



M. Sc. (Microbiology)
Semester- III

Course Code	PS03CMIC22	Title of the Course	Environmental Microbiology
Total Credits of the Course	04	Hours per Week	04

Main Focus of the Course outcomes	Employability	Skill Development	Entrepreneurship
	√		

Course Objectives:	<p>To understand major environmental pollution issues and possible solutions through knowledge of microbiology.</p> <p>To understand biogeochemical cycling of essential elements and its implications.</p> <p>To understand physiological and molecular adaptations in extremophiles and their possible biotechnological applications,</p> <p>To understand various beneficial plant- microbes interactions and their importance in agriculture.</p> <p>To learn various experimental approaches for detection and quantification of microbes in environment.</p> <p>To understand fundamental aspects of microbial ecology.</p>
--------------------	---

Course Content		
Unit	Description	Weightage* (%)
1.	<ul style="list-style-type: none"> • Global environmental problems: Global warming, Ozone depletion, Acid rain • Global warming and infectious diseases • Water pollution: Sources and types, Physical, chemical and biological pollution. • Eutrophication and its control. • Microbial Indicators of water pollution • Biodeterioration of wood and metals: Role of micro-organisms, mechanisms and control. 	25
2.	<p>Biogeochemical cycles: Carbon, Nitrogen, Sulphur, Iron and Phosphorous cycles.</p> <p>Detrimental effects of diverted biogeochemical cycles: acid mine drainage, nitrous oxide emission, nitrate pollution of ground water</p> <p>Biological Nitrogen Fixation in detail:</p> <p>Asymbiotic, symbiotic and associative nitrogen fixation.</p>	25





	Structure, function and genetic regulation of nitrogenases.	
3.	<p>Microorganisms in extreme environments: Characteristics of extreme environments ,Microbial diversity, habitat and adaptive strategies of thermophiles and hyperthermophiles, psychrophiles and psychrotrophs, halophiles, acidophiles and alkalophiles. Biotechnological applications of extremophiles Methods to study microorganisms in environment: Detection of microbial populations: Phenotypic detection, Lipid profile analysis, molecular detection Determination of microbial biomass: Biochemical assays, physiological approaches. Physiological methods to study microbial activity</p>	25
4.	<p>Microbial communities and ecosystems: o Microbial community dynamics, Structure of microbial communities, Ecosystems., Structure and function of some microbial communities in nature. Interactions between microorganisms and plant: o Mycorrhizae, o Symbiotic nitrogen fixing associations between rhizobia and legumes, <i>Anabaena and Azolla</i> o Plant growth promoting rhizobacteria: Transport / Mobility of microorganisms in soil and subsurface: o Factors affecting transport o Novel approaches to facilitate microbial transport</p>	25
...		

Teaching-Learning Methodology	<p>Topics will be taught and discussed in interactive sessions using conventional black board and chalk as well as ICT tools such as power point presentations and videos. Practical sessions will be conducted in a suitably equipped laboratory either individually or in groups depending on the nature of exercise as well as availability of infrastructure. Course materials will be provided from primary and secondary sources of information.</p>
-------------------------------	--

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%





3.	University Examination	70%
----	------------------------	-----

Course Outcomes: Having completed this course, the learner will be able to	
1.	Gain awareness about different Types of Environmental Pollution and Related Issues
2	Understand and appreciate crucial role of microbes in various biogeochemical cycles.
3.	Appreciate the diversity of microorganism and microbial communities inhabiting a multitude of extreme habitats and will be able to understand unique features of extremophiles which can be exploited for various industrially important activities/products and environmental conservation.
4.	Learn different methods for detection of microbes from various environments and their characterization.
5.	Understand fundamental aspects of microbial ecology and become familiar with current research in environmental microbiology.
6	Understand various plant microbes interactions especially rhizosphere, phyllosphere and mycorrhizae and their applications especially the biofertilizers

<p>Suggested References:</p> <ul style="list-style-type: none"> • .Environmental Microbiology. R. M. Maier, I. L. Pepper & G. P. Gerba. • Comprehensive Biotechnology Vol-4, Murray Moo Young. • Biotechnology- Rehm and Reid. • Microbial Ecology: Fundamentals and Applications- Atlas & Bartha, fourth edition, Pearson Education. • Environmental science, B. J. Nebel and R. T. Wright. • The prokaryotes- 3 rd edition, volume 2 • Brock Biology of microorganisms by Madigan, Martinko, Dunlap, and Clark

On-line resources to be used if available as reference material
On-line Resources





SARDAR PATEL UNIVERSITY
Vallabh Vidyanagar, Gujarat
(Reaccredited with 'A' Grade by NAAC (CGPA 3.25))
Syllabus with effect from the Academic Year 2018-2019

