



Course Syllabus  
Gyanmanjari Science College  
Semester-3 (M.Sc.)

**Subject:** Environmental Microbiology-MSCMB13516

**Type of course:** Major

**Prerequisite:** Student must have basic knowledge about organisms and association of organism with environment.

**Rationale:** Environmental microbiology is a field driven by a desire to understand the unseen world of microbes that underpins the health and functionality of our planet. By studying them, we can harness their potential for various applications and address pressing environmental challenges

**Teaching and Examination Scheme:**

Teaching Scheme			Credits	Examination Marks					Total Marks
CI	T	P		Theory Marks		Practical Marks		CA	
			ESE	MSE	V	P	ALA		
4	0	0	4	60	30	10	00	50	150

*Legends: CI-Class Room Instructions; T – Tutorial; P - Practical; C – Credit; ESE - End Semester Examination; MSE- Mid Semester Examination; V – Viva; CA - Continuous Assessment; ALA- Active Learning Activities.*



**Course Content:**

Unit No	Course content	Hrs	% Weightage
1	<p><b>Chapter-1 Concept and Dynamics of Ecosystem</b></p> <ul style="list-style-type: none"> <li>• Environment: Basic concept, global environmental problems, components, food chain and energy flow. Types and complexity of ecosystem.</li> <li>• Theories of population growth, biotic potential, inter and intra species interaction in ecosystem.</li> <li>• Population ecology: Characteristics of population, concept of carrying capacity, population growth and regulations, Keystone species, Community ecology: Definition, community concept.</li> </ul>	15	25%
2	<p><b>Chapter-2 Biodegradation and Bioremediation</b></p> <ul style="list-style-type: none"> <li>• Principles and mechanism Factors influencing biodegradation,</li> <li>• Biodegradation of hydrocarbons, lignin, dyes, pesticides, recalcitrant compounds</li> <li>• Biopulping and biobleaching</li> <li>• PHB biosynthesis and its degradation</li> <li>• Biosurfactants and their applications</li> <li>• Principles of bioremediation</li> <li>• Biosorption and bio accumulation</li> <li>• Bioremediation of oil spills and MEOR. Use of GMOs in bioremediation.</li> </ul>	15	25%
3	<p><b>Chapter-3 Extreme Environment</b></p> <ul style="list-style-type: none"> <li>➤ Physiological ecology of microorganisms: <ul style="list-style-type: none"> <li>• Adaptation to environmental conditions.</li> <li>• Abiotic growth limiting factors - Leibig's law of minimum, Shelford law of tolerance.</li> <li>• Biotechnological applications of extremophiles.</li> </ul> </li> </ul>	15	25%



4	<p><b>Chapter-4 Recent Trends in Environmental Microbiology</b></p> <ul style="list-style-type: none"> <li>• Strategies for bioenergy – microbial fuel cells, biodiesel, bioethanol, biohydrogen.</li> <li>• Bio-warfare agents, warning and detection of biological warfare agents, bioterrorism and measures to curtail the problem,</li> <li>• Use of superbugs, engineered enzymes, biosensors and metabolomics in bioremediation.</li> <li>• Environmental Impact Assessment (EIA) and guidelines, impact assessment methodologies, environmental impact statement (EIS) and environmental assessment plan (EAP).</li> </ul>	15	25%
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### Continuous Assessment:

Sr. No	Active Learning Activities	Marks
1	<p><b>Field Visit</b> Students will visit the instructed field under the guidance of faculty, will prepare the report and upload to GMIU web portal.</p>	10
2	<p><b>Effect of Industrial Pollution on ecosystem</b> Faculty will provide the knowledge about how industrial pollution impact on environment, student have to prepare data and upload it to GMIU web portal.</p>	10
3	<p><b>Coastal area cleaning</b> Students have to clean nearby coastal area and photo will be upload on GMIU web Portal.</p>	10
4	<p><b>Microbial Diversity Project</b> Faculty will assign students a project where they explore the diversity of microorganisms in a specific environment of their choice (e.g., soil, water, air). Students can use a combination of sampling, culturing, and molecular techniques to characterize microbial communities. They can then present their findings through research paper or report and upload on GMIU web Portal.</p>	10
5	<p><b>Identification of air microbiome</b> Students have to analyze the presence of mico-organisms at different location of the college campus and results need to upload on GMIU web portal.</p>	10
<b>Total</b>		<b>50</b>



**Suggested Specification table with Marks (Theory):60**

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage	20%	40%	30%	10%	-	-

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

**Course Outcome:**

After learning the course the students should be able to:	
CO1	Describe Concept and Dynamics of Ecosystem
CO2	Understand the principles and mechanism Factors responsible for Biodegradation and Bioremediation.
CO3	Analyze Microbial communities from various extreme environments.
CO4	Apply Recent Trends in Environmental Microbiology.

**Instructional Method:**

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, MOOCs etc.

From the content 10% topics are suggested for flipped mode instruction.

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

The internal evaluation will be done on the basis of Active Learning Assignment

Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in laboratory.



**Reference Books:**

- [1] Alexander, M. (1971). Microbial ecology. John Wiley & Sons, Inc, New York.
- [2] Alexander, M. (1971). Introduction to soil microbiology. John Wiley & Sons, Inc, New York
- [3] Ec Eldowney, S. Hardman, D. J. and waite, S. (1993). Pollution: Ecology and biotreatment. Longman Scientific Technical.
- [4] Baker, K. H. and Herson, D. S. (1994). Bioremediation. McGrew Hill Inc., New York.
- [5] K. C. Marshall (1985). Advances in microbial ecology Vol – 8. Plenum Press.
- [6] Burns R. G. and Slater H. (1982). Experimental Microbial ecology. Blackwell Scientific Publications, Oxford, London.
- [7] Vanghan, D. and Malcolm, R. E. C. (1985). Soil organic matter and biological activity. Martinus Nighoff W. Junk Publishers.
- [8] Brock, T. D., Madigan, M. T. Biology of Microorganisms. Prentice Hall Int. Inc.
- [9] R. M. Maier, I. L. Pepper and G. P. Gerba. Environmental Microbiology.
- [10] Arceivala, Waste water treatment for pollution control, 2nd Ed.
- [11] M Alexander, Biodegradation and Bioremediation by, Academic Press, 1999.

