoration	Introduction and types of bioremediations, bioremediation of surface soil and sludge, bioremediation of subsurface material, In situ and Ex-situ technologies, phytoremediation- restoration of coal mines a case study. bio restoration: reforestation through micropropagation, use of mycorrhizae in reforestation, use of microbes for improving soil fertility, reforestation of soils contaminated with heavy metals.	PPI, Smart board, short films, videos, Reference books and textbooks	8	ABL- Understand how bioremediation can be used to clean up oil spills 2.Learn how microorganisms and plants can remove heavy metals from contaminated soil.	CO4
5	Eco-Friendly Bioproducts From Renewable Sources	Introduction to Eco-Friendly Bio products from renewable sources, Fundamentals of composting process, scientific aspects and prospects of biofuel production-bioethanol, biohydrogen and biodiesel. Biofertilizers and biopesticides. Types, benefits,	PPI, Smart board, short films, videos	8	ABL- Investigate the creation and benefits of biodegradable packaging materials.	CO5

		limitations, challenges, and future prospective of Bioplastics, Status of biotechnology in environment protection and its future.	Reference books and textbooks		2. Understand how natural ingredients can be used to create effective and eco-friendly cleaning products.	
Total				**40**		

Textbooks	
Sr No	**Book Details**
1.	Textbook of Environmental Biotechnology (Woodhead Publishing India in Energy) by Pramod Kumar, Vipin Kumar WPI
	Environmental Microbiology by Dr P D Sharma Rastogi Publication.
	Textbook of Environmental Biotechnology by Pradipta Kumar Mohapatra
Reference Books	
Sr No	**Book Details**
	Environmental Biotechnology" by Bhattacharya B C and Banerjee R
	Environmental Biotechnology: Basic Concepts and Applications" by Indu Shekhar Thakur
	Environmental Biotechnology by Rajmohan Joshi Rekhta Books
Links (Only Verified links should be pasted here)	

- **Unit 1 https://www.youtube.com/watch?v=Jj16iZ6unBQ**
- **Unit 2 https://www.youtube.com/watch?v=6RHXbQBkXrY**
- **Unit 3 https://www.youtube.com/watch?v=QNOivQcSjWc**
- **Unit 4 https://www.youtube.com/watch?v=oRBeBZcUies**
- **Unit 5 https://www.youtube.com/watch?v=xAms3Q_3pXg**

NIET Greater Noida Autonomous Institute	**NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY** **GREATER NOIDA-201306** **(An Autonomous Institute)** **School of Biotechnology**

Subject Name: Immunology and Immunotechnology	**L-T-P [3-0-0]**
Subject Code: BBT0402	**Applicable in Department: Biotechnology**
Pre-requisite of Subject: Students should know the basics of cell biology and human physiology	
Course Objective: The course will foster an understanding of immunological principles, including antigen-antibody interactions, immune cell activation and regulation, and the development of immunological memory. Students will learn to critically analyze scientific literature, design experiments, and interpret research findings. They will also explore the application of immunological methods in areas such as immunotherapy, including the use of monoclonal antibodies, immune checkpoint inhibitors, vaccines, and adoptive cell therapies for treating various diseases.	

Course Outcomes (CO)

Course outcome: After completion of this course students will be able to:		**Bloom's Knowledge Level(KL)**
CO 1	Identify and explain in detail the basic components and functionalities of the immune system.	K1
CO2	Identify and explain antigen and antibody structure and function, thus will be able to understand the associated scientific and industrial research and technologies.	K1,K2
CO3	Understand the technical aspect of immunological reactions and their application in scientific research.	K2,K3
CO4	Describe various ways of regulation of immune response; and thus, will be able to critically evaluate the regulatory mechanisms and their importance in human health.	K2,K4
CO5	Associate the immunological mechanisms with various kinds of human diseases and health conditions.	K2

