Jaypee Institute of Information Technology

M.Sc. Environmental Biotechnology

Course Descriptions

SEMESTER 1

Biomolecules

Course Code	**19M21BT113**	**Semester:**Odd	**Semester:** I **Session: 2021-22** July-December
Course Name	**Biomolecules**		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Dr. Priyadarshini
	Teacher(s) (Alphabetically)	Dr. Priyadarshini, Dr. ReemaGabrani

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	**Carbohydrates**	Chemical composition and bonding;Carbohydrates: Classification, basic chemical structure; General reactionsof the functional groups; Physiological significance; Metabolism of carbohydrate: Glycolysis, TCA, gluconeogenesis, PPP	7
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; Enzymes: kinetics, functions; biosynthesis of non-essential amino acids and catabolism of protein and amino acids in born errors of metabolism.	7
4.	**Nucleotides**	Nucleic acid structure, Nucleotides and nucleosides; metabolism of purines and pyrimidines	6
5.	**Bioenergetics**	ATP role; respiratory chain and oxidative phosphorylation	4
6.	**Hormones**	Characteristics of hormones/ signalling molecules; function, signal transduction	6
7.	**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**

PBL: Students will choose any biomolecule/ hormone linked to a particular disease. How is it commercially used as a therapeutic molecule or as a target to manage the disease? The understanding of biomolecules is required for Biotechnology companies including patent firms.

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.	Biochemistry, L. Stryer, W.H. Freeman, San Francisco.
2.	Schaum's Outline Series of Theory and Problems of Biochemistry, Philip W. Kuchel and G.B. Ralston. Int. Ed., McGraw-Hill Book Co.
3.	Biochemistry by Voet and Voet
4.	Principles of Biochemistry, Lehninger C Rs. Publ.

Environmental Biotechnology Lab-I

Course Code	20M35BT111	**Semester** Odd	**Semester** I **Session** 2021-22 **Month from** July to December
Course Name	Environmental Biotechnology Lab-I		
Credits	0-0-4	**Contact Hours**	8
Faculty (Names)	**Coordinator(s)**	Prof Sudha Srivastava	
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES Students will be able to		**COGNITIVE LEVELS**
CO1	Analyze quantitation and purification techniques of biomolecules	Analyze Level (C4)
CO2	Analyze quality and differentiate various forms of isolated DNA	Analyze Level (C4)
CO3	Apply concepts of microbial genetics	Apply Level (C3)
CO4	Experiment with environmental parameter detection procedures	Apply Level (C3)
CO5	Analyze biological datasets using statistical tools	Analyze Level (C4)

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**	Introduction to Metering Devices (pH, Turbidity, Conductivity and DO); Alkalinity of Natural; Waters volumetric Analysis,	CO4

	Parameters	Technical Report; Nitrites/Nitrates in Drinking Water; Spectrophotometry/ Calibration Curves; Ortho-Phosphates in wastewater, heavy metal detection assay	
5.	**Biostatistical analyses**	Computational tools for statistical analysis of biological data; SPSS, Excel, GraphPad - compare the results of different experiments using t-test; compare the results of different experiments using ANOVA; understand the basic work flow of Graphpad and SPSS.	CO5

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. 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

Environmental chemistry

Subject Code	New	**Semester: Odd**	**Semester:**I **Session: 2021-22** July to December
Subject Name	**Environmental chemistry**		
Credits	**3**	**Contact Hours**	**3**

Faculty	**Coordinator(s)**	Ekta Bhatt
	Teacher(s) (Alphabetically)	1. 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**	Organic chemicals in the environment; Aliphatic/aromatic hydrocarbons. Soaps, surfactants,	8

	Environment	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.	
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 trade 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**
Total	**100**

Project Based learning: The students at the end of the course can learn various analytical techniques for the detection of environmental pollutants. The students at the end of the course will learn the sampling of soil and water pollutants, monitoring techniques and methodology, and report making.

