JAYPEE INSTITUTE OF INFORMATION TECHNOLOGY

M.Sc. ENVIRONMENTAL BIOTECHNOLOGY
(I SEMESTER)

2023-2024

Course Code	15B1NBT832	Semester Odd (specify Odd/Even)	Semester B Tech VII/ Integrated VII/M Sc (Micro) I/ MSc (Env Biotech) I Session 2023-2024
			Month July to December

Course Name	Biostatistics and Its applications		
Credits	4	Contact Hours	4

Faculty (Names)	Coordinator(s)	Shalini Mani
	Teacher(s) (Alphabetically)	Shalini Mani

COURSE OUTCOMES		COGNITIVE LEVELS
C430-3.1	Explain the various statistical methods to design a biological studies and data representation.	Understanding (Level 2)
C430-3.2	Apply different statistical methods and approaches to study the significance of a study.	Apply (Level 3)
C430-3.3	Examine the relationship between different parameters of a study.	Analyze (Level 4)
C430-3.4	Choose appropriate statistical methods, tools and resources including prediction, validation and evaluation of the biological studies.	Evaluate (Level 5)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction	Application and use of Biostatistics as a science, scope.	1
2.	Study design in various fields of research	general principles of study design and its implications for valid inference	1
3.	Sampling theory	Sampling scheme, simple/ systematic/ stratified/ cluster sampling, Sources of data collection	2
4.	Data presentation	Graphical, tabular, Mathematical, finding the central tendency, measure of variations	3
5.	Overview of different statistical methods used in the field of	Hypothesis testing, T-test, Chi square test, ANOVA, Sign Test, Wilcoxon Signed Rank Test, Wilcoxon Rank Sum Test, odds ratio, Binomial/normal/Poisson distribution of probabilities, determination of power of study and sample size calculation, regression analysis, correlation analysis,	13

		biological sciences.		
6.	Analysis of data source	Assess data sources and data quality for the purpose of selecting appropriate data for specific research questions	**3**
7.	Selection of statistical methods	Identifying the appropriate statistical methods to be applied in a given research setting, applying the selected methods and analysis.	**4**
8.	Application of Biostatistical analysis.	Designing various studies of medical/ health/ Microbial/Agricultural/Genetics/Pharamaceutical science related studies. Data analysis using different methods Result interpretation	**7**
9.	Case studies	Based on various research studies and systematic reviews.	**4**
10.	SPSS, Stats at the bench	Introduction to SPSS, Entering data in SPSS editor. Solving the compatibility issues with different types of files. SPSS and working with **descriptive statistics.**	4
		Total number of Lectures	**42**

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (assignment, class test, quiz)
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Pranab Kumar Banerjee, Introduction to Biostatistics (4th Edition), S Chand and Company, 2015.
2.	Veer Bala Rastogi, Biostatistics (3rd Edition), Medtech, 2015
3.	S. Kartikeyan, R. M. Chaturvedi, R. M. Bhosale, Comprehensive textbook of biostatistics and research methodology(1st Edition), Bhalani Publishing House, 2016
4.	B Antonisamy Prasanna Premkumar Solomon Christopher, Principles and Practice of Biostatistics, Elsevier India, 2017
5.	Susan Holmes, Wolfgang Huber, Modern statistics for Modern Biology. Cambridge University Press, 2019

Course Code	19M21BT113	Semester Odd	Semester M.Sc. Microbiology I
			Session 2023 -2024
			Month from July-December

Course Name	**Biomolecules**		
Credits	4	**Contact Hours**	4

Faculty (Names)	Coordinator(s)	Dr. Reema Gabrani
	Teacher(s) (Alphabetically)	Dr. Reema Gabrani, Dr. Shalini Mani

COURSE OUTCOMES		COGNITIVE LEVELS
C113.1	Explain the biomolecules structure and function	Understand Level (C2)
C113.2	Analyze bioenergetics and metabolic pathways for physiological and pathological conditions	Analyze Level (C4)
C113.3	Apply the concepts of enzymes, hormones and signaling	Applying Level (C3)
C113.4	Illustrate the basics in genomics and proteomics	Understand Level (C2)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Carbohydrates and Bioenergetics	Chemical composition and bonding; Carbohydrates: Classification, basic chemical structure; General reactions of the functional groups; Physiological significance; Metabolism of carbohydrate: Glycolysis, TCA, gluconeogenesis, PPP, ATP role; Respiratory chain and oxidative phosphorylation	11
2.	Lipids	Classification, structure and function of major lipid subclasses; chylomicrons, LDL, HDL, and VLDL; Pathological changes in lipid levels. Formation of micelles, monolayers, bilayer, liposomes; biosynthesis of fatty acids and ketogenesis	7
3.	Proteins	Amino acids: Classification, Properties, Protein Structure: primary, secondary, tertiary and quaternary structure; separation techniques; biosynthesis of non-essential amino acids and catabolism of protein and amino acids in born errors of metabolism. Enzymes: kinetics, functions	7
4.	Nucleotides	Nucleic acid structure, Nucleotides and nucleosides; metabolism of purines and pyrimidines	6
5.	Hormones	Characteristics of hormones/ signalling molecules; function, signal transduction	6