Syllabus

Unit No	Module Name	Topic covered	Pedagogy	Lecture Required (L+P)	Practical/ Assignment/ Lab Nos	CO Mapping
1	**OVERVIEW OF THE IMMUNE SYSTEM**	Introduction to immunity and immune system, Cells and Molecules of the immune system, Haematopoiesis, Characteristics and players of innate and adaptive immunity, Humoral and Cell mediated immune response, Primary and Secondary lymphoid organs, Structure, function and application of cytokines, Inflammation-features and Inflammatory response, Pro-inflammatory and anti-inflammatory cytokines, T &B cell maturation, activation and differentiation.	Visual Aids, Interactive Activities, Multimedia Resources	8	PBL: Count the blood cells using hemocytometer	CO1
2	**ANTIGEN AND ANTIBODY STRUCTURE**	**Antigens:** Characteristics and types of Antigens, Factors affecting the immunogenicity, Haptens and adjuvants, Epitopes, Characteristics of T&B cell epitopes. **Antibodies**: Structure, functions and characteristics of different classes of antibodies, Antigenic Determinants on Immunoglobulins, Generation of antibody diversity, Somatic hyper-mutation, Monoclonal and polyclonal antibodies and their commercial preparation	Visual Aids, Interactive Activities, Multimedia Resources	8	ABL: Understanding the structure and function of antibodies by preparing model.	CO2
3	**IMMUNO-TECHNIQUES AND IMMUNIZATION**	Antigen and antibody interactions cross reactivity, precipitation reactions, and Immunological techniques: serological techniques, Immuno-diffusion assay, ELISA, RIA, Western blotting. ELISPOT assay, Immuno-Histochemistry, Flow Cytometry, FACS sorting, Immuno-precipitation, Active immunization, passive immunization, Antibodies in diagnostics, Vaccines and their types.	Visual Aids, Interactive Activities, Multimedia Resources	8	PBL: Separate and identify proteins based on their electrophoretic mobility and antigen-antibody interactions.	CO3
4	**MHC AND REGULATION OF IMMUNE RESPONSE**	Structure and Function of MHC molecules, Antigen presenting cells, Exogenous and Endogenous pathways of antigen processing and presentation, Germinal centre, Plasma Cells, BCR signalling, Complement system and pathways, immune tolerance negative/positive selection, TCR rearrangement, co-stimulatory molecules. T cell subtypes: Th1, Th2, Th17, Tregs etc. Memory B and T cell responses, Immune checkpoints: PD1, CTLA4, TIM3 etc. CD4 and CD8 receptors.	Visual Aids, Interactive Activities, Multimedia Resources	8	ABL: To understand how the immune system responds to external threats.	CO4
5	**IMMUNITY AND DISEASES**	Immunity without infection: autoimmunity, hypersensitivity, Transplantation immunology host vs graft reaction Design of recombinant antibodies, Immuno-therapy in cancer, checkpoint therapy. Immunity against infectious diseases (virus, bacteria and protozoan), AIDS, Immune response in plants- an Overview	Visual Aids, Interactive Activities, Multimedia Resources	8	ABL: Role-playing exercise as immune cells and cancer cells, demonstrating how checkpoint	CO5

					inhibitors work.	
Total				**40**		

.

Textbooks	
Sr No	**Book Details**
1.	Immunology and Immunotechnology by Ashim K. Chakravarty, Oxford University Press
Reference Books	
Sr No	**Book Details**
1.	Kuby Immunology by Thomas J. Kindt, Barbara A. Osborne, Richard Goldsby. 8th edition
2.	Introduction to Medical Immunology by Gabriel Virella. 7th edition
Links (Only Verified links should be pasted here)	
https://youtu.be/lXfEK8G8CUI?si=31lzqyT4DZQlk0QI https://youtu.be/BSypUV6QUNw?si=uEY07sJyezf19TRy https://youtu.be/LmpuerlbJu0?si=TWVNfGAnMNsTbU4w https://youtu.be/UZTf3OXJDWA?si=PJpxMyHieof48RIE https://youtu.be/23O8rRHgluA?si=by_Yb1Qgpy5cMWfH	

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY
GREATER NOIDA-201306
(An Autonomous Institute)
School of Biotechnology

Subject Name: Analytical Techniques	**L-T-P [2-0-0]**
Subject Code: BBT0401	**Applicable in Department: Biotechnology**
Pre-requisite of Subject: Students should know about the different analytical techniques.	
Course Objective: The primary objectives of this course are to develop the skills to understand the theory and practice of bio analytical techniques and to provide scientific understanding of analytical techniques and detail interpretation of results that will help them to demonstrate a broad understanding of life science technologies.	

