

TRIPURA UNIVERSITY
SURYAMANINAGAR, AGARTALA, TRIPURA: 799022

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

**ENVIRONMENTAL SCIENCE
(MINOR)**

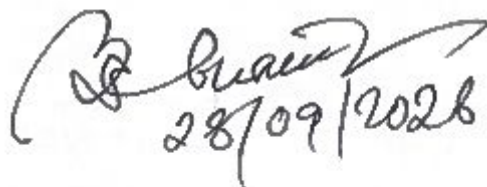
Credits: 4 (Theory 3 + Practical 1)

Semester : VII

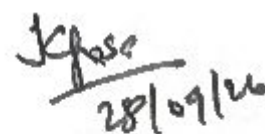
*(Under National Education Policy - 2020)
(Effective from the Academic Session 2026-2027)*

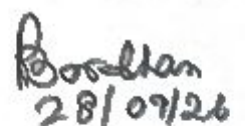
**ENVIRONMENTAL SCIENCE MINOR SYLLABUS
(UNDER NEP 2020)**


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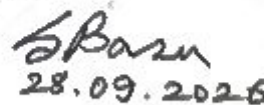

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Course Code : ENSG701M
 Title : ENVIRONMENTAL ISSUES, ETHICS, AND SUSTAINABLE SOLUTIONS
 Credits : 3 (Theory)
 Total Marks : 60 (EA: 36 + IA: 24)

COURSE OBJECTIVES

Upon completion of this course, the student will be able to:

- Understand the philosophical and ethical dimensions of environmental decision-making and justice.
- Analyze global environmental challenges including climate change, biodiversity loss, and urbanization.
- Evaluate the principles and applications of green technology, renewable energy, and sustainable resource management.
- Examine the role of industrial microbiology in environmental remediation and biotechnological innovations.
- Critically assess environmental movements, policy successes and failures, and pathways to sustainable development.

COURSE OUTCOMES (CO'S)

CO	Description
CO1	Analyze ethical frameworks and justice principles in environmental governance and policy.
CO2	Evaluate the causes, impacts, and mitigation strategies for global environmental issues like climate change and biodiversity loss.
CO3	Assess urbanization trends and propose sustainable urban planning solutions integrating green infrastructure.
CO4	Apply principles of green technology and renewable energy to address environmental degradation.
CO5	Examine microbial biotechnological applications in environmental remediation and industrial processes.
CO6	Critically evaluate environmental movements, policy frameworks, and sustainable development strategies.

UNIT-WISE DETAILED CONTENT

Unit 1	Number of Lectures: 16	Title of Unit: Philosophy, Ethics, and Global Environmental Issues
		Introduction to Philosophy & Ethics: Philosophy: Definition, nature, scope, concept, Branches. Ethics: Definition, Moral philosophy, nature of moral judgement and reaction. Anthropocentrism, biocentrism, and ecocentrism. Deep ecology, ecofeminism, and environmental pragmatism. Ethics with respect to

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		science and research. Environmental Justice and Equity: Definition and dimensions of environmental justice. Case studies: Environmental refugees, Environmental racism, unequal exposure to pollution, and climate justice. Global Environmental Issues: Climate Change: Causes, greenhouse gas emissions, global warming, impacts on ecosystems and human systems. Biodiversity Loss: Drivers, extinction rates, conservation significance, and international frameworks (CBD, CITES). Air pollution: Causes, Impact and remedies. Water Scarcity and Pollution: Causes, Impact and remedies.
Unit 2	Number of Lectures: 16	Title of Unit: Urban Growth, Planning, and Environmental Impacts
		Urbanization Processes and Trends: Global and Indian urbanization patterns. Drivers of urban growth, Development-induced displacement, resettlement and rehabilitation; impact of industry and technology on environment; urban sprawl, traffic congestion and social-economic problems; Urban heat island effect; modern agriculture and environmental degradation Urban Planning and Sustainable Development: Principles of sustainable urban planning: compact cities, mixed land use, transit-oriented development. Green Infrastructure and Urban Design: Green roofs, urban forests, permeable pavements, and rainwater harvesting. Sustainable Transportation Solutions: Bus rapid transit (BRT) systems, metro rail networks, electric mobility, and cycling infrastructure.
Unit 3	Number of Lectures: 16	Title of Unit: Green Technology, Renewable Energy, and Waste Management.
		Principles of Green Technology: Definition, scope, and objectives of green technology. Renewable Energy Technologies: Solar Energy: Photovoltaic cells, solar thermal systems, and grid integration. Wind Energy: Onshore and offshore wind turbines, potential and challenges. Hydroelectric Power: Large and small-scale hydropower.

		environmental impacts. Biomass Energy and Biofuels: Types, production processes (biogas, bioethanol, biodiesel), and sustainability concerns. Waste Management and Recycling: Waste-to-Energy Technologies: Incineration, gasification, pyrolysis, and anaerobic digestion. Circular Economy Principles: Reduce, reuse, recycle, and recover; product lifecycle management; extended producer responsibility.
Unit 4	Number of Lectures: 16	Title of Unit: Industrial Microbiology and Environmental Solutions
		Microorganisms in Environmental Remediation: Bioremediation of Pollutants: Microbial degradation of hydrocarbons, heavy metals, pesticides, and plastics. Microbial Biosensors for Environmental Monitoring: Principles, types, and applications for detecting pollutants. Microbial Biotechnology: Applications in agriculture: biofertilizers, biopesticides, and plant growth-promoting rhizobacteria. Applications in industry: fermentation technology, antibiotic production, and bioplastics. Restoration Ecology and Ecosystem Rehabilitation: Principles, approaches, and success stories. Sustainable Development Goals (SDGs) and Environmental Sustainability: SDG 6 (Clean Water), SDG 7 (Affordable and Clean Energy), SDG 11 (Sustainable Cities), SDG 13 (Climate Action), SDG 15 (Life on Land).

