

Name of Faculty	:	Faculty of Science
Name of Program	:	Master of Science
Course Code	:	1MSB04
Course	:	Environmental Microbiology
Type of Course	:	Professional Core
Year of Introduction	:	2023-24

Prerequisite	:	To impart the knowledge of role of microorganisms in the environment
Course Objective	:	The role of microorganisms expanded and shifted to discovery and application of new microbes and their products to the environment, human health and welfare. New strains have been discovered and successfully used in the maintenance of the quality of environment through minimizing the use of conventional chemicals in municipal waste disposal, public health and agriculture.
Course Outcomes	:	At the end of this course, students will be able to:
	CO1	Understanding the diversity of microorganisms in which they grow under natural conditions
	CO2	Analyzing the role of microorganisms in bioremediation of polluted sites of the environment.
	CO3	Application of various microorganisms in the bioremediation of various pollutants.
	CO4	Remembering the role of microbes in term nitrogen fixation and helping in combating the global warming.

Teaching and Examination Scheme

Teaching Scheme (Contact Hours)			Credits	Examination Marks				
				Theory Marks		Practical Marks		Total marks
L	T	P	C	SEE	CIA	SEE	CIA	
4	0	0	4	70	30	0	0	100

Legends: L-Lecture; T-Tutorial/Teacher Guided Theory Practice; P – Practical, C – Credit, SEE – Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.



Course Content

Unit No.	Topics	Teaching Hours	Weightage	Mapping with Cos
1	History and developments A) Brief history and development of environmental microbiology: History and development of microbial ecology highlighting significant contributions of microbiologists and emergence of environmental microbiology, and significant applications of microbes in solving environmental pollution problems. B) Ecosystem characteristics, structure and function. Food chains, food webs and trophic structures. Ecological pyramids.	10	22%	CO1
2	Water Pollution and Eutrophication A) Water pollution and its control: Need for water management. Sources of water pollution. Measurement of water pollution. B) Eutrophication: Definition, causes of eutrophication, and microbial changes in eutrophic bodies of water induced by various inorganic pollutants. Effects of eutrophication on the quality of water environment. Measurement of degree of eutrophication. Algae in eutrophication, algal blooms, their effects and toxicity, coloured waters, red tides, and cultural eutrophication. Physico-chemical and biological measures to control eutrophication .	10	23%	CO2
3	Global Warming and Lignin degradation A) Global warming: The source and variety of gases which contribute to global warming, effects of global warming and remedial measures B) Lignin degradation: Lignocellulolytic microorganisms, enzymes and their biotechnological applications in: (i) biopulping, (ii) biobleaching, (iii) textiles (iv) biofuels, (v) animal feed production.	12	26%	CO2 CO4



4	<p>Waste management and Bioremediation A) Liquid waste management: Treatment of sewage (Primary, Secondary and Tertiary treatments) and Treatment of Industrial effluents (distillery, textile, pulp and paper). B) Solid waste management: Waste types & their possible usages, landfill development and composting. C) Bioremediation of environmental pollutants: Petroleum hydrocarbons and pesticides. Microbes and mineral recovery: Bioleaching of copper, gold and uranium.</p>	15	29%	CO3 CO4
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Suggested Distribution of Theory Marks Using Bloom's Taxonomy						
Level	Remembrance	Understanding	Application	Analyse	Evaluate	Create
Weightage	25	25	25	25	0	0

NOTE: This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Major Equipment / Instruments

Sr. No.	Name of Major Equipment/ Instruments and Software
1	Analytical Balance
2	Autoclave
3	Micropipettes
4	Stains
5	Light Microscope
6	Anaerobic jar
7	UV Chamber
8	Hot Air Oven
9	Centrifuge
10	Electrophoresis
11	SDS PAGE
12	PCR
13	Deep Freezer
14	Autoradiography

Suggested Learning Websites

Sr. No.	Name of Website
1	http://onlinelibrary.wiley.com

Reference Books

Sr. No.	Name of Reference Books
1	Microbial Ecology by Atlas R.M., Bartha R., Benjamin Cummings Publishing Co, Redwood City, CA., 1993.
2	Environmental Microbiology by A.H. Varnam & M.G. Evans, Manson Publishing Ltd., 2000.
3	Manual of Environmental Microbiology by Christon J. Hurst, Ronald L. Crawford, Jay L. Garland, David A. Lipson, Aaron L. Mills, ASM Press, 2007.
4	Lignocellulose Biotechnology: Future Prospects by R.C. Kuhad and A. Singh, I.K. International, 2007.
5	Advances in Applied Bioremediation by A. Singh, R.C. Kuhad and O.P. Ward, Springer, 2009