Course Outcomes (CO)

Course outcome: After completion of this course students will be able to:		**Bloom's Knowledge Level(KL)**
CO 1	Describe the principles and various components of different microscope to analyse and characterize biomolecules.	K1
CO2	Describe the general principle of chromatographic separations and apply these techniques to the separation of a hypothetical protein sample.	K1, K3
CO3	Understand the regions of electromagnetic spectrum and relate them to spectroscopic methods	K2
CO4	Outline and understand the concept of gel electrophoresis.	K2
CO5	Apply centrifugation techniques for the separation of biological samples.	K3

Syllabus

Unit No	**Module Name**	**Topic covered**	**Pedagogy**	**Lecture Required (L+P)**	**Practical/ Assignment/ Lab Nos**	**CO Mapping**
1	Microscopy and its types	Light microscopy, Bright & Dark Field microscopy, Fluorescence microscopy, Phase Contrast microscopy, Electron microscopy: TEM and SEM, Atomic force microscopy.	Motivation and Direction of activity	6	ABL: Comparative microscopy observation.	CO1

			Practical based learning			
2	Chromatography	Principle and Operations of Chromatography, Thin layer chromatography, Ion Exchange Chromatography, High Performance Liquid Chromatography (HPLC), Gas Liquid Chromatography (GLC), Affinity Chromatography	Motivation and Direction of activity Practical based learning	7	ABL: Affinity chromatography role-play.	CO2
3	Spectroscopy	Electromagnetic radiation and spectrum,Atomic absorption and Atomic emission spectroscopy,Principle, working and applications of UV-VIS, NMR, ESR and IR spectrometer, Principle and applications of Mass Spectroscopy, Basics of X-Ray diffraction analysis and their application in biotechnology.	Motivation and Direction of activity Practical based learning	8	ABL: Instrument Familiarization Acitivity	CO3
4	Electrophoresis	Theory of Electrophoresis, Factors affecting the migration of substances Gel electrophoresis, PAGE, SDS-PAGE, Agarose Electrophoresis of Nucleic Acid, Isoelectric Focusing of Protein Pulse Gel Electrophoresis and Western Blotting.	Motivation and Direction of activity Practical based learning	6	ABL: Electrophoresis Simulation.	CO4
5	Centrifugation and Biosensors	Theory of centrifugation and sedimentation. Types of centrifuges, Preparative and analytical centrifugation; Density gradient centrifugation. Application of centrifugation for preparative and analytical purpose.Biosensors: Principles and definition, characteristics of Ideal biosensors, Biochemical components of biosensors:Enzyme based biocatalyst sensors, Bioaffinity systems, Immunosensors.	Motivation and Direction of activity Practical based learning	8	ABL: Centrifuge Simulation.	CO5
Total				**35**		

Textbooks	
Sr No	**Book Details**
1.	Wilson and Walker, “Principles and Techniques of Practical Biochemistry” 5th Edn., Cambridge Knew pros 1997.

	Biotechniques: Theory & Practice: Second Edition by SVS Rana, Rustogi Publications.
	Biochemical Methods of Analysis: Saroj Dua And Neera Garg: Narosa Publishing House, New Delhi. 4. Bioanalytical Techniques: ML Srivastava; Narosa Publishing House, New Delhi.

