

EN4103 Biotechnology in Environmental Engineering

[Lecture: 26 hrs ; Tutorial: 13 hrs; Lab: 0 hr; Pre-requisite: Year 3 standing; Academic Unit: 3]

Learning Objective :

To consolidate student's knowledge in environmental microbiology and molecular biotechnology with emphasis on methods for characterizing, studying, monitoring, and improving microorganisms and microbial activity during pollution control.

To provide a solid knowledge on selection, design and operation of bioprocess for supporting water, air, and soil treatment.

Course Content :

Environmental biotechnology and microbiology; bioassays; environmental molecular biology; principle, methods and environmental applications of microbial acclimation and genetic engineering; selection, design and operation of bioprocess for pollution control; bioremediation; introduction to bio-energies and green chemistry.

Course Outline :

S/N Topic

1. Introduction to environmental microbiology and biotechnology
2. Basic molecular biology: cell structure, DNA, RNA, gene expression
3. Molecular methods for isolation, characterization, classification and bio-monitoring
4. Bioassays for testing biodegradability and toxicity
5. Improving activity: genetic engineering, microbial selection and acclimation
6. Soil remediation: pollutants characteristics and fate, bioavailability, substrate uptake, microbial degradation, bioremediation methods and selection, monitoring
7. Wastewater treatment: characterization, mass balance analysis, microbial kinetics, bioprocess design, control, and selection, odor and sludge treatment
8. Bioenergy production: biogas, biofuel, bioelectricity, bioplastics

Learning Outcome :

The students should be familiar with the biotechnological concepts, methods and processes involved in environmental engineering applications. They should be able to select and develop biological methods for the testing of chemicals or wastes and for the monitoring of microorganisms and microbial activity. They should also be able to select the best biotechnology(ies) to address a specific environmental issue and should be able to understand and utilize the relations between microbial activity and process efficiency.

Textbooks :

Nil

References :

- Rittman BE & McCarty PL, "Environmental Biotechnology: Principles and Applications", McGraw-Hill, 2001.
- Madigan MT, Martinko JM, Dunlap PV & Clark DP, "Brock Biology of Microorganisms", 12th ed., Pearson/Benjamin Cummings, 2008.
- Maier RM, Pepper IL & Gerba CP, "Environmental Microbiology", 2nd ed., Academic Press, 2008.