

Jaypee Institute of Information Technology

M.Sc. Environmental Biotechnology

Course Descriptions

SEMESTER 2

Environmental Pollution, Assessment & Monitoring

Subject Code	New	Semester: Even	Semester: II Session: 2021-22 Jan to June
Subject Name	Environmental Pollution, Assessment & Monitoring		
Credits	3	Contact Hours	3

Faculty (Names)	Coordinator(s)	Prof. Neeraj Wadhwa
	Teacher(s) (Alphabetically)	Prof. Neeraj Wadhwa

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures for the module
1.	Environmental Pollution and transport of pollutants in environment	Concept of Environmental Pollution; Origin of pollution; Classification and nature of Environmental Pollutants; Major sources; Impacts of Environmental Pollution at local regional and global level, Dispersal, Reconcentration and Degradation of natural organic compounds and Metal Ions	6
2.	Air pollution	Major air pollutants and their sources; Meteorological aspects of air pollution; Oxides of nitrogen and sulphur; Particulate matter; Air pollution standards; Indoor and outdoor air pollution Vehicular air pollution; Air pollution episodes and disasters; Effects of air pollution on human health, animals, plants, material and climate; Formation of fog and photochemical smog and acid rain; Monitoring of air pollution; Control on release of smoke; Gaseous contaminants and odour; Control on release of particulate matter by using different control devices	4
3.	Water Pollution	Principal forms of Water Pollutants and their sources; Pollution of stream, lakes and phenomenon of eutrophication; Water pollution monitoring and water quality standards; Ocean pollution – oil pollution; Ground water pollution and its control, Water pollution prevention Chemical methods in monitoring - Detection methods for COD, pH, alkalinity, TSS, TDS, Total organic carbon, oil, grease etc.; Biosensors of pollution Methods of water sampling for pollution analysis; Biosensors - types and applications in	6

		environmental pollution detection and monitoring; Biological treatment: stabilization pond, aerated lagoon, activated sludge process, trickling filter anaerobic treatment. Methods of monitoring; Biological methods in monitoring; Detection methods for DO, BOD, Pathogen monitoring by heterotrophic plate count; Multiple tube method; Membrane filtration methods; Other emerging techniques such as enzyme detection, hybridization, PCR, Gene probe technology etc.	
4.	Noise Pollution	Concept of noise; Sources of noise; Measurement of noise; Religious festival and noise; Standards of noise; Effects of noise on plants, animals and human beings; Control of noise at source; Industrial noise control; Prevention of public noise; Community noise control..	3
5.	Radiation Pollution	Types and possible hazards of radioactive substances; Measurement of radiation intensity; Effects of radioactive waste pollution on environment and impact of radiation on life; Monitoring and control of radiation pollution	3
6.	Soil Pollution	Importance of soil; Concept of soil pollution; Soil acidity, saline and alkaline soil; Causes of soil salinity; Major soil types; Physical, chemical and biological methods of soil reclamation; Different causes of soil degradation; Chemical and metallic pollution of agricultural soil; Mining and soil pollution; Soil pollution and air quality; Control of soil pollution	4
7.	Solid Waste	Concept of solid waste; Industrial solid waste; Domestic solid waste; Agricultural solid waste; Municipal solid waste; Major sources of solid wastes; Effects of solid waste generation on quality of air, water and public health; Technical approach for solid waste management; Disposal of organic and medical waste; Recovery and recycling of metallic waste; Disposal of plastic waste and hazardous wastes.	4
8.	Environmental Quality Assessment and Monitoring	What is environmental quality? Quality of environment for life on earth and man; Deterioration of environmental quality with reference to anthropogenic impact; Methods of assessment of environmental quality; Short term studies/surveys; Rapid assessment; Continuous short and long term monitoring.	3
9.	Environmental Impact Assessment (EIA)	Need of EIA; Scope and objectives; Types of environmental impacts; Steps involved in conducting the EIA Studies; Environmental Impact Assessment techniques-Ad-hoc method, checklist method, overlay mapping method, network method, simulation and	3

		modeling technique, matrix method, and system diagram technique; Merits and Demerits of EIA studies	
10.	Principles of Remote sensing, its applications in Environmental Monitoring	Concept of Remote sensing; EMR & its interaction with matter; Aerial Photography: Types, Camera, Elements of photo interpretation (Aerial Photography/image recognition); Sensors & platforms; IRS satellites & their sensors; Application of remote sensing in environmental studies	3
11.	Geographical Information System (GIS)	Concept of GIS; Types of Geographical Data; Data Structure; Vector and Raster data: their Advantages and Disadvantages; Input, verification, storage and output of geographical data; Importance of Geographical Information System in environmental studies	3
Total number of Lectures			42
Evaluation Criteria			
Components		Maximum Marks	
T1		20	
T2		20	
End Semester Examination		35	
TA		25	
Total		100	
PBL component: The students at the end of the course can practice solid waste management, applications of remote sensing and GIS in environmental pollution management.			

