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 Monitoring and Ecosystem Restoration BOT-GE-17	4	2	0	2	Class XII pass with science	Nil

Learning Objectives:

● The course will train students on methods for conducting environmental monitoring protocols.
● It will provide experiential learning in conducting quality check experiments on soil, water and air.
● The course will develop understanding on different aspects of ecosystem restoration and processes through monitoring system.

Learning Outcomes:

At the end of this course, students will be able to:
● understand the problem of environmental degradation
● assessment of quantitative and qualitative parameters used in environmental monitoring of air, soil and water.
● understand the strategies and methods for ecosystem restoration, including physico-chemical and biological indicators.
● understand degraded and restored sites through field visits.

Unit 1: Introduction   03 Hours
Ecosystem degradation, Magnitude/ Scale of degradation (National and Global Scenario); influence of climate change in Ecosystem degradation (extreme and erratic natural events)

Unit 2: Factors of environmental degradation   03 Hours
Factors responsible for degradation of soil, water, air and loss of biodiversity; natural and anthropogenic-forest fires, landslides, floods, deforestation, overgrazing, soil erosion, mining, landfills, etc.

Unit 3: Ecosystem Restoration   06 Hours

Definition; UN decade on Ecosystem Restoration; Bradshaw's Concept: Restoration, Rehabilitation and Reclamation (replacement); Role of Sustainable Development Goals (SDGs)., REDD+, Joint Forest Management; Relevance for people, nature and climate.

Unit 4: Environment Monitoring **09 Hours**

Indicators of land degradation: Soil- alkalinity, salinity, organic carbon and soil health; Water- pH, Hardness, BOD, COD and Heavy metals content; Air- PM 10 , PM 2.5 , SO_2 , NOx, ozone), Air Quality Index (AQI); Bioindicators/ Biomonitors (plants, animals and microbes).

Unit 5: Role of Plants and Microbes in Ecosystem Restoration **09 Hours**

Brief account of remediation technologies: bioremediation, phytoremediation (phytoextraction, rhizofiltration, phytovolatilization, phytostabilization etc); Role of associations of Grasses-AMF, Legumes-Rhizobium in restoring degraded land/ mined out areas; Role of macrophytes in wetland restoration; Role of green spaces including parklands and avenue plantations in amelioration of air quality.

Practicals **60 hours**

1. Field visit to degraded ecosystem/ natural ecosystem/restored ecosystem.
2. Analyze the soil and water samples from polluted and unpolluted sites for their pH
3. Analyze carbonates, chlorides, nitrates, sulphates, organic matter and base deficiency by rapid field tests in soil samples from degraded and healthy sites.
4. Determine the organic matter in soil samples by Walkley and Black's rapid titration method.
5. Determine the dissolved oxygen of water samples of polluted and nonpolluted sites by Winkler's method.
6. Determine the BOD and COD content of water samples of polluted and nonpolluted sites.
7. To collect, collate and analyze Air Quality Index (AQI) data, Water Quality data of various locations from DPCC/CPCB website collected from real-time monitoring stations.
8. Study of bioindicators (plant, animal and microbes).

Suggested Readings:

1. Bagyaraj, D.J. and Jamaluddin (2016) Microbes for Restoration of Degraded Ecosystems, New India Publishing Agency
2. Majumdar R., Kashyap R (2020). Practical Manual of Ecology and Environmental Science, Prestige
3. Ricklefs, R. E., Miller, G. L., (2000). Ecology, 4th edition W.H. Freeman.
4. Sharma, P. D. (2017). Ecology and Environment, 13th Edition. Meerut: Rastogi Publications.
5. Smith, T. M., Smith, R. L. (2012). Elements of Ecology 8th Edition. Pearson.

Additional Resources:
1. Central Pollution Control Board (CPCB) Air and Water: https://cpcb.nic.in/real-time-data/
2. Managing Ecosystems in The Context of Climate Change Mitigation: A review of current knowledge and recommendations to support ecosystem-based mitigation actions that look beyond terrestrial forests https://www.cbd.int/doc/publications/cbd-ts-86-en.pdf
3. National Clean Air Programme (NCAP) 2018. https://moef.gov.in/wp-content/uploads/2019/05/NCAP_Report.pdf
4. Real Time Ambient Air Quality Data (DPCC). https://www.dpccairdata.com/dpccairdata/display/index.php
5. Restoration for People, Nature and Climate, https://wedocs.unep.org/bitstream/handle/20.500.11822/36251/ERPNC.pdf
6. Champion, H. G., and S. K. Seth. A revised classification of forest types of India. Manager Publication, Government of India, Delhi (1968).

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