Reference Books

Sr No	Book Details

Links (Only Verified links should be pasted here)

1- https://www.youtube.com/watch?v=n18jMutR_z0
2- https://www.youtube.com/watch?v=PMq02umihQk
3- https://www.youtube.com/watch?v=2Y8pSoS0d1g
4- https://www.youtube.com/watch?v=BM9qQ_sHWP8
5- https://www.youtube.com/watch?v=jn8iT31w9s4

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY
GREATER NOIDA-201306
(An Autonomous Institute)
School of Biotechnology

Subject Name: Structural and Computational Biology **L-T-P [0-0-6]**

Subject Code: BBT0455 **Applicable in Department: Biotechnology**

Pre-requisite of Subject: Bioinformatics

Course Objective: To exhibit depth and breadth of knowledge by demonstrating a well-developed understanding of biological sciences and able to critically analyse and solve problems in biotechnology by gathering, synthesizing and critically evaluating information from a range of sources.

Course Outcomes (CO)

Course outcome: After completion of this course students will be able to:		**Bloom's Knowledge Level(KL)**
CO 1	Understand the various tools and techniques related to in-silico modeling of biomolecules. Analyze problems related to collection and analysis of biological data	K1, K2, K3
CO2	Speculate RNA Structure by different methods and its limitations	K1, K2
CO3	Understand different Machine algorithms and capable to evaluate and validate by statistical significance	K1, K2, K3
CO4	Understand the application of molecular dynamics, molecular mechanism and its application in protein folding	K1, K2
CO5	Apply the knowledge of molecular modeling in drug designing and development	K1, K2, K3

Syllabus

Unit No	**Module Name**	**Topic covered**	**Pedagogy**	**Lecture Required (L+P)**	**Practical/ Assignment/ Lab Nos**	**CO Mapping**
1	Sequence Alignment	Exercise 1: Homology identification Exercise 2: Genomic sequence annotation (Genes and ORFs identification) Exercise 3: Protein structure prediction (Secondary	Encourage students to explore freely available	12	• PBL: Biological Network Identification	CO1

		Exercise 4: Protein structure prediction (Tertiary structure prediction) Exercise 5: Protein function prediction. Exercise 6:Biological network identification Exercise 7: Next generation sequencing Exercise 8: Microarray data analysis	bioinformatics databases, tools, and resources to gain practical experience.		Tools: Cytoscape, Gephi Exercises: Create and visualize protein-protein interaction networks using Cytoscape. Analyze and interpret biological networks using network statistics and clustering. Import and analyze gene co-expression networks using Gephi.	
2	RNA Structure and Function	Exercise 9 Basics of RNA Structure prediction and its limitations. Exercise 10: Database Searching: Introduction, Evolutionary Basis of Sequence Alignment Exercise 11: Features of RNA Secondary Structure Exercise 12: RNA structure prediction methods: Based on self-complementary regions in RNA sequence Exercise 13: RNA structure prediction methods: Minimum free energy methods Exercise 14: Suboptimal structure prediction by MFOLD Exercise 15: Prediction based on finding most probable structure and Sequence co-variance method Exercise 16: Application of RNA structure modeling	Practical examples, and hands-on exercises to engage learners and reinforce their understanding.	12	PBL: Use the RNAfold web server to predict the secondary structure of a given RNA sequence.	CO2
3	Biostatistics	Exercise 17: Introduction to biostatistics and its role in biomedical research Exercise 18: Data collection methods and sampling techniques search Exercise 19: Measures of central tendency (mean, median, mode) Exercise 20: parametric tests and non-parametric tests. non-parametric	Numerical approach	12		CO3

		tests. Correlation and Regression Analysis.				
4	Molecular Modelling:	Exercise 21: Molecular Modeling by Homology Exercise 22: construction of frame work, selecting variable regions, Exercise 23: Back bone and side chain placement and refinement Exercise 24: Optimization and validation of protein models. Exercise 25: Threading and Ab-initio modeling Exercise 26: Ramchandran plot.	Practical examples, hands-on	12	PBL: Validate Protein 3D Structure using Ramchandran plot	CO4
5	Insilico Drug Designing	Exercise 27: Major steps in Drug Designing, Ligand and Structure based drug designing Exercise 28: Protein-ligand docking Exercise 29: QSAR Modeling Exercise 30: P Pharmacodynamics (Efficacy & Potency) &Pharmacokinetics (ADME), Lipinski's rule of five, Pharmacogenomics, MD simulations	Hands-on exercises to engage learners and reinforce their understanding	12	PBL: Perform a protein-ligand docking simulation using MVD	CO5
Total				**60**		

