

Subject Code: 02MB0532
Subject Name: Environmental Biotechnology (Elective)
M.Sc. Semester- III

OBJECTIVE: Students are expected to have the advanced learning of environmental biotechnology. The course also discusses application of microbial environment, Eutrophication and its management, microorganisms in extreme environments, microbiological treatment of waste water, bioremediation and biodegradation of xenobiotics.

Credits Earned: 6 Credits

Course outcomes: By the end of this course students should be able to

- To describe and comprehend the fundamental concepts of solid waste management, biodegradation, bioremediation process and microbial treatment of waste water.
- To understand, evaluate and analyze the role of aerobic and anaerobic microbial process in biogeochemical cycles, recycling and waste management strategies.
- To analyze and develop critical thinking skills in order to communicate to a wide range of audiences with oral and written reports that target the field of environmental microbiology.
- To acquire analytical skills in designing of cost effective and sustainable waste management strategies with consideration of public health, safety, welfare of society and environment by contributing to innovation and entrepreneurship.

Teaching Scheme:

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	IA (M)	CSE (I)	Viva (V)	Practical (PR)	
5	0	2	6	50	30	20	25	25	150

Pre-Requisite of Course: N.A.



Contents:

Unit	Topics	Contact Hours
1	<p>Microbial Environment</p> <p>Microbiology of Water -Importance of water; Types of Water; Water borne diseases; Microbiology of air- Airborne microorganisms; Soil Microbiology- Layers of Soil; Classification; Scope and Importance of Soil Microbiology; Role of microbes in biogeochemical cycles - Carbon cycle; Sulphur cycle; Nitrogen cycle and Phosphorus cycle. Eutrophication and its management.</p>	10
2	<p>Biotechnology for Solid waste Management</p> <p>Basic aspect of solid waste management, Current practice of solid waste management in India, Aerobic treatment of solid waste: Composting, Anaerobic treatment of solid waste and biogas generation, Comparison of Aerobic and Anaerobic solid waste treatment, Treatment of Hazardous wastes, Biomedical Waste management. Composting: Objectives, fundamentals, microbiology, factors influencing composting and composting systems. Compost quality and uses. Vermicomposting.</p>	16
3	<p>Microbial treatment of waste water</p> <p>Waste water treatment- Waste water characterization and its significance: COD, BOD, Inorganic constituents, solids, biological components. Primary, secondary and tertiary treatment of waste water. Principles and aims of biological wastewater treatment processes. Biochemistry and microbiology of inorganic phosphorus and nitrogen removal. Suspended growth technologies: Activated sludge, oxidation ditches, waste stabilization ponds. Fixed film technologies: Trickling filters, rotating biological contactors, fluidized bed and submerged aerated filters. Anaerobic waste water treatment systems: RBC, UASB, anaerobic filters. Merits and demerits of anaerobic treatment of waste.</p>	16
4	<p>Biodegradation of organic pollutants</p> <p>Mechanisms and factors affecting biodegradation. Pollution problems and biodegradation of simple aliphatic, aromatic, polycyclic aromatic hydrocarbons, halogenated hydrocarbons, azo dyes, lignin and pesticides.</p> <p>Bioremediation</p> <p>Introduction of Bioremediation; advantages and applications; Types of bioremediation ;Natural (attenuation) ;Ex-situ and In-situ ;Bioaugmentation and bio stimulation ;Solid phase and slurry phase bioremediation; Biological Filtration Processes for Decontamination of Air Stream; Biofiltration; Biotrickling Filtration; Bio scrubbers; Use of microbes for Heavy metal detoxification.</p>	18
	Total	60



References:

1. Microbiology, M. J. Pelczer ,E.C.S Chan (1993), McGraw Hill Education Private limited , New Delhi.
2. Environmental Microbiology, S.K.Agarwal (2009), APH Publishing corporation, New Delhi
3. Introduction to Environmental biotechnology, A.K.Chatterji (2011), PHI Learning private limited, New Delhi.
4. Textbook of Environmental Biotechnology by Pradipta Kumar Mohapatra, (2006), I. K. International publishing house, New Delhi
5. Biodegradation and bioremediation by M.Alexander (1999), Academic press
6. Environment Biotechnology by T.R. Srinivas (2008), New Age Publishers

Suggested Theory distribution:

The suggested theory distribution as per Bloom’s taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process.

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyze	Evaluate	Create
20%	20%	30%	15%	10%	5%

Instructional Method:

- m. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, etc.
- n. The internal evaluation will be done on the basis of continuous evaluation of students in the class-room in the form of attendance, assignments, verbal interactions etc.
- o. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.

Expreiments

1. To Estimate Total Hardness of Water B) To Estimate Calcium Hardenss of Water
2. To Estimate The Total Solids (Ts), Total Dissolved Solids (TDS) And Suspended Solids (SS) In The Given Water Sample.
3. To Estimate Dissolved Oxygen Content of Wastewater (DO)
4. To Estimate Chemical Oxygen Demand of The Given Sample (COD)
5. To Estimate Biological Oxygen Demand (BOD)
6. To Measure the Concentration of Chloride in the Given Sample
7. To Estimate the Amount of Ammonical Nitrogen in the Given Sample
8. To Estimate the Amount of Nitrate Nitrogen
9. To Estimate the Amount of Phosphorus Phosphate in the Given Sample
10. To Find Out The Most Probable Number of Coliforms In The Given Water Sample