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.	S. Glasstone, D. Van Nastrand, Source book on atomic energy, 3rd Edition, Germany, 1967
2.	M. Eisendbud, Environmental radioactivity, , Academic Press
3.	E.D. Enger, B.E. Smith, Environmental Science- A study of Inter relationships, WCB Publication
4.	Christon J. Hurst, Ronald L. Crawford, Guy R. Knudsen, Michael J. McInerney, Manual of Environmental Microbiology, 2nd edition, ASM Press. 2001.
5.	Foin, Ecological Systems and the Environment – I
6.	D.L. Wise, Biotreatment Systems, Volume II.
7.	Mizrahi & Wezel, Advances in Biotechnological Process Raina M. Maier, Ian L. Pepper, Charles P. Gerba. Environmental Microbiology,

	Academic Press, 2000.
8.	Gabriel Bitton, Wastewater Microbiology, 2nd Edition. Wiley-Liss; 2nd Edition, 1999
9.	Martin Alexander, Biodegradation and Bioremediation, 2nd Edition, Academic Press, 1999.
10	Bruce Rittman, Perry L. McCarty. Environmental Biotechnology: Principles and Applications, 2nd Edition McGraw-Hill, 2000.

Environmental Microbiology

Course Code	19M21BT114	Semester:Even	Semester:II Session: 2021-22 January to June
Course Name	Environmental Microbiology		
Credits	3	Contact Hours	3

Faculty (Names)	Coordinator(s)	Prof. Krishna Sundari
	Teacher(s) (Alphabetically)	Dr. Susinjan Bhattacharya

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction	Introduction of air, water and soil microbiology, Ecological groups and microbial interactions	4
2.	Extremophiles	Occurrence, diversity, adaptations and potential applications of thermophiles, psychrophiles, methanogens, methylotrophs, acidophiles, alkalophiles, halophiles, oligotrophs, barophiles, organic solvent and radiation tolerants, metallophiles.	3
3.	Biogeochemical cycles	Microbes in nutrient cycling with special reference to carbon, phosphorous, sulfur and nitrogen cycles	3
4.	Degradation & applications of microbial interactions	Microbial degradation of lignocellulosic substances, keratin and chitin and Xenobiotics, Microbial degradation of pesticides; hydrocarbons; clean-up of sites polluted with oil spills, heavy metals and chlorinated solvents; biological treatment of effluents of sugar, pulp and paper industry, Recovery of minerals and metals from ores, Biodeterioration of properties & cultural heritage; microbial deterioration of paper, textile, wood, paint and metal corrosion. Principal methods for their protection, Microbial Plastics	12
5.	Microbial Diversity	Understanding microbial diversity in the environment by culture-dependent approaches and their limitations, and by culture-independent molecular approaches (DNA heterogeneity by reannealing denatured environmental DNA, ARDRA, analysis of FAME profiles, measuring metabolic capabilities using BIOLOG microtitre plates, using DNA probes and PCR primers, G+C analysis, slot-blot hybridization of	10

		community DNA, and fluorescent <i>in situ</i> hybridization of intact cells)	
6.	Waste treatment	Microbes in solid waste and sewage treatment systems. Disinfection of potable water supplies; Chemical and Biological indicators of water safety and quality determination; Microbial assessment of water quality; Standards for tolerable levels of fecal contamination.	10
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: The project involves the students understanding the concepts related to international norms for drinking water quality guidelines and their relation to human health. Students are also acquainted with the air borne disease and their transmissions.

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.	Chan ECS, Pelczar Michael J, Krieg NR, Microbiology, Tata McGraw-Hill Education Pvt. Ltd, 7th Edition, (2009)
2.	R.C. Dubey and D.K. Maheshwari, A textbook of microbiology, S Chand Publishing; Fourth edition (2016)
3.	H D Kumar & Swati Kumar, Modern concept of microbiology, New Delhi Vikas Publishing House 2006, second Revised edition.
4.	Talaro K P, Chess B, Foundation in Microbiology, McGraw-Hill Education, 9 th edition (2014)
5.	Prescott's Microbiology, McGraw-Hill Education; 10th edition (2016)
6.	Ramesh, K. Vijaya, Donnelly James H, Environmental Microbiology, Chennai MJP Publishers 2008.