Textbooks	
Sr No	**Book Details**
1.	Bioinformatics Data Skills by Vince Buffalo
	An Introduction to Bioinformatics Algorithms by Neil C. Jones and Pavel A. Pevzner
	Biological Sequence Analysis: Probabilistic Models of Proteins and Nucleic Acids" by Richard Durbin, Sean R. Eddy, Anders Krogh, and Graeme Mitchison.
Reference Books	
Sr No	**Book Details**
Links (Only Verified links should be pasted here)	

NIET Greater Noida Autonomous Institute	**NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY** **GREATER NOIDA-201306** **(An Autonomous Institute)** **School of Biotechnology**

Subject Name: **Immunology and Immuno-technology Lab**	**L-T-P [0-0-4]**
Subject Code: **BBT0452**	**Applicable in Department:** **Biotechnology**

Lab Experiments

Course Objective: The course aims to equip students with practical skills and theoretical understanding in immunology and immunotechnology, fostering proficiency in experimental techniques and clinical applications.

Course Outcomes (CO)

Course outcome: After completion of this course students will be able to:		**Bloom's Knowledge Level (KL)**
CO 1	Gain a comprehensive understanding of fundamental concepts in immunology, including the immune system's components, mechanisms, and functions.	K1
CO2	Analyze, and interpret experimental data obtained from immunological experiments, including quantitative analysis of antigen-antibody interactions	K6
CO3	Develop practical skills in performing a variety of immunological assays and experiments.	K6
CO4	Apply immunological methods and techniques to investigate questions related to immune function, disease pathology, and therapeutic interventions.	
CO5	Identify blood cells and immune cells using staining technique and isolate, as well as visualize immunological cells microscopically.	

List of Practicals

Sr No	**Program Title**	**CO Mapping**
1.	To identify the blood cells/ immune cell with the help of leishman stain.	1

2.	To determine the blood group and Rh factor of given blood	2
3.	To perform single radial immunodiffusion	3
4.	To perform double immunodiffusion	3
5.	To perform counter current immune electrophoresis	3
6.	To perform Sand-witch ELISA	3
7.	To determination of binding affinity of antigen-antibody complex.	2
8.	To Isolate and perform microscopic visualization of T-cells and B-cells	1
9.	To perform western blotting.	3,4
10.	Histological examination of immune organs.	3,5

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY
GREATER NOIDA-201306
(An Autonomous Institute)
School of Biotechnology

Subject Name: Analytical Techniques Lab	**L-T-P [0-0-4]**
Subject Code: BBT0451	**Applicable in Department: Biotechnology**

Lab Experiments

Course Objective: The course aims to equip students with practical skills and theoretical understanding in immunology and immunotechnology, fostering proficiency in experimental techniques and clinical applications.

Course Outcomes (CO)

Course outcome: After completion of this course students will be able to:		**Bloom's Knowledge Level (KL)**
CO 1	Prepare students to gain practical knowledge about the instruments for analytical techniques used in laboratory.	K1
CO2	Develop among students hand-on experience of separation of biomolecules on electrophoresis unit.	K6
CO3	Provide students with handing of UV spectrophotometer and its understanding.	K6
CO4	To make students understand the application of analytical techniques in research laboratories.	
CO5	Instill the understanding of chromatography among students.	

