COMMON POOL OF GENERIC ELECTIVES (GE) COURSES OFFERED BY THE DEPARTMENTS

GENERIC ELECTIVES (GE-6: MICROBES IN ENVIRONMENTAL 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	Department offering the course
		Lecture	Tutorial	Practical/ Practice			
MICROB-GE6: **MICROBES IN ENVIRONMENTAL MANAGEMENT**	**4**	**2**	**0**	**2**	**None**	**NIL**	**Microbiology**

Learning Objectives

The Learning Objectives of this course are as follows:

- The main objective of the course is for students to appreciate how various microorganisms are bestowed with the capacity to modulate the environment.
- Students will get acquainted with the role of microbes in biodegradation, biogeochemical cycling, and production of biofuels.
- They will become aware of environmental problems and how microorganisms are used to manage these problems.
- This course will motivate them to think of novel ways to solve various environmental issues, including newer challenges such as e-waste management and plastic degradation using suitable microbes

Learning outcomes

The Learning Outcomes of this course are as follows:

- The student will be able to recall the importance of microbes in any ecosystem with reference to nutrient cycling/ biogeochemical cycling, and biofuels and the role of microbes in mineral recovery.
- The student will be able to describe BOD, COD and various methods of waste treatment (solid and liquid) utilizing diverse microorganisms.

- The student will be able to describe microbial bioremediation, including petroleum products, microbial degradation of pesticides, plastics and e-waste management for a cleaner environment.
- The student will be able to describe the concept of potability of water and demonstrate various tests to check the potability of given water samples.
- The student will be able to demonstrate isolation of microorganisms with special and unique properties from natural reservoirs of soil and landfills etc. and analyse how they keep reclaiming and rejuvenating our environment.
- The student will be able to demonstrate the use of conventional methods with innovative solutions to preserve and enhance environmental sustainability.

SYLLABUS OF MICROB-GE6

UNIT – I (5 Weeks)
Role of microbes in biodegradation, biofuels and bioleaching: Role of microbes in biodegradation and maintaining a continuous supply of nutrients like carbon, nitrogen (nitrogen fixation, ammonification and denitrification) and phosphorus in the ecosystem. Microbes as sources of Biofuels: bioethanol, algal biofuels, biogas, microbes in mineral recovery (iron, gold).

UNIT – II (6 Weeks)
Microbes in waste management: Sources and types of solid waste, sanitary landfill, composting. Liquid waste management: composition and strength of sewage (BOD and COD). Primary, secondary (aerobic: Oxidation pond, Trickling filter, Activated sludge process; anaerobic: Septic tank, Imhoff tank, anaerobic sludge digestor); and tertiary sewage treatment

UNIT – III (4 Weeks)
Microbial bioremediation: Bioremediation of contaminated soils (heavy metals and petroleum) and marine pollutants. Microbial degradation of pesticides (2,4-D and 2,4,5-T). Role of microbes in e-waste management and plastic degradation

Practical component –

UNIT – 1 (5 Weeks)
Determination of water potability: Water potability, Safety standards of drinking (potable) water. Methods to determine potability of water samples, standard qualitative procedure - presumptive test/MPN test, confirmed and completed tests for faecal coliforms; membrane filtration technique and Presence/Absence tests for coliforms using rapid detection kit

UNIT – 2 (6 Weeks)
Isolation of microbes important in environment management: Detection of starch/ cellulose-degrading and dye (malachite green/ crystal violet/ methylene blue) decolorising microorganisms from the soil. Isolation of heavy metal-accumulating

(copper/ nickel/ zinc/ cobalt/ aluminium) microorganisms from soil, and plastic-degrading microbes from landfills

UNIT – 3 (4 Weeks)

Preparation of compost using composting pits on college premises or elsewhere. Student Idea Presentation on environment protection. Visit to a wastewater treatment plant/solid waste treatment site. Understanding eutrophication and algal blooms with the help of pictures

Essential/recommended readings

1. Brock Biology of Microorganisms by M.T. Madigan,J. Aiyer,D. Buckley,W.Sattley and D. Stahl.16th edition. Pearson, USA. 2021.
2. Prescott's Microbiology by J. M. Willey, K. Sandman and D. Wood. 11th edition. McGrawHill Higher Education, USA. 2019.
3. Soil Microbiology by N.S. Subba Rao. 5th edition. Medtech, India. 2017.
4. Environmental Microbiology edited by I.L. Pepper, C.P. Gerba, T.J. Gentry. 3rd edition.Academic Press, USA. 2014.
5. Advances in Applied Bioremediation edited by A. Singh, R.C. Kuhad and O. P. Ward.Springer-Verlag, Germany. 2009.
6. Microbial Ecology: Fundamentals and Applications by R.M. Atlas, R. Bartha. 4th edition.Benjamin Cummings, USA. 2000.
7. An Introduction to Soil Microbiology by A. Martin. 2nd edition. John Wiley and Sons Co, UK. 1991.

Suggestive readings (if any)

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.