Suggested Readings

- 1) Kothari, C. R. (2019). Research Methodology: Methods and Techniques. New Age International.
- 2) Kumar, R. (2019). Research Methodology: A Step-by-Step Guide for Beginners. SAGE Publications.
- 3) Singh, J.S., Singh, S.P., & Gupta, S.R. (2015). Ecology, Environmental Science and Conservation. S. Chand Publishing.
- 4) Daily, G. C. (Ed.). (1997). Nature's Services: Societal Dependence on Natural Ecosystems. Island Press.
- 5) Skoog, D. A., Crouch, S. R., & Holler, F. J. Principles of Instrumental Analysis. Cengage Learning.
- 6) Meiners, R. Environmental Instrumentation and Analysis Handbook. McGraw-Hill Education.

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- 7) Norman, M., & Kent, J. Environmental Issues and Solutions: A Modular Approach. Cengage Learning.
- 8) Kutting, G. Global Environmental Politics: Concepts, Theories, and Case Studies. Routledge.
- 9) Elmqvist, T. et al. (Eds.). Urbanization and Sustainability: Linking Urban Ecology, Environmental Justice and Global Environmental Change. Springer.
- 10) Anastas, P. T., & Warner, J. C. Green Chemistry: Theory and Practice. Oxford University Press.
- 11) Boyle, G. Renewable Energy: Power for a Sustainable Future. Oxford University Press.
- 12) Lacy, P., & Rutqvist, J. Waste to Wealth: The Circular Economy Advantage. Palgrave Macmillan.
- 13) Waites, M. J. et al. Industrial Microbiology: An Introduction. Wiley.
- 14) Crawford, R. L., & Crawford, D. L. (Eds.). Bioremediation: Principles and Applications. Cambridge University Press.
- 15) Hu, Z. Environmental Science and Technology: Concepts and Applications. CRC Press.
- 16) van Andel, J., & Aronson, J. Restoration Ecology: The New Frontier. Wiley.
- 17) O'Riordan, T., & Page, S. J. Environmental Management: Principles and Practice. Routledge.
- 18) Katila, P. et al. (Eds.). Sustainable Development Goals: Their Impacts on Forests and People. Cambridge University Press.
- 19) Henry, J. G., & Heinke, G. W. Environmental Science and Engineering. Pearson Education.

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PRACTICAL SYLLABUS

Course Code: ENSG702M
Course Title: Practicals in Environmental Issues, Ethics, and Sustainable Solutions
Credits: 1 (Practical)
Total Marks: 40 (EA: 24 + IA: 16)

COURSE OBJECTIVES:

Upon completion of the practical course, the student will be able to:

- Assess environmental quality parameters using field and laboratory techniques.
- Analyze and interpret data related to climate change, urban heat islands, and pollution.
- Develop sustainable solutions for urban environmental challenges.
- Evaluate green technology applications and renewable energy systems.
- Conduct micro-level studies on bioremediation and microbial applications.

COURSE OUTCOMES (COS)

CO	Description
CO1	Collect and analyze environmental data using standard field and laboratory methods.
CO2	Prepare reports on urban environmental challenges and propose sustainable urban planning solutions.
CO3	Demonstrate the application of green chemistry principles and renewable energy technologies through case studies.
CO4	Perform experiments related to bioremediation and microbial biotechnology.
CO5	Critically evaluate environmental policies and movements through case study analysis.

PRACTICAL DETAILS

Practical 1:

Environmental Quality Assessment

Collect water/soil samples from a local site.

Analyze physico-chemical parameters (pH, temperature, dissolved oxygen, BOD, COD, heavy metals).

Interpret results in the context of environmental standards.

Practical 2:

Climate Change and Urban Heat Island Study

Analyze temperature data from different land use zones (urban, suburban, rural).

Prepare graphs showing temperature variations and propose mitigation strategies.

Practical 3:

Green Technology and Renewable Energy

Study solar panel efficiency under varying conditions.

Design a small-scale biogas plant model or solar water heater.

Prepare a report on the feasibility of renewable energy for a local community.

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Practical 4:

Waste Management and Circular Economy

Conduct a waste audit of a campus or local area.

Categorize waste into recyclable, compostable, and hazardous fractions.

Propose a waste-to-energy or composting solution with a cost-benefit analysis.

Practical 5:

Bioremediation and Industrial Microbiology

Isolate and identify microorganisms from contaminated soil/water.

Study microbial degradation of organic pollutants (e.g., oil, dye).

Suggested Readings for Practical

- 1) Shah, C. M. (2017). *Practical Environmental Analysis*. Campus Books.
- 2) Kumar, A., & Singh, P. (2020). *Handbook of Environmental Analysis*. TERI Press.
- 3) Crawley, M. J. (2012). *The R Book*. Wiley.
- 3) APHA (2017). *Standard Methods for the Examination of Water and Wastewater*. American Public Health Association.

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