

<b>Programme</b>	Biochemistry	<b>Course Code</b>	BC. 401	<b>Credit Hours</b>	3 (2+1)
<b>Course Title</b>	<b>Environmental Biochemistry</b>				
<b>Course Introduction</b>					
<p>This course is design to impart essential concepts in the field of environmental biochemistry. It focuses to develop an understanding of issues related to environmental pollution and their impact on health. It tends to provide knowledge of bioremediation and other environmental clean-up techniques as well.</p>					
<b>Learning Outcomes</b>					
<p>After completing this course the students should be able to:</p> <ul style="list-style-type: none"> <li>• Acknowledge the harmful effects of pollutants.</li> <li>• Understand the chemistry of pollutants in air, land and water.</li> <li>• Understand the pathways in bioremediation.</li> <li>• Apply the acquired knowledge to design ways for the eradication of pollutants.</li> </ul>					
<b>Course Content</b>					
<p><b>Theory Unit</b></p> <ul style="list-style-type: none"> <li>• Introduction to pollution and its types</li> <li>• Air/atmosphere composition</li> <li>• Sources of air pollutants, Analysis of air pollutants, Strategies to control air pollution, Effects of air pollutants on humans, plants and environment</li> <li>• Land pollution: Introduction, Soil composition, Sources of land pollutants, Solid and hazardous waste, Effects of land pollution on plants, humans and environment</li> <li>• Solid waste management</li> <li>• Water pollution: Water composition, Sources and types of water pollution, Effects of water pollution on plants, humans and environment</li> <li>• Waste water composition, Waste water treatment</li> <li>• Microbial bioremediation: Factors affecting microbial bioremediation, Microbial enzymes used in bioremediation</li> <li>• Recent Advancements and Challenges in Bioremediation</li> <li>• Phytoremediation</li> <li>• General Features of Biodegradation of Xenobiotics, Co-Metabolism and use of mixed populations to degrade Xenobiotic Compound, Reasons of xenobiotic compounds to be recalcitrant, Microbes involved in biodegradation of xenobiotic compounds</li> <li>• Biomarkers used to assess environmental exposures, Types and importance of biomarkers used to assess environmental exposures</li> <li>• Radiation hazards (sources and effect), Radiation control</li> </ul> <p><b>Practical Unit -I</b></p> <ul style="list-style-type: none"> <li>• Coliform test,</li> <li>• Microbial isolation from industrial wastes involved in bioremediation: sampling and initial screening, confirmation of bioremediation potential</li> <li>• Determination of cations in environmental samples.</li> <li>• Determination of anions in environmental samples.</li> <li>• Determination of iron in solution</li> <li>• Water pH determination by different methods</li> <li>• Water colour and turbidity measurement</li> <li>• Water acidity and alkalinity determination</li> <li>• Water Quality Tests (total solid, BOD, COD, TOD)</li> <li>• Detection of water temporary and total hardness</li> <li>• Hydroponics growth of plants (Experiment set up and optimization)</li> </ul>					

## Textbooks and Reading Material

### Textbooks (Theory)

1. Environmental Chemistry Fundamentals by Jorge G. Ibanez et al., 2007 Springer Science-Business Media, LLC.
2. Manahan, Stanley E. "FRONTMATTER" Environmental Chemistry by Boca Raton: CRC Press LLC, 2000
3. Environmental Chemistry. Ninth Edition. By Stanley E. Manahan, CRC press.
4. Vowles, P. D., & Connell, D. W. (2013). Experiments in environmental chemistry: a laboratory manual (Vol. 4). Elsevier.
5. Manahan, S. E. (2011). Fundamentals of environmental chemistry. CRC press.
6. Hooda, S., & Kaur, S. (1999). Laboratory manual for environmental chemistry. S. Chand and Company Ltd.

### Teaching Learning Strategies

- Class Lecture
- Class Discussions
- Class Tutorials
- Lab Demonstration

### Assignments: Types and Number with Calendar

- 1<sup>st</sup> Quiz in 4<sup>th</sup> Week of 5 marks
- 2<sup>nd</sup> Quiz in 10<sup>th</sup> Week of 5 marks
- 3<sup>rd</sup> Quiz in 14<sup>th</sup> Week of 5 marks
- 1<sup>st</sup> Assignment in 8<sup>th</sup> Week of 10 marks

### Assessment

Sr. No.	Elements	Weightage	Details
1	Midterm Assessment	35%	Written Assessment at the mid-point of the semester.
2	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentations, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical, reflections, readings, quizzes etc.
3	Final Assessment	40%	Written Examination at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.