6.	Introduction to Genomics and proteomics	DNA sequence analysis methods; gene disease association; Introduction and scope of proteomics	5
		Total number of Lectures	**42**

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Presentation, Assignments)
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	JM Berg, L Stryer, J Tymoczko, G Gatto, "Biochemistry", 9th Ed. San Francisco, 2019 WH Freeman
2.	ljsbrand Kramer, "Signal transduction", Academic Press, 2015 Harper
3.	VW Rodwell, D Bender, K M Botham, P J Kennelly, P A Weil, "Harper's Illustrated Biochemistry", 31st Ed. McGraw-Hill Lange 2018
4.	Jeremy M. Berg , "Biochemistry" 8th Ed. W. H. Freeman 2015
5.	DL Nelson and MM Cox, "Lehninger Principles of Biochemistry", 7th Ed. WH Freeman 2017

Biomolecules & 19M21BT113			
	Course Outcome	**Direct Assessment Tools (80%)**	**In-Direct Assessment Tools (20%)**
C113.1	Explain the biomolecules structure and function (C2)	T1, End Sem, Assignment-1	Course Exit Survey
C113.2	Analyze bioenergetics and metabolic pathways for physiological and pathological conditions (C4)	T1, T2, End Sem, Assignment-2	Course Exit Survey
C113.3	Apply the concepts of enzymes, hormones and signaling (C3)	T2, End Sem	Course Exit Survey
C113.4	Illustrate the basics in genomics and proteomics (C2)	End Sem, Assignment-3	Course Exit Survey

Subject Code	20M31BT111	Semester Odd	Semester I
			Session 2023-24
			Month from July to December
Subject Name	Environmental chemistry		
Credits	3-1-0	Contact Hours	4

Faculty	Coordinator(s)	Dr. Ekta Bhatt
	Teacher(s) (Alphabetically)	Dr. Ekta Bhatt

COURSE OUTCOMES		COGNITIVE LEVELS
CO.1	Explain various aspects of chemical and biochemical principles of environmental processes	Understanding Level Level II
CO.2	Identify types of toxic substances and analyze their toxicological impact	Applying Level Level III
CO.3	Apply concepts in organic and inorganic substances to processes involved in addressing environmental problems	Applying Level Level III
CO.4	Analyze degradation products of hazardous substances, their environmental fate and associated risks	Analyzing Level Level IV

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures for the module
1.	Concept and scope of Environmental Chemistry	Definition and explanation for various terms and segments of the environment; Principles and cyclic pathways in the environment.	5
2.	Chemistry of Air, water, soil and waste water	Chemical composition of air and air pollutants; Sources; Sinks; Classification and effects of air pollutants on living and non-living things. Chemistry of water, Chemistry of soil, Industrial waste	8
3.	Chemistry of Organic and Inorganic chemicals in the Environment	Organic chemicals in the environment; Aliphatic/aromatic hydrocarbons. Soaps, surfactants, Pesticides, Polymers, drugs, dyes, oils, grease. Inorganic chemicals in the environment; Inorganic gaseous pollutants; Particulate matter; Trace level toxic metals; Inorganic pesticides & fertilizers, acids, alkalis, salts, complexes.	8

