



Established Under Gujarat Private Universities Act No. 9 of 2016

Syllabus for Master of Science

Microbiology

Subject Code: 02MB0457

Subject Name: Environmental Biotechnology

M.Sc. Semester- II

OBJECTIVE: Students are expected to have the advanced learning of environmental microbiology. 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.

COURSE OUTCOMES: By the end of this course students should be able to:

- 1) Describe and comprehend the fundamental concepts of environmental microbiology
- 2) Analyze primary literature articles in the field of environmental microbiology to develop critical thinking skills and develop essential writing and verbal communication skills through essays and oral presentations that target the field of environmental microbiology.
- 3) To learn about biodegradation and bioremediation process.
- 4) To learn about microbial treatment of waste water
- 5) To learn about microbial life in extreme environments.

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	Mid Sem (M)	Internal(I)/(CSE)	Viva (V)	Termwork (TW) /Practicals (P)	
4	0	4	6	50	30	20	25	25	150

Pre-Requisite of Course: N.A.

Contents:

Unit	Topics	Contact Hours
1	MICROBIAL ENVIRONMENT Microbiology of Water -Importance of water; Types of Water; Water born diseases; Microbiology of air- Airborne microorganisms; Soil Microbiology- Layers of Soil; Classification; Scope and Importance of Soil Microbiology; Microbes and Biogeochemical cycles; Role of microbes in biogeochemical cycles - Carbon cycle; Sulphur cycle; Nitrogen cycle and Phosphorus cycle.	10
2	EUTROPHICATION, AND ITS MANAGEMENT Eutrophication; Microbial changes induced by organic and inorganic pollutants; role of phosphorus and nitrogen in eutrophication; process and control of eutrophication. MICROORGANISMS IN EXTREME ENVIRONMENTS Acidophilic; alkalophilic; thermophilic; barophilic and osmophilic; microorganisms- mechanisms of adaptation; Halophiles- membrane variation; Applications of thermophiles and extremophiles.	10
3	MICROBIAL TREATMENT OF WASTE WATER Potability of water - Microbial assessment of water quality; Test of BOD and COD for water analysis. Conventional treatment process; Primary- Sedimentation or settling Principles; Biological waste water treatment-Aerobic suspended-growth; Aerobic attached-growth (TF, RBC, PBR); Anaerobic suspended growth; Anaerobic attached growth; Advanced tertiary process:-Solids removal; Biological nitrogen removal Biological phosphorus removal; Disinfection	20
4	BIOREMEDIATION Introduction of Bioremediation; advantages and applications; Types of bioremediation ;Natural (attenuation) ;Ex-situ and In-situ ;Bioaugmentation and biostimulation ;Solid phase and slurry phase bioremediation; Biological Filtration Processes for Decontamination of Air Stream; Biofiltration; Biotrickling Filtration; Bioscrubbers; Use of microbes for Heavy metal detoxification. BIODEGRADATION Aerobic vs. anaerobic Degradation; Microbial basis of Biodegradation; Biodegradation of Xenobiotics; Microbial degradation of pesticides.	20
	Total	60



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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. Environmental Microbiology R.M Maier, I.L. Pepper and C.P.Gerba, Academic Press. (2000).

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:

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