

<b>Subject Code: 2SC2010304</b>	<b>Subject Title: Environmental Biotechnology</b>
<b>COURSE TYPE: CORE COURSE</b>	

**Course Objective:** Environmental Biotechnology is a subject with great emphasis on environmental issues and risk assessment. Biotechnological techniques used in environmental problem solving are at the core of this subject. Applications of microbial techniques with different strategies of solving environmental issues will satisfy the thrust for curiosity of students

Teaching scheme (hours) per week		Credit			Theory Marks		Practical Marks		Total
Theory	Practical	Theory	Practical	Total	Uni. Assessment	Cont. Assessment	Uni. Assessment	Cont. Assessment	
4	-	4	-	4	60	40	-	-	100

Unit	Content	Lectures	Weightage
1	<p><b>Environmental monitoring and Bioremediation</b></p> <ul style="list-style-type: none"> <li>Environmental monitoring: Sampling, physical chemical and biological analysis bio indicators, biomarkers, biosensors,</li> <li>Methods for the analysis of microbial population in-situ,</li> <li>Toxicity testing using organic material</li> <li>Environmental laws and policies in India</li> </ul> <p><b>Bioremediation</b></p> <ul style="list-style-type: none"> <li>Bioremediation principles</li> <li>Strategies and techniques of bioremediation: insitu and exsitu</li> <li>Bio remediation of metals and other inorganic pollutants.</li> <li>Phytoremediation</li> <li>GMOs and their impact on bioremediations</li> </ul>	15	25%
2	<p><b>Water and wastewater microbiology</b></p> <ul style="list-style-type: none"> <li>Characteristics and sampling of water and wastewater.</li> <li><b>Waste Treatment Processes:</b> <ul style="list-style-type: none"> <li><b>Suspended Growth Technology:</b> Activated Sludge, Oxidation Ditches, Aerated Lagoons, Waste Stabilization ponds.</li> <li><b>Fixed Film Technology:</b> Rotating Biological Contractor (RBC), trickling filters Packed-Bed Reactors, Waste stabilization ponds</li> <li><b>Anaerobic Digestion</b></li> </ul> </li> </ul> <p><b>Solid waste types and management.</b></p>	15	25%
3	<p><b>Biodegradation and bio deterioration</b></p> <p><b>Biodegradation</b></p> <ul style="list-style-type: none"> <li>✓ Principles of biodegradation and mechanism</li> <li>✓ Biodegradation of detergent, pesticide, lignin, hydrocarbon and dyes</li> </ul> <p><b>Bio deterioration</b></p> <ul style="list-style-type: none"> <li>✓ Principles and mechanisms of bio deterioration</li> <li>✓ Methodology to assess bio deterioration</li> <li>✓ Prevention and control of bio deterioration</li> </ul> <p>Bio deterioration of selected material</p>	15	25%
4	<ul style="list-style-type: none"> <li>Air pollution, Formation and degradation of air pollutant</li> <li>Global environmental Problems</li> <li>Detoxification</li> <li>Cometabolism</li> <li>Bio magnifications of recalcitrant compounds</li> <li>Biofuels</li> </ul>	15	25%

	<ul style="list-style-type: none"> <li>• Bio surfactants</li> <li>• Bioleaching</li> <li>• MEOR</li> </ul>		
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**Learning Outcome:** Students will principally learn the core aspects of Bio deterioration, Bioremediation, Biodegradation & Environmental problems and their monitoring.

**Reference Books:**

1. Wastewater treatment for pollution control, 2<sup>nd</sup> edition. *Arceivala*.
2. Environmental Microbiology. *R.M. Maier, I. L. Pepper & G.P. Gerba*.
3. Essentials of Ecology and Environmental Science, S V S Rana
4. Biodegradation and Bio remediation. Second edition, Martin Alexander
5. Environmental Bio technology. Allan Scragg
6. Wastewater Engineering , Treatment and Reuse. Metcalf and Eddy
7. Wastewater Microbiology. Gabriel Bitton
8. Microbial Degradation and bioremediation. Surajit Das
9. Encyclopedia of Environmental Science and Engineering. Fifth edition. Pfafflin and Ziegler
10. Comprehensive Biotechnology Vol-4, *Murray Moo Young*.
11. Biotechnology. *Rehm and Reid*.
12. Industrial pollution Vol. I *E. Joe middle brooks*.
13. Wastewater treatment *M. N. Rao & A. K. Datta*
14. Water and water pollution handbook Vol. I, *Leonard, L. Ciaccio*.
15. Industrial pollution, *N. Iruving sax, Van Mostrand Rein hold company*.
16. Encyclopedia of environmental science & tech. Vol. II *Ram Kumar*.
17. Environmental engineering and management by S.K.Dhameja, Publ:Kataria&Sons
18. MicrobialecologybyBarthaandAtlas, PearsonEdu
19. Atextbookofenvironmentalchemistry&pollutioncontrolbyS.S.Dara
20. BiotechnologybyU.Satyanarayana
21. GeneralMicrobiologybyMichael, M.M.JohnStanieretal.
22. ExperimentalecologybyR.M.Atlas
23. PrinciplesofMicrobiologybyRM.Atlas
24. AssessingEcologicalRisksofBiotechnologybyLevR.Ginzburg
25. EnvironmentalBiotechnologybyB.C.BhattacharyyaandR.Banerjee
26. EnvironmentalSciencebyS.C.Santra, Central, India
27. EnvironmentalMicrobiology–ALaboratoryManualbyPepperet.Al



**FACULTY OF SCIENCE**  
**M.Sc. (Biotechnology) (Semester-3)**  
In Effect from Academic Year 2022-23