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.	Kenneth Wark , Cecil F. Warner, Wayne T. Davis, Air pollution origin and its control work, 3rd Edition,Prentice Hall.
2.	Environmental chemistry, B. K. Sharma.
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.

Biostatistics and Its applications

Course Code	**15B1NBT832**	**Semester:**Odd	**Semester:**I **Session: 2021-22** July to December
Course Name	**Biostatistics and Its applications**		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Dr. Shalini Mani
	Teacher(s) (Alphabetically)	Dr. Shalini Mani

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 biological sciences.**	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**
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
Total	**100**

Project Based learning: Students will learn to represent the data of various fields using various statistical methods. Students will also be able to select the appropriate statistical tool for analysis of different data set and interpret the outcome of any study.

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.	Marcello Pagano, KinberleeGauvreau, Principle of Biostatistics.
2.	Stephen W Looney, Biostatistical methods, Humana Press
3.	Alan J Cann, Maths from Scratch for Biologist, John Willey and Sons Limited Press.
4.	M Bremer, R W Doerge, Statistics at the Bench, Cold Spring harbor Lab Press.
5.	B K Mahajan, Methods in Biostatistics, VII edition, Jaypee Bothers Medical Publishers, 2010.

Microbial Genetics & Molecular Biology

Course Code	**19M21BT115**	**Semester:** Odd	**Semester:** I **Session: 2021-22**July to December
Course Name	**Microbial Genetics & Molecular Biology**		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Dr. Sonam Chawla
	Teacher(s) (Alphabetically)	1. Prof. Krishna Sundari, 2. Dr. Vibha Gupta

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, Post-transcriptional processes: RNA processing, Capping and polyadenylation, rRNA and tRNA processing, RNA Editing; RNAi and miRNAs, Antisense RNA	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, stringent response in bacteria, Post-translational processes: Protein modification,	06

		folding, chaperones, transportation; protein degradation	
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	04
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	03
9.	**Linkage and gene Mapping**	Recombination (homo and heterologous), linkage symbolism, single and double cross overs, linkage maps, genetic analysis	03
10.	**Technological advances**	Recombination as a molecular biology tool, Genetically modified organisms (GMOs) and applications	03
		Total number of Lectures	**42**

Evaluation Criteria

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

Project based Learning: Students were asked to select any disease that is a result of disturbance at cellular level and present their research findings/understanding covering pathophysiological mechanisms, clinical and economic consequences of the disease to the class. The class was also asked to come prepared on the topic so as to contribute during discussions/ brain-storming for alternative solutions to currently accepted clinical approaches to the disease. This real-world example of concepts developed during the lectures reinforced their knowledge in the genetics and molecular biology areas.

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.	Genes IX by Benjamin Lewin, Jones and Bartlett Publishers, Sudbury, Massachusetts, 2007.
2.	Molecular Biology of the Gene by J.D. Watson, T.A. Baker, S.P. Bell, A. Gann, M. Levin, R. Losick, 6th edition, Benjamin Cummings, San Francisco, USA, 2007.
3.	Molecular Biology of the Cell by B. Alberts, A. Johnson, J. Lewis, M. Raff, K. Roberts, P. Walter, 5th edition, Garland Science, New York and London, 2007.
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

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Presentation and Communication Skills

Course Code	**19M21HS111**	**Semester: Odd**	**Semester:** 2021-2022 **Month: July-Dec 2021**
Course Name	Presentation and Communication Skills		
Credits	2	**Contact Hours**	2 (2-0-0)

Faculty (Names)	**Coordinator(s)**	Dr. Ankita Das
	Teacher(s) (Alphabetically)	Dr. Ankita Das

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,	7

		subject-verb agreement • Techniques of Vocabulary Building	
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 • Developing Cultural for Adapting.	6
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	30
(Presentation)	40
End Semester Examination	30 (Assignment/Participation)
TA	
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