

**PRE-REQUISITE:** ENSC-**COURSE LEARNING OUTCOMES**

- The students will learn about the ecology and diversity of microbial communities in soil, water and air
- Students will learn about ecological importance of microorganism
- Their roles in wastewater treatment and bioremediation of polluted environment
- Role of microorganisms in industry and agriculture sectors

**CONTENTS****Unit-I: Environmental microbiology and microbial growth**

- 1.1. Introduction, scope of environmental microbiology and brief history
- 1.2. Microbial metabolism and microbial growth in the environment
- 1.3. Physicochemical factors affecting the environmental fate of microorganisms
- 1.4. Microbial habitats and ecology (air, soil and water)

**Unit-II: Air, water and soil microbiology**

- 2.1. Nature of microbial communities
- 2.2. Life at low nutrient concentrations
- 2.3. Occurrence and distribution of microbial communities in extreme environments
- 2.4. Air microbiology
- 2.5. Role of fresh water and marine water microorganisms
- 2.6. Microorganisms in different terrestrial habitats

**Unit-III: Industrial and agricultural microbiology**

- 3.1. Microorganisms in sewage and sewage treatment
- 3.2. Role of microorganisms in biofuel production
- 3.3. Role of microbial enzymes in different industries
- 3.4. Soil Microorganisms of higher plants
- 3.5. Microorganisms and organic agriculture

**Unit-IV: Ecological importance of microorganisms for environmental management**

- 4.1. Microbial ecology
- 4.2. Symbiosis between plants and microorganisms (nitrogen fixation, mycorrhiza)
- 4.3. Microbial functions in biogeochemical cycles
- 4.4. Solid waste treatment by composting
- 4.5. Bioremediation of organic pollutants and heavy metals in soil and aquatic environments
- 4.6. Bioleaching and biomining

**TEACHING – LEARNING STRATEGIES**

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

## ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

- classroom participation,
- attendance, assignments and presentation,
- homework
- attitude and behavior,
- hands-on-activities,
- short tests, quizzes etc.

## ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

## RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

2. Singh, A., Srivastava, S., & Rathore, D. (2021). *Environmental microbiology and biotechnology: volume 2: bioenergy and environmental health*. Springer Nature.
3. Di Prisco, G., Edwards, H. G., Elster, J., & Huiskes, A. H. (Eds.). (2020). *Life in Extreme Environments: Insights in Biological Capability*. Cambridge University Press.
4. Singh, C., Tiwari, S., Singh, J. S., & Yadav, A. N. (Eds.). (2020). *Microbes in agriculture and environmental development*. CRC Press.
5. Singh, J., Vyas, A., Wang, S., & Prasad, R. (2020). *Microbial Biotechnology: Basic Research and Applications*. Springer Singapore.
6. Mishra, B. B. (2020). *Frontiers in Soil and Environmental Microbiology*. CRC Press.
7. Goldman, E., & Green, L. H. (Eds.). (2015). *Practical handbook of microbiology*. CRC press.

### Further Reading:

As suggested by the Instructor.

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### **CONTENTS**

#### **Unit-I: Preparation of growth media**

- 1.1. Preparation and sterilization of different microbial growth media

#### **Unit-II: Isolation and growth of microorganisms**

- 2.1. Detection of microorganisms in the ground, water and air
- 2.2. Isolation of bacteria from different industrial effluents
- 2.3. Effects of different pH and temperatures on microbial growth

#### **Unit-III: Characterization of microorganisms**

- 3.1. haracterization of microorganisms through morphological, gram staining and biochemical methods
- 3.2. Study of different growth media on bacterial growth curves

#### **Unit-IV: Environmental implications of microorganisms**

- 4.1. Plant growth promotion by microorganisms
- 4.2. Bioremediation of heavy metals by microorganisms

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