List of Practicals

Sr No	**Program Title**	**CO Mapping**
1.	Demonstration of basic concept of precision and accuracy using appropriate experimental data.	CO1
2.	To study principle and working of laboratory microscope.	CO1
3.	To analyse the isolated plant pigments using paper chromatography.	CO2
4.	Separation of amino acids using thin layer chromatography.	CO2

5.	Separation of a mixture of polar and non-polar compounds using column chromatographic technique.	CO2
6.	Study of Beer-Lambert's law-using UV-Visible spectrophotometer.	CO3
7.	To study and analysis of DNA sample by agarose gel electrophoresis.	CO4
8.	To study and analysis of protein sample by SDS- PAGE.	CO4
9.	To study the separation of compounds using liquid-liquid extraction experiments.	CO5
10.	To study the separation of biological compounds using various membrane separation.	CO5

NIET Greater Noida Autonomous Institute	**NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY** **GREATER NOIDA-201306** **(An Autonomous Institute)** **School of Biotechnology**

Technical Communication Lab	**L-T-P [0-0-2]**
Subject Code: BASL0451	
List of Practicals	

Lab No.	Unit	Topic	Program Logic Building	CO Mapping	Aligned with university/industry/certifications
1	1	**Case Study Analysis**	The students will be able to develop their critical thinking and analytical skills.	CO1	AKTU/Industry
2	2	**Email Role Reversal: Writing and responding to emails in peer groups**	The students will practice writing and responding to professional emails.	CO2	AKTU/Industry
3	2	**Infographics – Data Analysis and Interpretation Task**	The students will develop their ability to decipher important information from charts, graphs, tables, and diagrams.	CO3	AKTU/Industry
4	3	**Document Redesign Challenge: Redesigning existing technical documents to improve readability**	The students will develop their ability to write and edit professional documents.	CO3	AKTU/Industry
5	3	**Abstract Formulation and Referencing**	The students will be able to write research papers with proper source citations.	CO3	AKTU/Industry
6	4	**Case Study presentations**	The students will improve their analytical skills and by presenting improve their speaking skills.	CO4	AKTU/Industry
7	4	**Presentation on Project Report**	The students will develop professional speaking skills.	CO4	AKTU/Industry
8	4	**Ted talk simulation – summarising a Ted Talk**	The students improve their ability to condense speeches.	CO4	AKTU/Industry
9 & 10	4	**Mock Interviews**	The students will practice and enhance their interview skills.	CO4	AKTU/Industry
11 & 12	5	**Webinar Presentations/Online Interviews**	The students will improve their ability to make presentations in professional scenarios and perform well in online interviews.	CO5	Industry

Textbooks	
Sr No	**Book Details**
1.	Technical Communication – Principles and Practices by Meenakshi Raman & Sangeeta Sharma, 4th Edition, Oxford University Press, 2023, New Delhi.
Reference Books	
Sr No	**Book Details**
1	Technical Communication: A Practical Guide by William S. Pfeiffer and Kaye A. Adkins, Pearson, 2020, UK.
2	The Essentials of Technical Communication by Elizabeth Tebeaux and Sam Dragga, Oxford University Press, 2021, UK.
3	Technical Communication Today by Richard Johnson-Sheehan, Pearson, 2020, UK
4	Strategic Communication in Technical Professions" by Susan K. Miller-Cochran and Jason Tham, Routledge, 2020, UK.
5	Technical Writing for Engineers & Scientists by Michelle V. Z. Holmes, McGraw Hill, 2020, US.
6	Speaking: Second Language Acquisition, from Theory to Practice by William Littlewood, Cambridge University Press, 2022, UK.
7	The Writing Revolution: A Guide to Advancing Thinking Through Writing in All Subjects and Grades by Judith C. Hochman and Natalie Wexler, Jossey-Bass, 2022, USA.

NIET Greater Noida Autonomous Institute	**NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY** **GREATER NOIDA-201306** **(An Autonomous Institute)** **School of Biotechnology**

Branch- B.TECH. (CSE/IT/CSE(R)/AI/AIML/DS/CYS/IOT/CS/EC/ME/BT)/M. Tech (Int.)	
Subject Code- BNC0301/BNC0401	**L - T – P** **2 – 0 - 0**
Subject Name- Artificial Intelligence and Cyber Ethics	**No. of hours- 30**

Pre-requisite of Subject: Basic understanding of computer systems and ethics.

