INSTITUTE	**FACULTY OF SCIENCE**
PROGRAM	**MASTER OF SCIENCE (MICROBIOLOGY)**
SEMESTER	**3**
COURSE TITLE	**ENVIRONMENTAL BIOTECHNOLOGY**
COURSE CODE	**02MB0509**
COURSE CREDITS	**4**

Objective:

1 Students are expected to have the advanced knowledge of environmental biotechnology, focusing on microbial applications in wastewater treatment, eutrophication management, bioremediation, and biodegradation of xenobiotics.

Course Outcomes: After completion of this course, student will be able to:

1 Explain the concepts of biodegradation, bioremediation, solid waste management, and microbial wastewater treatment.

2 Describe the role of aerobic and anaerobic microbial processes in biogeochemical cycles, recycling, and waste management strategies.

3 Develop critical thinking skills to communicate environmental microbiology concepts effectively through oral and written reports.

4 Acquire skills in designing cost-effective and sustainable waste management strategies while considering public health, safety, societal welfare, and environmental sustainability.

Pre-requisite of course:NA

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
4	0	0	50	30	20	0	0

Contents : Unit	Topics	Contact Hours
1	**Microbial Environment** 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.	10

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Contents : Unit	Topics	Contact Hours
2	**Biotechnology for Solid waste Management** 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.	16
3	**Microbial treatment of waste water** 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.	16
4	**Biodegradation of organic pollutants** Mechanisms and factors affecting biodegradation. Pollution problems and biodegradation of simple aliphatic, aromatic, polycyclic aromatic hydrocarbons, halogenated hydrocarbons, azo dyes, lignin and pesticides. Bioremediation 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.	18
Total Hours		**60**

Textbook :

1 Textbook of Environmental Biotechnology, Pradipta Kumar Mohapatra, I. K. International publishing house, New Delhi, 2006

2 Introduction to Environmental biotechnology, A.K.Chatterji , PHI Learning private limited, New Delhi., 2011

References:

1 Environmental Biotechnology: Theory and Application , Environmental Biotechnology: Theory and Application , Evans, G.M., & Furlong, J. , Wiley-Blackwell., 2011

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as 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 / Knowledge	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Higher order Thinking / Creative**
5.00	10.00	30.00	30.00	20.00	5.00

Instructional Method:

1 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.

2 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.

3 Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.

Supplementary Resources:

1 https://onlinecourses.nptel.ac.in/noc21_bt41/preview

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