4.	**Environmental monitoring and sample analysis**	Sampling of air and water pollutants; Monitoring techniques and methodology, pH, Dissolved Oxygen (DO); Chemical oxygen demand (COD); Biological Oxygen Demand (BOD); Speculation of metals, monitoring & analysis of CO, NO2, CO2, SO2, Pesticide residue; Phenols and petrochemicals.	5
5.	**Instruments used in chemical analysis of environmental samples**	UV-Visible spectrophotometer; High performance liquid chromatography (HPLC); Gas chromatography (GC); Electro analytical methods; NMR and Gas chromatography and Mass Spectrometry (GC-MS).	8
6.	**Chemistry of degraded hazardous substances**	Introduction to hazardous waste; Degradation products of commercial waste; Degradation of agro based chemicals; Solid waste management and environment; Destruction of hazardous substances: acid halides and anhydrides, alkali metals.	6
7.	**Toxic chemicals in the environment**	Atmospheric toxicants; Toxic heavy metals; Pesticides and pesticide residues; Solvents and other organic chemicals; Petroleum and other related compounds; Carcinogens; Assessment of toxicity; Assessment of environmental risks; Chemistry of toxic chemical and hazardous substances in the environment.	4
		Total number of Lectures	**44**

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Presentation, Assignments)
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)
1. A Text-Book of environmental chemistry by V. Subramanian, Year - 2011 Publishing house I.K. International publishing house Pvt. Ltd ISBN – 9789381141199
2. Environmental chemistry by Colin Baird and Michael Cann, 2004, Publishing house W. H. Freeman, Third edition, ISBN - 978 - 0716748779
3. Mahajan, S.P., Pollution Control in Process Industries, Tata McGraw-Hill, 1985.
4. Y. Mido & M. Satake, Chemicals in the environment, Discovery Publishing House, 2003.
5. C.S. Rao, Pollution Control Engineering, John Wiley & Sons Inc.
6. S. M. Khopkar, Environmental pollution analysis, 1st Edition, Wiley Eastern, 1993.

Scheme of Evaluation:

T1 Examination: 20 marks

T2 Examination: 20 marks

End Term Examination: 35 marks

Teacher's Assessment: 25 marks

PBL component:

1. The students at the end of the course can learn various analytical techniques for the detection of environmental pollutants.
2. The students at the end of the course will be learn the sampling of soil and water pollutants, monitoring techniques and methodology, and report making.

Course Code	20M35BT111	Semester Odd	Semester I Session 23-24
			Month from July to December

Course Name	Environmental Biotechnology Lab-I		

Credits		0-0-4	Contact Hours		8

Faculty (Names)	Coordinator(s)	Dr. Garima Mathur
	Teacher(s) (Alphabetically)	Dr. Smriti Gaur, Dr. Nidhi Batra, Dr. Ankisha Vijay, Dr. Nivedita

COURSE OUTCOMES Students will be able to		COGNITIVE LEVELS
CO1	Identify methods for quantitative analysis of biomolecules and their purification techniques	Apply Level (C3)
CO2	Apply various methods for water quality analysis, nucleic acid isolation and its quantification	Apply Level (C3)
CO3	Analyze different microbial genomes using computational tools	Analyze Level (C4)
CO4	Summarize computational tools for statistical analysis of biological data	Evaluate Level (C5)

Module No.	Title of the Module	List of Experiments	
1.	**Analytical Techniques**	Preparation of buffers; Quantitative determination of proteins, carbohydrates, nucleic acids; Analysis of amino acids by TLC; Purification of proteins and their analyses using Chromatography techniques a) Ion exchange chromatography, b) Size exclusion chromatography and c) Affinity chromatography	CO1
2.	**Nucleic acid isolation and quantification**	Genomic DNA isolation; Plasmid DNA isolation; DNA/RNA quantification	CO2
3.	**Microbial genetics**	Microbial antibiotic resistance, comparative analysis of microbial genomes	CO3
4.	**Environmental Parameters**	Introduction to Metering Devices (pH, Turbidity, Conductivity and DO); Alkalinity of Natural; Waters volumetric Analysis, Technical Report; Nitrites/Nitrates in Drinking Water; Spectrophotometry/ Calibration Curves; Ortho-Phosphates in wastewater, heavy metal detection assay	CO2
5.	**Biostatistical analyses**	Computational tools for statistical analysis of biological data; SPSS, Excel, GraphPad - compare the results of different	CO4

		experiments using t-test; compare the results of different experiments using ANOVA; understand the basic work flow of Graph pad and SPSS.	

