



**SYLLABUS & PROGRAMME
STRUCTURE OF FOUR YEARS
UNDERGRADUATE PROGRAMME**

ENVIRONMENTAL SCIENCE

**(Minor)
Semester - IV**

(Under National Education Policy- 2020)

(Effective from the Academic Session 2023-2024)

**MAHARAJA BIR BIKRAM UNIVERSITY
AGARTALA, TRIPURA: 799004**

Four Years Undergraduate Programme (As per NEP- 2020)

Environmental Science

Paper: ENSG4T

(Theory)

Course 4: Environmental Pollution

COURSE OBJECTIVES:

- 1) To introduce the concept and classification of environmental pollution.
- 2) To understand the sources, types, and control technologies for air, water, and soil pollution.
- 3) To develop knowledge about solid waste and hazardous waste management.
- 4) To understand environmental quality parameters and regulatory frameworks.

CO No.	Attributes	
CO1	Understand the definitions, types, and sources of environmental pollution and pollutants.	
CO2	Gain knowledge about air pollution, monitoring, analysis, and pollution control technologies.	
CO3	Comprehend various water pollutants, water quality standards, and treatment methods.	
CO4	Learn about soil pollution, solid and hazardous waste management, including regulatory aspects.	
Unit wise detailed content		
Unit 1	Number of Lectures 15	Title of Unit: Introduction to Environmental Pollution
		• Definition of environmental pollution and pollutants • Sources: Natural and anthropogenic, point and non-point sources • Types of pollutants: Primary and secondary • Role of regulatory bodies: MoEFCC, CPCB, NGT, SPCBs, EPA, FSI
Unit 2	Number of Lectures 20	Title of Unit: Air Pollution
		• Definition, types, and sources of air pollution • Major air pollutants and their effects on public health and the environment • Indoor air pollution, acid rain, photochemical smog, particulates

		• Air quality standards and air monitoring • Atmospheric sampling and analysis techniques • Technologies for industrial air pollution control • Prevention and control of air pollution in India
Unit 3	Number of Lectures 20	Title of Unit: Water Pollution
		• Classification of water pollutants: Organic and inorganic • Sources: Sewage, agricultural runoff, synthetic compounds, oil, sediments • Bio-concentration and Bio-magnification • Wastewater treatment methods: Preliminary, primary, secondary, tertiary • Water quality parameters: pH, EC, turbidity, TDS, hardness, chlorides, fluorides, salinity, DO, BOD, COD, nitrates, phosphates, heavy metals • Indian standards for drinking water quality • Drinking water treatment: Coagulation, flocculation, sedimentation, filtration, disinfection, softening • Prevention and control of water pollution
Unit 4	Number of Lecturers 20	Title of Unit: Soil Pollution and Solid Waste Management
		• Sources and types of soil pollutants: Inorganic, organic • Effects of soil pollution from agriculture, fertilizers, pesticides, industry, and urban waste • Soil pollution control and remediation techniques • Integrated solid waste management and waste hierarchy • Solid waste rules and regulations in India • Municipal solid waste: Sources, characteristics, collection, processing, disposal • Hazardous waste: Characteristics, generation, treatment, and disposal • Management of biomedical waste, plastic waste, and E-waste

Suggested Readings:

- 1) **Vallero, D. A.** *Fundamentals of Air Pollution*. 5th ed. Elsevier, 2014.
- 2) **Seinfeld, J. H. & Pandis, S. N.** *Atmospheric Chemistry and Physics: From Air Pollution to Climate Change*. 3rd ed. Wiley, 2016.
- 3) **Rao, C. S.** *Environmental Pollution Control Engineering*. 3rd ed. Wiley-Eastern, 2007.
- 4) **Wark, K. & C. F. Warner.** *Air Pollution: Its Origin and Control*. 2nd ed. Harper & Row, 1976.