Immunology and Immunotechnology

Subject Code	19M11BT116	Semester: Even (specify Odd/Even)	Semester: II Session: 2021-22 January to June
Subject Name	Immunology and Immunotechnology		
Credits	3	Contact Hours	3

Faculty (Names)	Coordinator(s)	Prof. Rachana
	Teacher(s) (Alphabetically)	Prof. Rachana, Dr. Shalini Mani

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures for the module
1.	Component of Immune system	Cells and organs of immune system, Innate immunity, adaptive immunity, B cell receptor, T cell receptor	6
2.	Regulation of immune response	Antigen presentation, MHC molecules, Cytokines, Complement systems	4
3	Diseases related to immune system	Autoimmune diseases, hypersensitivity reactions, Immune deficiency, cancer, infectious diseases.	5
4	Organ and tissue transplantation	HLA typing, graft rejection, graft acceptance, case studies.	3
5	Antibody engineering	Antibody diversity, Polyclonal antibody, Hybridoma Technology and its application, Humanized antibody, Phage display technology.	6
6	Immunotechnology	Theory, cross reactivity, precipitation reactions, agglutination reactions, ABO blood grouping, Ouchterlony, Western blotting, Elispot,	10

		immunofluorescence(IHC, FACS), ELISA, Kits for diseases. RIA	
7	Vaccine Technology and its application	Adjuvants, live, attenuated, killed, inactivated, toxoids, recombinants, sub unit, conjugate and DNA vaccines	4
8	Immunotherapy	Passive immunization, activation of NK cells, T Cells, generation of antibody	4
Total number of Lectures			42
Evaluation Criteria			
Components		Maximum Marks	
T1		20	
T2		20	
End Semester Examination		35	
TA		25	
Total		100	
<p>Project based learning: Each student in a group of 4-5 will search the authentic scientific sites (NCBI/Sciencedirect/companies/labs) for the relevant articles/reports discussing application of Immunotechnology and will present/discuss the topic among the class students. Students would also discuss the medical reports of patients (collected from home/friends/internet) and will learn the basic methodology and parameters which are relevant to diagnose a particular disease.</p>			

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.	Immunology (3rd edition) Janus Kuby ,W.H. Freeman and company
2.	Essentials of Immunogy Ivan- roit; 6 th edition (1988); Blackwell Publ
3.	Antibodies A laboratory Manual Harlow and David Lane, Old spring Harbor Laboratory
4.	Immunology – A Short Course, Richard Coico, <i>et al.</i> 5th Ed., Wiley – Liss, 2003.
5.	Immunology, 4th Ed Richard Hyde. Lippincott Wilkins & Wilkins, 2000.
6.	Microbiology & Immunology Online. Richard Hunt. Univ South Carolina, School of Medicine, http://pathmicro.med.sc.edu/book/immunol-sta.htm

Environmental Toxicology

Course Code	20M31BT11 3	Semester: Even	Semester: II Session : 2021-22 Month from: January to June
Course Name	Environmental Toxicology		
Credits	3-1-0	Contact Hours	4
Course Coordinator	Ms. Ekta Bhatt		
Teachers	Dr. Sonam Chawla, Ms.Ekta Bhatt		

COURSE OUTCOMES: Upon completion of the course, students will be able to		COGNITIVE LEVELS
CO1	Identify origin, properties and impact of organic, inorganic pollutants on the environment	Understanding Level (C2)
CO2	<ul style="list-style-type: none"> Interpret the risks and fate of environmental toxicants in relation to principle biotic forms and human health 	Apply Level (C3)
CO3	Examine environmental toxicological problems, communicate to colleagues, write a report and present scientific summary of toxicology and health risks of specific toxicants	Analysis Level (C4)
CO4	Indicate types of toxicants and pertinent environment legislations and regulations	Understanding Level (C2)

Faculty (Names)	Coordinator(s)		
	Teacher(s) (Alphabetically)	Dr. Sonam Chawla Ms. Ekta Bhatt	
1.	Principles of Environmental Toxicology	Introduction to Environmental Toxicology, Toxicology of air pollutants in the ambient, indoor, and occupational environments, soil pollutants insecticides/pesticides, aquatic toxicology in marine and freshwater systems	6
2.	Environmental Fate of Toxicants	Properties of toxic chemicals influencing their distribution and transformations; action of environmental forces affecting toxicant breakdown, movement, and accumulation; sources and occurrence of major classes of environmental toxicants	6
3	Perspectives in Aquatic, Air and Soil	Toxic substances, their fate in marine, freshwater, air and soil, effects on aquatic organisms (effect on development), avian species and soil	7

