Environmental Biotechnology

Course Outcomes:
Students will be able to:

1. Remember the need of environmental values
2. Understand the various factors of human activity which deteriorate the environment
3. Apply the biotechnological solutions for environment protection
4. Analyze the impact of all the aspects of pollutants and hazardous substances present in environment
5. Evaluate the efficiency of the effects and treatments of waste and harmful products
6. Create and propose strategies & solutions for various environmental problems

UNIT – I
Introduction, Role of Biotechnology in Environment Protection: Introduction and current status of biotechnology in environment protection, Strategies of waste management with respect to domestic industrial and hazardous wastes

UNIT – II

Biodiversity: Plant and Animal diversity, Role of microorganisms in geochemical cycles, relevant microbiological processes, microbial ecology.

Biological Waste Treatment: aerobic and anaerobic biological treatment Removal of heavy metals by bio sorption, bioleaching: Impact of pollutants on bio treatment. Use of packaged microorganisms and genetically engineered organisms.

UNIT III
Bioremediation: Definition, Types of bioremediation. Bioaugmentation, Biostimulation Applications of bioremediation, Biomarkers, Biosensors.

Biotechnology for Hazardous Waste Management: Xenobiotic compounds, recalcitrant and hazardous waste, Biodegradation of xenobiotics.

UNIT IV
Solid Waste Management: Incineration, Composting, Biogas Plant.

Restoration of degraded lands: Development of stress tolerant plants, use of mycorrhizae and microbes for improving soil fertility. Organic farming and Vermitechnology,

UNIT V
Air Pollution: Dynamic nature of air quality, Principles and practices of air quality management, Air treatment technologies, Contaminant movement in air matrices, and data analysis
Novel Methods for Pollution Control: Aiming for biodegradable and eco-friendly products.

PRACTICAL:

1. Total Suspended Solids (TSS) and Total Dissolved Solids (TDS) in Water Samples
2. Electrical Conductivity of Waste Water
3. Coliform MPN Test for Bacteriological Examination of Water
4. Organic Matter and Organic Carbon Content in Soil Samples
5. Study of the Effect of pH on Growth of Microbes
6. Sampling of Air Microflora
7. Microbiological study of water
8. IC_{50} study of given heavy metal
9. Ash determination from Municipal Solid Waste
10. Comparative evaluation of sorbents for the treatment of complex metal-bearing laboratory wastewaters

Texts:

1. B. Ritmann and P. L. McCarty, *Environmental Biotechnology: Principle & Applications*, 2nd Ed., McGraw Hill Science, 2000.
2. G. M. Evans and J. C. Furlong, *Environmental Biotechnology: Theory and Applications*, Wiley Publishers, 2002.
3. Environmental Biotechnology. Jogland, S.N. (1995) Himalaya Publishing House, New Delhi.
4. Environmental Biotechnology: Bhattacharya and Banerjee (2007) Oxford University Press.
5. Comprehensive Biotechnology (Vol. 1-4) Young Murray Moo (Ed.) 1985 Elsevier Sciences.

References:

1. H. S. Peavy, D. R. Rowe and G. Tchobanoglous, *Environmental Engineering*, McGraw-Hill Inc., 1985.
2. J. S. Devinny, M. A. Deshusses and T. S. Webster, *Biofiltration for Air Pollution Control*, CRC Press, 1998.
3. H. J. Rehm and G. Reed, *Biotechnology – A Multi-volume Comprehensive Treatise, Vol. 11,* 2nd Ed., VCH Publishers Inc., 1993.
4. Waste water Engineering Treatment, Disposal and Reuse. Metcalf & Eddy (1991) McGraw Hill.
5. Biochemical Engineering Fundamentals 2nd ed. Bailey, J. E. and Ollis, D. F. (1986) MacGraw Hill. New York

Digital resource:

https://onlinecourses.nptel.ac.in/noc21_bt41/
https://www.ntnu.edu/studies/courses/TBT4130