- 5) **Sawyer, C. N., McCarty, P. L. & G. F. Parkin.** *Chemistry for Environmental Engineering and Science*. 5th ed. McGraw-Hill, 2003.
- 6) **Peavy, H. S., Rowe, D. R. & G. Tchobanoglous.** *Environmental Engineering*. 3rd ed. McGraw-Hill, 1985.
- 7) **Metcalf & Eddy, Inc.** *Wastewater Engineering: Treatment and Resource Recovery*. 5th ed. McGraw-Hill, 2014.
- 8) **Brady, N. C. & R. R. Weil.** *The Nature and Properties of Soils*. 15th ed. Pearson Prentice Hall, 2016.
- 9) **Tchobanoglous, G., Theisen, H. & S. A. Vigil.** *Integrated Solid Waste Management: Engineering Principles and Management Issues*. 2nd ed. McGraw-Hill, 1993.
- 10) **Pichtel, J.** *Waste Management Practices: Municipal, Hazardous, and Industrial*. 2nd ed. CRC Press, 2014.
- 11) **Vesilind, P. A., Worrell, W. A. & D. R. Reinhart.** *Solid Waste Engineering*. 5th ed. Cengage, 2016.

COURSE: ENVIRONMENTAL SCIENCE
COURSE CODE: ENSG4P

Fourth Semester

COURSE OUTCOME: After successful completion of the course, the students will develop following attribute.

CO No.	Attributes
CO1	Develop practical skills in environmental sampling and analysis of air, water, and soil.
CO2	Apply analytical techniques to assess pollution levels and water/soil quality.
CO3	Gain field-level exposure to pollution control strategies and industrial practices.
CO4	Understand environmental regulations through institutional visits and real-time observations.
	Detail Content of Practical
<i>Air Quality and Monitoring</i> 1. Visit to State Pollution Control Board to understand role and regulations 2. Sampling and analysis of particulate matter: PM₁₀, PM_{2.5} 3. Study of air pollutants and calculation of Air Quality Index (AQI) 4. Visit to local industry to understand pollution control technologies	
<i>Water Quality Analysis</i> 1. Collection and preservation of water samples 2. Determination of transparency of pond water 3. Estimation of pH, free dissolved CO₂, alkalinity, chloride, fluoride 4. Estimation of nitrate, phosphate, hardness, and dissolved oxygen	
<i>Soil Quality Analysis</i> 1. Determination of soil pH and moisture 2. Texture analysis, bulk density, and water-holding capacity 3. Estimation of soil organic carbon and total nitrogen 4. Estimation of available and total phosphorus in soil	

Suggested Readings:

- 1) **Patnaik, P.** *Handbook of Environmental Analysis: Chemical Pollutants in Air, Water, Soil and Solid Wastes*. 3rd ed. CRC Press, 2017. ISBN: 978-1498745611
- 2) **Sood, A.** *Laboratory Manual of Environmental Chemistry*. Alpha Science International, 2012.
- 3) **Trivedi, R. K. & P. K. Goel.** *Chemical and Biological Methods for Water Pollution Studies*. Environmental Publication, 1986.

- 4) **APHA, AWWA & WEF.** *Standard Methods for the Examination of Water and Wastewater*. 23rd ed. American Public Health Association, 2017. ISBN: 978-0875532875
- 5) **NEERI.** *Field and Laboratory Manual for Environmental Monitoring*. National Environmental Engineering Research Institute, 2015.
- 6) **CPCB.** *Manual for Ambient Air Quality Monitoring*. Central Pollution Control Board, India, 2013.
- 7) **Lodha, R.** *Environmental Pollution and Control*. McGraw-Hill Education, 2005.
- 8) **Welsch, H.** *Water Quality: Guidelines, Standards and Health*. IWA Publishing, 2008.
- 9) **Manivasakam, N.** *Physico-Chemical Examination of Water, Sewage and Industrial Effluents*. Pragathi Prakashan, 2005.
- 10) **Tandon, H. L. S.** *Methods of Analysis of Soils, Plants, Waters and Fertilizers*. Fertilizer Development & Consultation Organization, 1991.
- 11) **Jackson, M. L.** *Soil Chemical Analysis*. Prentice Hall of India, 1973.