Course Objective- The course aims to foster critical thinking about ethical issues, promote responsible use of technology, and ensure students can identify, analyze, and address ethical dilemmas in AI and cyber domains.

Course Outcome – After completion of this course students are able to:

CO1 - Learn key principles of AI ethics, summarizing ethical considerations and applications in AI development and deployment.

CO2- Apply policies and framework for Fairness in AI and Machine Learning.

CO3- Apply privacy and security concepts, risk management and regulatory compliance in the field of AI and Cyber Security.

CO4- Understand the nature of cybercrimes, the principles of intellectual property rights (IPR), and the legal measures necessary to address and prevent these issues.

CO5- Describe the impact of AI in Society, employment and workforce.

Course Content

Unit No	Module	Topics Covered	Pedagogy	Lecture Required (T=L+P)	Aligned Practical/Assignment/Lab	CO Mapping
1	**An overview to AI Ethics**	Definition of AI. Ethical principles in AI. Sources of AI data. Legal implications of AI security breaches, Privacy and AI regulations. Key Principles of responsible AI, transparency and accountability, Dual-use dilemma, Human-centric design. Introduction to Cyber	Lecture and Case studies	5	Assignment	CO1

		Laws and Ethics, Historical development of cyber laws, Legal frameworks.				
2	**Fairness and Favoritism in Machine Learning**	Introduction to Fairness and Bias in AI, Types of Fairness and Bias. Impact of Bias and Fairness in AI, techniques for measuring Fairness and Bias. Techniques for mitigating bias. Current policies and frameworks for fairness in AI. Bias in data collection, Fairness in data processing. Generative AI, Types of Bias in Generative AI.	Lecture and Case studies	6	Assignment	CO2
3	**AI Ethics and Cybersecurity Principles**	Importance of privacy and security in AI, AI specific security tools and software, privacy-preserving machine learning (PPML) and privacy-preserving data mining (PPDM) Ethical considerations in phases of AI development life cycle, **Risk management**: Risk assessment and incident response **Regulatory compliance**: GDPR, HIPAA **Case studies:** Implementation of AI ethics guidelines and best practices in engineering projects, Ethical decision-making processes and tools for engineers working with AI technologies	Lecture and Case studies	8	Assignment	CO3
4	**Cybercrimes, IPR and Legal Measures**	Types of cybercrimes and their impact, Legal measures for cybercrime prevention and prosecution. IPR: Copyrights, trademarks, patents, and trade secrets, Ethical implications of intellectual property, Cyber security and privacy issues	Lecture and Case studies	5	Assignment	CO4
5	**AI Contribution to Social Evolution**	Positive and negative political impacts of AI, Role of AI in social media and communication platforms, AI-generated content and deepfakes, Applications of AI in addressing global challenges, Key technical stakeholders in AI deployment: developers, researchers, policymakers, Technical Impacts on Employment and Workforce: Automation technologies: robotic process automation (RPA), autonomous systems	Lecture and Case studies	6	Assignment	CO5

References-

Text Books:

1. Introduction to Information Security and Cyber Laws, Simplified Chinese Edition by Surya Prakash Tripathi, Ritendra Goel, 1 January ,2014

2. AI ETHICS: Paving the Path for Responsible Machine Learning, Shivanand Kumar, 2014

Reference Books:

1. AI ETHICS (The MIT Press Essential Knowledge series), by Mark Coeckelbergh, 2018

2. Computers, Internet and New Technology Laws by Karnika Seth – by Karnika

Links:

Unit 1 https://www.youtube.com/watch?v=VqFqWIqOB1g
Unit 2: https://www.youtube.com/watch?v=hVJqHgqF59A
Unit 3: https://www.youtube.com/watch?v=O5RX_T4Tg24
Unit 4: https://www.youtube.com/watch?v=RJZ0pxcZsSQ
Unit 5: https://www.youtube.com/watch?v=I9FOswjTSGg