

Maulana Abul Kalam Azad University of Technology, WB
(Formerly known as West Bengal University of Technology)
Syllabus of B.Sc in Environment Science
Effective from academic session 2023-24

Semester-V

Major Paper Code: BENVS-501 & BENVS -591	SEM-V
Paper Name: Ecology & Ecosystem	Maximum Marks: 100
Teaching Scheme	Examination Scheme
Lecture hour: 45	End semester exam: 70
Tutorial hour: 0	Continuous Assessment: 30
Practical hour: 30	Practical/Seasonal internal continuous evaluation
Total hours: 75	Practical/Seasonal external examination: 0
Credit: 3+2	Mode of Exam: Offline

Course Objective:

- To provide a comprehensive understanding of ecological principles and the structure and function of ecosystems.
- To develop knowledge of biotic and abiotic interactions in different ecosystems.
- To understand ecosystem dynamics and the role of biodiversity in maintaining ecological balance.

Course Outcome:

- Knowledge: Understand the basic concepts and structure of ecosystems and biodiversity.
- Scientific Skills: Demonstrate the ability to analyze ecological parameters and biodiversity indices.
- Environmental Problem-Solving: Evaluate ecosystem functioning and assess anthropogenic impacts.
- Environmental Policy and Regulation: Relate ecological knowledge to environmental policy and conservation strategies.
- Sustainable Practices: Promote conservation and sustainable use of natural resources aligned with SDGs.

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MODULE I: 8 Hours

Introduction to Ecology: Definition, scope, and relevance of ecology. Levels of organization. Ecological factors: abiotic (temperature, water, light, soil) and biotic components.

MODULE II: 10 Hours

Ecosystem Structure and Function: Components of ecosystems. Food chains, food webs, and ecological pyramids. Energy flow and productivity (GPP, NPP, NEP).

MODULE III: 10 Hours

Population and Community Ecology: Population characteristics and growth models. Species interactions. Community structure and ecological succession.

MODULE IV: 9 Hours

Types of Ecosystems: Forest, grassland, desert, freshwater, marine, estuarine, and wetland ecosystems and their significance.

MODULE V: 8 Hours

Biodiversity and Conservation: Types of biodiversity, threats and conservation measures, ecosystem services.

Reference Books:

- Gillespie, A. 2006. Climate Change, Ozone Depletion and Air Pollution: Legal Commentaries with Policy and Science Considerations. Martinus Nijhoff Publishers.
- Maslin, M. 2014. Climate Change: A Very Short Introduction. Oxford Publications.
- Mathez, E.A. 2009. Climate Change: The Science of Global Warming and our Energy Future. Columbia University Press.
- Mitra, A.P., Sharma, S., Bhattacharya, S., Garg, A., Devotta, S. & Sen, K. 2004. Climate Change and India. Universities Press, India.
- Philander, S.G. 2012. Encyclopedia of Global Warming and Climate Change (2nd edition). Sage Publications.

Practical

Major Paper Code: BENVS -591

Credit: 2

- Study of various ecosystems through field visits.
- Identification of flora and fauna.
- Measurement of environmental factors.
- Estimation of productivity and biodiversity indices.

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Major Paper Code: BENVS-502 & BENVS -592	SEM-V
Paper Name: Environmental Biotechnology	Maximum Marks: 100
Teaching Scheme	Examination Scheme
Lecture hour: 45	End semester exam: 70
Tutorial hour: 0	Continuous Assessment: 30
Practical hour: 30	Practical/Seasonal internal continuous evaluation
Total hours: 75	Practical/Seasonal external examination: 0
Credit: 5	Mode of Exam: Offline

Course Objective:

- To introduce the concepts of biotechnology with a focus on environmental applications.
- To understand the role of microorganisms in waste treatment and pollution control.
- To familiarize students with biotechnological tools for environmental monitoring and bioremediation.

Course Outcome:

- Knowledge: Describe the fundamentals of environmental biotechnology and microbial diversity.
- Scientific Skills: Apply microbial techniques in waste treatment and pollutant degradation.
- Environmental Problem-Solving: Analyze the use of biotechnology in bioremediation and pollution control.
- Environmental Policy and Regulation: Assess biosafety, legal, and ethical issues in the deployment of GMOs.
- Sustainable Practices: Support sustainable environmental management through biotechnological innovations.

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MODULE I: 8 Hours

Introduction to Environmental Biotechnology: Definition, scope and role of biotechnology in environmental protection. Microbial diversity in natural and polluted environments.

MODULE II: 10 Hours

Waste Treatment Technologies: Microbial degradation of organic pollutants. Biotreatment of solid and liquid wastes. Anaerobic digestion and composting.

