

DISCIPLINE SPECIFIC ELECTIVE COURSE (DSE-12): Environmental Biotechnology & Management

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course
		Lecture	Tutorial	Practical/Practice		
Environmental Biotechnology & Management DSE-12	4	2	0	2	Class XII pass	Nil

Learning Objectives:

The course aims to build awareness of:

- various global and regional environmental concerns due to natural causes and/or human activities.
- different types of pollution and their impacts on the environment.
- existing and emerging technologies that are important in the area of environmental biotechnology to fulfill Sustainable Development Goals.

Learning Outcomes:

After completion of course the student will be able to:

- demonstrate awareness about emerging concerns such as climate change, waste management; biodegradation of xenobiotic compounds; bioremediation, etc.
- relate applications of biotechnology for alleviating the environmental concerns
- appreciate the scientific, ethical and/or social issues
- understand the national and international legislations, policies and role of public participation in Environmental Protection

Theory : **30 hours**

Unit 1: Environment **5 hours**

Basic concepts and issues, global environmental problems - ozone layer depletion, UV-B, greenhouse effect and acid rain due to anthropogenic activities, their impact and biotechnological approaches for management. Fate of pollutants in the environment, Bioconcentration, Biomagnification.

Unit 2: Microbiology of waste water treatment	7 hours
Aerobic process - activated sludge, oxidation ponds, trickling filter. Anaerobic process - anaerobic digestion, anaerobic filters, up-flow anaerobic sludge blanket reactors. Treatment schemes for waste waters of dairy and sugar industries.	
Unit 3: Content: Xenobiotic compounds and their Biotreatment	12 hours
Organic (Bio degradation of petroleum products and pesticides) and inorganic (heavy metals, phosphates, nitrates). Bioremediation of xenobiotics in environment - ecological consideration, Bioaccumulation and Biosorption of heavy metals, Biopesticides, bioreactors, bioleaching, biomining, biosensors, Bioindicators and Bioprospecting	
Unit 4: Legislations, Policies for Environmental Protection and Pollution Management	6 hours
Stockholm Conference (1972) and its declaration, WCED (1983) and Montreal Protocol - 1987, Kyoto Protocol- 1997. Environmental ethics, Water Pollution (Prevention and Control) Act-1974, Air Pollution (Prevention and Control) Act-1981, National Environmental Policy - 2006, Central and State Pollution Control Boards: Constitution and power.	
PRACTICALS:	60 hours
1. Study the working and uses of trickling filters and activated sludge in treating waste water through photographs.	
2. Study of biomagnification and bioconcentration and its impact on environment through photographs.	
3. Study of different xenobiotic compounds (including pesticides (DDT), PAHs, heavy metals (Cr (VI) and Hg), and their effects on Environment.	
4. Study of airborne microbes using settle plate method from various sites (classroom, terrace and garden).	
5. Prepare compost pits using fruit peels, leaves noting the changes as well as temperature over time for biodegradation.	
6. Estimate Cr(VI) concentration in water sample (through diphenylcarbazide using spectrophotometric method).	
7. Detect nutrient pollution that causes eutrophication by performing colorimetric estimation of nitrate (using salicylic acid method) and phosphate (molybdenum blue method)	
8. A visit to any institute/ industry/ field site to understand the uses of microbes in environmental management and a report to be submitted for the same.	

Suggested Readings:

1. De, A. K. (2022). Environmental Chemistry, 10th Edition, New Delhi. New Age International Pvt. Limited

2. Dennis, A., Seal, K.J., Gaylarde, C.C. (2004). *Introduction to Biodeterioration*, Cambridge University Press
3. Rahman, Z. Thomas, L., (2025) *Industrial and Environmental Microbiology*. ISBN: 9781032644769. CRC Press
4. Ahmed, N., Qureshi, F.M., Khan, O.Y. (2006). *Industrial and Environmental Biotechnology*, Horizon Press
5. Rochelle, P.A. (2001). *Environmental Molecular Biology*, Horizon Press.
6. Jadhav, H.V., Bhosale, V.M. (2015). *Environmental Protection and Laws*, Himalaya publishing House Pvt Ltd.
7. Trivedi, P. C. (2006). *Biodiversity Assessment and Conservation*, Agrobios Publ.
8. Rana, S.V.S. (2015). *Environmental Biotechnology*, Rastogi Publications, India.