

Course Type	Course Code	Name of the Course	L	T	P	Credits
DE	NESD504	Environmental Biotechnology	3	0	0	3

#### Course Objectives

- Provides comprehensive knowledge of state-of-the-art biotechnological processes for wastewater treatment, landfilling, sludge treatment, bioremediation, bioenergy production and metal recovery.

#### Learning Outcomes

Upon successful completion of this course, students will be able to:

- Provide biotechnological solutions to address environmental issues including pollution, recovery of mineral resource, renewable energy and water recycling.

Unit No.	Topics to be covered	Lecture Hours	Learning outcomes
1.	<b>Genetic Engineering:</b> Cell genetic material; Nucleic acid-based methods of analysis: Extraction of nucleic acids from environmental samples, Polymerase chain reaction (PCR), Real- time PCR, PCR detection of specific and universal genes.	6	To gain elementary idea about important biotechnological processes such as PCR
2.	<b>Recombinant DNA technology:</b> Safety, social, moral and ethical considerations; Applications of recombinant technology for enhanced biodegradation, organisms with novel catabolic capabilities; Detection of pathogens and parasites in environmental samples using nucleic acid probes and PCR.	10	To gain knowledge about fundamentals and applications of recombinant DNA technology.
3.	<b>Ex-Situ and in-situ bioremediation:</b> Phytoremediation; Ex- situ and in-situ biological decontamination of groundwater; Landfill leachate; bio-treatment of Industrial Wastewater and Surface Waters; Microbial degradation of contaminants in gas phase.	11	To understand concepts of popular biotechnological processes such as bio-remediation and microbial degradation.
4.	<b>Environmental applications of biological processes:</b> Bio-bleaching in pulp and paper industries, bioleaching of ores for recovery of precious metals, Biological desulphurization of coal, Biological fuel generation (bio-hydrogen, bio-methanation and alcohol production), bio-insecticides, cleaner biotechnologies in oil and agro-industries.	11	To get a clear understanding of the applications of biotechnology for real life environmental problems.
5.	<b>Biosensors:</b> Use of immobilized cells and enzymes as biosensors.	4	To gain knowledge about biosensors and their application in environmental monitoring.
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#### Text Books:

- Environmental Biotechnology: Principles and Applications, B. E. Rittmann and P. L. McCarty, 2001.

#### Reference books:

- B. Bhattacharya and R. Banerjee, Environmental Biotechnology, 2008.
- Smith, J.E. (2004) Biotechnology, 3rd Edition, Cambridge University Press, UK.