Evaluation Criteria

Components	Maximum Marks
Mid Term Exam	20
End Term Exam	20
Day to Day	60
Total	**100**

PBL: Students can work in groups and give presentation/report on analysis of waste water from different sites and carry out statistical analysis of the same or they can look for recent advances in environmental monitoring and remediation techniques. Also, genomic or water sample data from database/net can be used for statistical analysis and presentation of the report for the same.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Keith Wilson, John Walker. ―Principles and Techniques of Practical Biochemistry‖. Cambridge University Press, 2000
2.	R C Gupta and S Bhargav Practical Biochemistry 5th ed. (PB 2018) CBS Publishers and Distributers Pvt Ltd.
3	https://vlab.amrita.edu/?sub=2&brch=191&sim=341&cnt=1
4	https://vlab.amrita.edu/?sub=3&brch=70&sim=1099&cnt=1
5	https://vlab.amrita.edu/?sub=3&brch=63&sim=154&cnt=1
6.	https://www.youtube.com/watch?v=7h0XrF1BleM
7	Design of experiments, principle and the expected outcome and related literature will be provided to the student

Course Name & Code: Microbial Genetics & Molecular Biology (19M21BT115), NBA Code: C112

Detailed Syllabus

Course Code	19M21BT115 C112	Semester: Even		Semester: I Session: 2023-24 Month from: January to June
Course Name	Microbial Genetics & Molecular Biology			
Credits	3-1		Contact Hours	4

Faculty (Names)	Coordinator(s)	Dr Sonam Chawla
	Teacher(s) (Alphabetically)	Dr Sonam Chawla, Dr Vibha Gupta

S. No.	DESCRIPTION	COGNITIVE LEVEL (BLOOM's TAXONOMY)
CO112.1	Explain fundamental principles of molecular biology	Understanding Level (C2)
CO112.2	Apply knowledge of microbial genome architecture and gene regulation	Apply Level (C3)
CO112.3	Analyse various methods of gene transfer and extrachromosomal inheritance	Analysis Level (C4)
CO112.4	Interpret different aspects of DNA mutations, DNA repair, Linkage & Mapping	Understanding Level (C2)

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures for the module
1.	The nature of Genetic material	Discovery of DNA and experimental evidence, The structure of DNA and RNA; Melting of DNA, Superhelicity, Genome architecture, Chromatin arrangement, nucleosome formation, C value paradox, central dogma	02
2.	DNA replication and repair	DNA replication mechanism, enzymes involved and models of DNA replication, DNA methylation, inhibitors of DNA replication, DNA damage and repair: Molecular basis of spontaneous and induced mutations, types of mutation, Ames test, DNA repair pathways - excision, mismatch, photoreactivation, Double Strand Break Repair	06
3.	DNA transcription	Transcription machinery - various transcription enzymes and cofactors, initiation, elongation and termination, enhancer sequences and control of transcription, Structure and function of RNA polymerase	07
4.	DNA translation	The genetic code and protein structure, Mechanisms of translation - initiation complex, ribosomes and tRNA, factors, elongation and termination, *in vitro* translation systems, polycistronic/monocistronic synthesis, inhibitors of translation,	06
5.	Methods of gene transfer in Bacteria	Transformation - natural transformation systems, mechanism, chemical-mediated and electro-transformation; Conjugation - nature of donor strains and compatibility, interrupted mating and temporal mapping, F plasmid, Hfr transfer, horizontal gene transfer	04

6.	**Plasmids & Movable genetic elements**	Plasmid types, detection, replication, partitioning, copy-number control, properties of some known plasmids, Extrachromosomal inheritance	04
7.	**Genetic control mechanism in prokaryotes**	Operons, lac system, trp system for negative & positive gene regulation, lambda phage, complex operons	06
8.	**Viral genome & Methods of gene transfer in Viruses**	Introduction to viral genetics, viral life cycles and phage replication, Transduction - Generalized and specialized transduction; gene mapping by specialized transduction	04
9.	**Linkage and gene Mapping**	Recombination (homo and heterologous), linkage symbolism, single and double cross overs, linkage maps, genetic analysis, Recombination as a molecular biology tool.	03
		Total number of Lectures	**42**

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	Lewin's Genes XII by Jocelyn E. Krebs, Elliott S. Goldstein and Stephen T. Kilpatrick Jones and Bartlett Publishers, Sudbury, Massachusetts, 2018.
2.	Molecular Biology of the Gene by J.D. Watson, T.A. Baker, S.P. Bell, A. Gann, M. Levin, R. Losick, 7th edition, Benjamin Cummings, San Francisco, USA, 2013.
3.	Molecular Biology of the Cell by B. Alberts, A. Johnson, J. Lewis, M. Raff, K. Roberts, P. Walter, 6th edition, Garland Science, New York and London, 2017.
4.	Lehninger Principles of Biochemistry Seventh Edition – David L. Nelson; Michael M. Cox, 2017
5.	An Introduction to Genetic Analysis by Suzuki DT, Griffiths AJF, Miller JH and Lewontin RC, WH freeman and Company, New York