MODULE III: 10 Hours

Bioremediation and Phytoremediation: In-situ and ex-situ bioremediation. Role of microbes and plants in degradation. Use of genetically engineered organisms.

MODULE IV: 9 Hours

Environmental Monitoring Tools: Biosensors – types, design and application. Bioindicators. Molecular tools – PCR, DNA probes.

MODULE V: 8 Hours

Sustainable and Emerging Technologies: Bioplastics, biofuels, microbial fuel cells. Environmental genomics and metagenomics.

Reference Books:

- Environmental Biotechnology: Principles and Applications, Bruce E. Rittmann & Perry L. McCarty, McGraw-Hill
- Environmental Biotechnology: A Biosystems Approach, Daniel A. Vallero, Academic Press
- Textbook of Environmental Biotechnology, Mohapatra P.K., I.K. International Publishing
- Biotechnology for Environmental Protection in the Pulp and Paper Industry, P. Bajpai

Practical

Major Paper Code: BENVS -592

Credit: 2

- Isolation and identification of pollutant-degrading microbes.
- Compost preparation and quality analysis.
- Biosensor design and testing.
- Environmental monitoring using molecular tools.

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Semester-VI

Major Paper Code: BENVS-601	SEM-VI
Paper Name: Ecotoxicology & Environmental Science	Maximum Marks: 100
Teaching Scheme	Examination Scheme
Lecture hour: 45	End semester exam: 70
Tutorial hour: 30	Continuous Assessment: 30
Practical hour: 0	Practical/Seasonal internal continuous evaluation: 0
Total hours: 75	Practical/Seasonal external examination: 0
Credit: 5	Mode of Exam: Offline

Course Objective:

- Introduce core concepts of ecotoxicology, including types of toxicants, exposure pathways, dose-response relationships, and toxicokinetic.
- Examine the fate, transport, and bioaccumulation of pollutants in the environment.
- Equip students with the knowledge to conduct ecological and human health risk assessments.
- Introduce bioassays and toxicity testing methods using indicator species
- Study global environmental issues like climate change, biodiversity loss, water and air pollution, waste management

Course Outcome:

- Understand key concepts like toxicity, exposure pathways, dose-response relationships, and types of toxicants.
- Analyze the impact of heavy metals, pesticides, industrial chemicals, and pharmaceuticals on aquatic and terrestrial organisms.
- Discuss the science and impacts of climate change, deforestation, water scarcity, pollution, and biodiversity loss.
- Demonstrate skills in report writing, data interpretation, presentations, and environmental impact analysis.

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MODULE 1: 6 Hours

Introduction to Ecotoxicology Definition, scope, environmental contaminants, toxic chemicals in the environment (air, water, soil).

MODULE 2: 9 Hours

Toxicokinetics and Toxicodynamics Absorption, distribution, metabolism, and excretion (ADME), dose-response relationship, interaction of toxicants.

MODULE 3: 9 Hours

Bioaccumulation and Biomagnification Mechanisms, factors affecting bioaccumulation, food chain effects, examples from aquatic and terrestrial ecosystems.

MODULE 4: 10 Hours

Environmental Monitoring and Risk Assessment Ecotoxicological testing, biomarkers, ecological risk assessment methods, regulatory guidelines.

MODULE 5: 6 Hours

Case Studies and Global Perspectives Pesticide pollution, heavy metals, emerging contaminants (e.g., microplastics), and their mitigation strategies.

Reference Books:

1. Newman, M. C. (2014). *Fundamentals of Ecotoxicology*.
2. Connell, D. W., & Miller, G. J. (2006). *Chemistry and Ecotoxicology of Pollution*.
3. Walker, C. H. et al. (2012). *Principles of Ecotoxicology*.
4. Manahan, S. E. (2010). *Environmental Chemistry*.

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Major Paper Code: BENVS-602 & BENVS -691	SEM-VI
Paper Name: Environmental Engineering & Pollution Control Measures	Maximum Marks: 100
Teaching Scheme	Examination Scheme
Lecture hour: 45	End semester exam: 70
Tutorial hour: 0	Continuous Assessment: 30
Practical hour: 30	Practical/Seasonal internal continuous evaluation:0
Total hours: 75	Practical/Seasonal external examination: 0
Credit: 5	Mode of Exam: Offline

Course Objective:

- Understand the causes, characteristics, and environmental impacts of various pollutants.
- Familiarize students with national and international environmental standards
- Understand the legal and regulatory framework for pollution control and environmental protection.
- Understand water treatment processes such as sedimentation, filtration, disinfection, and coagulation.
- Explore wastewater treatment methods including primary, secondary, and tertiary treatment (e.g., activated sludge, trickling filters, anaerobic digesters).
- Learn about air pollutant dispersion, meteorological parameters, and emission sources.
- etc

Course Outcome:

- Understand the sources, characteristics, and effects of air, water, soil, and noise pollution.
- Understand legal frameworks related to environmental protection and pollution control.
- Explain the principles of physical, chemical, and biological treatment processes.
- Design control measures for industrial and vehicular emissions.
- Identify techniques for collection, segregation, treatment, and disposal of municipal and industrial solid wastes.