	Toxicology	microbiota populations, and ecosystems. Emphasis on substances and issues of current concern, toxicity assessment in relation to specific environment (case studies)	
4	Testing for Environmental Toxic substances	Dose–Response Relationships, Biological systems for toxicity testing, toxicogenomic databases, prediction tools for toxicity	3
5.	Biological Effects of Toxicants	Biological effects of toxic substances in living organisms. Metabolism, cellular and tissue targets (neurological, pulmonary responses, metabolic responses), mechanisms of action, and pathological effects, endocrine disruptors, biomarkers and bioassays, evaluation of specific gene-environment interaction and disease incidence due to toxin exposure	8
6.	Health Risk Assessment of Toxicants	Introduction to the concept of Health Risk Assessment (HRA), current practices of health risk assessment of environmental chemicals.	4
7.	Role of environmental Toxicology in Modern Industry	Role of toxicology in industry research and development, human health and environmental protection, hazard and risk evaluations, risk management and communications, product stewardship, and regulatory compliance. Scientific principles and methods of toxicology in chemical, energy, pharmaceutical, pesticide, biotechnology industries.	2
8.	Toxic Tragedies and Their Impact on Society	National/International Case studies on Toxic tragedies, their origins, consequences, and effects on toxic regulation	3
9.	Legal Aspects of Environmental Toxicology	legislation concerning air and water pollution, air-quality criteria and standards pesticide use, food and feed additives, consumer protection, and occupational exposure to toxic substances; roles of regulatory agencies	3
Total number of Lectures			42
Evaluation Criteria			
Components		Maximum Marks	
T1		20	
T2		20	
End Semester Examination		35	
TA		25	
Total		100	

PBL:Students will be asked to identify an environmental pollutant from modern industries, collect information about its fate/biotransformation in aquatic/s, and toxic effects on plant/animal/human health it comes in contact with. Students will also collect information about the regulatory guidelines followed by that industry to control the environmental exposure to the pollutant.

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.	Essentials of environmental toxicology: The Effects of Environmentally Hazardous Substances on Human Health, Taylor & Francis
2.	Ecotoxicology Essentials: Environmental Contaminants and Their Biological Effects on Animals and Plants 1st Edition, Authors: Donald Sparling , Academic Press, 2016
3.	Research articles from refereed journals such as Ecotoxicology and Environmental safety
4.	Sigmund F. Zakrzewski, Environmental Toxicology, 3rd, Oxford University Press, 2002, New York
5.	Ming Ho Yu, HumioTsunoda, Masashi Tsunoda Environmental Toxicology: Biological and Health Effects of Pollutants, 3rd Edition, CRC Press, USA, 2011

Environmental Biotechnology Lab-II

Course Code	20M35BT112	Semester Even	Semester II Session 2021 -22 Month from January to June
Course Name	Environmental Biotechnology Lab-II		
Credits	0-0-4	Contact Hours	8

COURSE OUTCOMES Students will be able to		COGNITIVE LEVELS
CO1	Understand various culture media, their applications and methods of sterilization	Level II (Understand)
CO2	Apply standard microbiological techniques for isolation, culturing and enumeration of microorganisms	Level III (Apply)
CO3	Apply microorganisms as indicators of environmental health	Level III (Apply)
CO4	Examine different types of toxic substances, their toxicological impact and their remediation	Level IV (Analyze)
CO5	Apply immunological principles for understanding of microbial diseases	Level III (Apply)

Module No.	Title of the Module	List of Experiments
1.	Isolation of microorganisms from different sources	Media preparation & sterilization – Bacteria; Media preparation & sterilization – fungi; Preparation of agar plants and slants; Culturing microorganisms on agar media by streaking / stab / point inoculation; Serial dilution of microbial culture; Estimation of microbial growth by colony counting
2.	Environmental Microbiology	Determination of enzyme activities as pollution indicator (e.g. esterase, lipase, dehydrogenases) in contaminated soil and water samples; Total coliform bacteria count in contaminated water samples from different locations; Determination of BOD, COD
3.	Environmental Toxicology	Evaluating of health of agriculture soil (pH, Organic carbon, phosphorous, nitrate-nitrogen); Microbial degradation of selected pollutants; microbe-mediated removal of pollutant
4.	Immunology & Immunotechnology	Differential WBC counts; Virtual Lab: Removal of spleen and thymus from mice and isolation of lymphocytes; Antigen- antibody interactions by SRID, ODD techniques; virtual lab; ELISA; application of immunotechniques in determinations of blood groups
Evaluation Criteria		

Components	Maximum Marks
Mid Term Exam	20
End Term Exam	20
Day to Day	60
Total	100
<p>PBL: Group of students can prepare report on pollution indicator (enzyme activity) of contaminated soil and water samples from different locations along with the statistical analysis. Students can also work on development of immunotechniques for monitoring of environmental pollutants.</p>	
<p>Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)</p>	
<p>Practical Microbiology Dr. R. C. Dubey and Dr. D. K. Maheshwari, ed 2006, S Chand & Company</p>	
<p>Practical Toxicology Evaluation, Prediction, and Risk By David Woolley (Toxicologist), Adam Woolley · 2017, CRC Press, Taylor & Francis Group</p>	
<p>A Practical Manual for Basic Immunotechniques, January 2009, Edition: 1stPublisher: Samanthi Publications, India.ISBN: 978-81 906565 0-4</p>	