Project based learning: Students in groups will present applications of microbial mutations and horizontal gene transfer on human health, environment preservation

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	M. J. Pelczar, E. C. S. Chan and N. R. Krieg. *Microbiology: Concepts and Applications.* India: Tata McGraw Hill, 1993.
2.	M. T. Madigan, J. M. Martinko and J. Parker. *Brock Biology of Microorganisms,* 10th Edition. New Jersey, USA: Prentice Hall, 2003.
3.	G. J. Tortora, B. R. Funke and C. L. Case. *Microbiology: An Introduction,* 8th Edition. San Francisco, USA: Pearson/Benjamin Cummings, 2004.
4.	J. Black. *Microbiology: Principles and Applications*. New Jersey, USA: Prentice Hall, 2004.
5.	L. M. Prescott, J. P. Harley and D. A. Klein. *Microbiology*, 6thedition. New York, USA: McGraw Hill, 2005.
6.	E. W. Nester. *Microbiology Study Guide*. New York, USA: McGraw Hill, 2004.

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Course Code	19M21HS111	**Semester: Odd**	**Semester:** 2023-2024
			Month: July-Dec 2022
Course Name	Presentation and Communication Skills		
Credits	2	**Contact Hours**	2 (2-0-0)

Faculty (Names)	**Coordinator(s)**	Dr. Ekta Singh
	Teacher(s) (Alphabetically)	Dr. Ekta Singh

COURSE OUTCOMES		**COGNITIVE LEVELS**
C101.1	Develop an understanding and appreciate the basics aspects of communication	Understand(C2)
C101.2	Assess the communication challenges of a diverse, global marketplace	Analyze (C4)
C101.3	Create & compose formal reports	Create (C6)
C101.4	Evaluate the effectiveness of business etiquettes and presentation skills	Evaluate (C5)
C101.5	Apply the acquired skills in delivering effective presentations	Apply (C3)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Communication Process, Grammar, and Vocabulary	• Communication: Definition, Model, Channel, Goals • Process of Communication: Linear Concept, Shannon-Weaver Model, the Two-Way Process • Communication Traits: Communication • Apprehension, Style, Argumentativeness and VerbalAggressiveness • Grammar: denotative and connotative words, subject-verb agreement • Techniques of Vocabulary Building	7
2.	Intercultural Communication	• Recognizing cultural diverse world • Developing Cultural Intelligence: High-ContextCultures and Low-Context Cultures • Time as a cultural factor: Monochronic and Polychronic Time • Challenges of Intercultural Communication	6

		• Developing Cultural for Adapting.	
3.	Business Etiquettes, and Presentation Skills	• Ekman's classification of communicative movements • Face Facts, Positive Gestures, Negative Gestures, Lateral Gestures • Preparing and Delivering a Presentation Using Audio-Visual Aids: Presentation Support Sample Presentations	6
4.	Communication for Conflict Management	• Negotiation, Mediation, and Conciliation • Stages in the Negotiation Process • Strategies of Conciliation • Solving Deadlocks • Reaching an Agreement	5
5.	Technical Communication	• Characteristics of a Report • Types of Report • 5 W's and 1 H of a Report • Structure, Format, Parts of a Report • Referencing, and Documentation	4
			28

Evaluation Criteria	
Components	**Maximum Marks**
Mid Term Examination (Presentation)	30
End Semester Examination	40
TA	30 (Assignment/Participation)
Total	**100**

Project Based Learning: Students will be given a project which would require them to work in groups of 5-6 members, identify a TEDTalk and analyse its significance/relevance to the course. While the task of identifying the talk would help them revisit the entire course, analyzing and underlining its significance would help them attain an in depth understanding of the chosen topic. The most important learning however would be to appreciate and understand the importance of team work.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	C.L.Bovee, J.V.Thill, Business Communication Today, 14th Ed, Global Edition Pearson Education, 2018.
2.	R.C. Sharma and Krishna Mohan, Business Correspondence and Report Writing, Mc GrawHillEducation, 2016
3.	Meenakshi Raman and Sangeeta Sharma, Technical Communication: Principles and Practice, Oxford University Press, 2015.
4.	Anna Koneru, Professional Communication, Mc Graw Hill Education Pvt Ltd., 2017
5.	Murli Krishna, Communication Skills for Engineers, Pearson, 2014
6	Menu Dudeja, Communication Skills for Professionals, Satya Prakashan, 2017.
7	Barun K. Mitra, Personality Development and Soft Skills, Oxford University Press, 2012