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MODULE 1: 6 Hours

Introduction to Environmental Engineering Concept, scope, role of engineers, overview of environmental issues.

MODULE 2: 10 Hours

Air Pollution and Control Technologies Types, sources, effects of air pollutants, control equipment – scrubbers, filters, cyclones, ESPs.

MODULE 3: 10 Hours

Water and Wastewater Treatment Water quality parameters, primary, secondary and tertiary treatment processes, sludge management.

MODULE 4: 8 Hours

Soil and Solid Waste Management Sources and types of solid waste, composting, incineration, landfilling, soil contamination and remediation.

MODULE 5: 6 Hours

Environmental Standards and Pollution Control Acts Overview of CPCB, WHO standards, major Indian environmental laws and compliance mechanisms.

Reference Books:

1. Peavy, H. S., Rowe, D. R., & Tchobanoglous, G. (1985). *Environmental Engineering*.
2. Masters, G. M. (1998). *Introduction to Environmental Engineering and Science*.
3. Rao, M. N., & Rao, H. V. N. (2004). *Air Pollution*.
4. Metcalf & Eddy. (2013). *Wastewater Engineering: Treatment and Resource Recovery*.

Practical

Major Paper Code: BENVS -692

Credit: 2

- Determination of pH, Turbidity, and Electrical Conductivity of Water
- Determination of Total Dissolved Solids (TDS) and Total Suspended Solids (TSS)
- Determination of Dissolved Oxygen (DO) in Water

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Major Paper Code: BENVS-603	SEM-VI
Paper Name: Environmental Impact Assessment and Management	Maximum Marks: 100
Teaching Scheme	Examination Scheme
Lecture hour: 45	End semester exam: 70
Tutorial hour: 30	Continuous Assessment: 30
Practical hour: 0	Practical/Seasonal internal continuous evaluation: 0
Total hours: 75	Practical/Seasonal external examination: 0
Credit: 5	Mode of Exam: Offline

Course Objective:

- Introduce the principles, purpose, and scope of Environmental Impact Assessment.
- Explain the historical development and legal frameworks governing EIA at national and international levels.
- Understand the stages of the EIA process: screening, scoping, baseline study, impact prediction, mitigation, reporting, review, and monitoring.
- Learn to develop Environmental Management Plans to mitigate, monitor, and manage identified impacts.
- Understand the role of stakeholder engagement, transparency, and public hearings in EIA.
- Emphasize the integration of EIA into the planning and policy-making process.

Course Outcome:

- Understand the concept, objectives, and evolution of EIA
- Describe national and international legal and policy frameworks governing environmental assessments.
- Explain the step-by-step process of conducting an EIA, including screening, scoping, baseline studies, impact prediction, mitigation, and monitoring.
- Understand the structure and content of an EIA report, including environmental management plans (EMP).
- Identify and assess environmental impacts for projects in sectors such as transportation, energy, industry, mining, and infrastructure.

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MODULE 1: 6 Hours

Introduction to EIA Definition, purpose, historical development, legal and institutional framework.

MODULE 2: 10 Hours

EIA Process and Methodologies Screening, scoping, baseline studies, impact identification and prediction methods (checklists, matrices, modeling).

MODULE 3: 9 Hours

Environmental Management Plan (EMP) Mitigation measures, environmental monitoring, post-EIA audits and follow-up strategies.

MODULE 4: 8 Hours

Public Participation and EIA Reporting Stakeholder engagement, public hearing, structure and content of EIA report, decision making.

MODULE 5: 7 Hours

EIA Case Studies and Emerging Trends Case studies from infrastructure, mining, power and industrial sectors; strategic environmental assessment (SEA), life cycle analysis.

Reference Books:

1. *Canter, L. W. (1996). Environmental Impact Assessment.*
2. *Glasson, J., Therivel, R., & Chadwick, A. (2013). Introduction to Environmental Impact Assessment.*
3. *Noble, B. (2015). Introduction to Environmental Impact Assessment: A Guide to Principles and Practice.*
4. *Petts, J. (Ed.). (2009). Handbook of Environmental Impact Assessment.*