

UNIVERSITY GRANTS COMMISSION

Ability Enhancement Compulsory Course (AECC – Environment Studies)

Unit 1 : Introduction to environmental studies

- Multidisciplinary nature of environmental studies;
- Scope and importance; Concept of sustainability and sustainable development.

(2 lectures)

Unit 2 : Ecosystems

- What is an ecosystem? Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession. Case studies of the following ecosystems :
 - a) Forest ecosystem
 - b) Grassland ecosystem
 - c) Desert ecosystem
 - d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

(6 lectures)

Unit 3 : Natural Resources : Renewable and Non-renewable Resources

- Land resources and land use change; Land degradation, soil erosion and desertification.
- Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations.
- Water : Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state).
- Energy resources : Renewable and non renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

(8 lectures)

Unit 4 : Biodiversity and Conservation

- Levels of biological diversity : genetic, species and ecosystem diversity; Biogeographic zones of India; Biodiversity patterns and global biodiversity hot spots
- India as a mega-biodiversity nation; Endangered and endemic species of India
- Threats to biodiversity : Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity.
- Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.

(8 lectures)

Unit 5 : Environmental Pollution

- Environmental pollution : types, causes, effects and controls; Air, water, soil and noise pollution
- Nuclear hazards and human health risks
- Solid waste management : Control measures of urban and industrial waste.
- Pollution case studies.

(8 lectures)

Unit 6 : Environmental Policies & Practices

- Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture

- Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act. International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity (CBD).
- Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context. (7 lectures)

Unit 7 : Human Communities and the Environment

- Human population growth: Impacts on environment, human health and welfare.
- Resettlement and rehabilitation of project affected persons; case studies.
- Disaster management : floods, earthquake, cyclones and landslides.
- Environmental movements : Chipko, Silent valley, Bishnois of Rajasthan.
- Environmental ethics: Role of Indian and other religions and cultures in environmental conservation.
- Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).

(6 lectures)

Unit 8 : Field work

- Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc.
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural.
- Study of common plants, insects, birds and basic principles of identification.
- Study of simple ecosystems-pond, river, Delhi Ridge, etc.

(Equal to 5 lectures)

Suggested Readings:

1. Carson, R. 2002. *Silent Spring*. Houghton Mifflin Harcourt.
2. Gadgil, M., & Guha, R. 1993. *This Fissured Land: An Ecological History of India*. Univ. of California Press.
3. Gleeson, B. and Low, N. (eds.) 1999. *Global Ethics and Environment*, London, Routledge.
4. Gleick, P. H. 1993. *Water in Crisis*. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press.
5. Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. *Principles of Conservation Biology*. Sunderland: Sinauer Associates, 2006.
6. Grumbine, R. Edward, and Pandit, M.K. 2013. Threats from India's Himalaya dams. *Science*, 339: 36-37.
7. McCully, P. 1996. *Rivers no more: the environmental effects of dams* (pp. 29-64). Zed Books.
8. McNeill, John R. 2000. *Something New Under the Sun: An Environmental History of the Twentieth Century*.
9. Odum, E.P., Odum, H.T. & Andrews, J. 1971. *Fundamentals of Ecology*. Philadelphia: Saunders.
10. Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. *Environmental and Pollution Science*. Academic Press.
11. Rao, M.N. & Datta, A.K. 1987. *Waste Water Treatment*. Oxford and IBH Publishing Co. Pvt. Ltd.
12. Raven, P.H., Hassenzahl, D.M. & Berg, L.R. 2012. *Environment*. 8th edition. John Wiley & Sons.
13. Rosencranz, A., Divan, S., & Noble, M. L. 2001. *Environmental law and policy in India*. Tripathi 1992.
14. Sengupta, R. 2003. *Ecology and economics: An approach to sustainable development*. OUP.
15. Singh, J.S., Singh, S.P. and Gupta, S.R. 2014. *Ecology, Environmental Science and Conservation*. S. Chand Publishing, New Delhi.
16. Sodhi, N.S., Gibson, L. & Raven, P.H. (eds). 2013. *Conservation Biology: Voices from the Tropics*. John Wiley & Sons.
17. Thapar, V. 1998. *Land of the Tiger: A Natural History of the Indian Subcontinent*.
18. Warren, C. E. 1971. *Biology and Water Pollution Control*. WB Saunders.
19. Wilson, E. O. 2006. *The Creation: An appeal to save life on earth*. New York: Norton.
20. World Commission on Environment and Development. 1987. *Our Common Future*. Oxford University Press.

Cross cutting issue: Environment and sustainability	
SEMESTER I PAPER –I Fundamentals of Environmental Science	UNIT – I - Basics of Environmental Science 1) Introduction to Environmental Science: 2) Environmental Education: UNIT – II - Basics of Atmospheric Science 1) Atmosphere: 2) Chemical Aspects of Ozone Layer: UNIT – III - Basics of Climatology 1) Climatology: 2) Clouds: UNIT – IV- Basics of Meteorology 1) Meteorology: 2) Meteorological measurements:
SEMESTER I PAPER –II Environmental Ecology	UNIT – I - Basics of Ecology 1) Introduction of Ecology: 2) Environmental Factors: UNIT - II - Ecological Relationship: 1) Inter specific and intraspecific relationships 2) Ecological adaptations: UNIT – III Population and Marine Ecology: 1) Population Ecology: 2) Marine Ecology: UNIT - IV - Community Ecology 1) Introduction to Community Ecology: 2) Ecological Succession:
Practical's and Visits	1) Visit to Regional Meteorological Centre, Nagpur. 2) Visit to Nearby Forest to Study the Flora in its Natural Environment.
SEMESTER II PAPER – III Introduction to Water and Soil Chemistry	UNIT – I - Hydrosphere: 1) Characteristics of water: 2) Water Sampling and Analysis: UNIT – II - Physico-Chemical Characteristics of Water Quality: 1) Physical Parameters: 2) Chemical Parameters: UNIT – III - Pedology 1) Soil: 2) Properties of Soil: i. Physical Properties: ii. Chemical Properties of Soils: UNIT – IV - Issues of Soil Sciences: 1) Soil Erosion: 2) Soil Conservation:
SEMESTER II PAPER – IV Introduction to Ecosystem and Biodiversity	UNIT – I - Basics of Ecosystem 1) Ecosystems: 2) Biochemical Cycles: UNIT – II - Production Ecology: 1) Productivity: 2) Biogeochemical cycles: UNIT - III - Forest Ecology 1) Forestry: 2) Social Forestry: UNIT - IV - Fundamentals of Biodiversity and Conservation. 1) Biodiversity: 2) Biodiversity Conservation:

Practical's and Visits	1) Visit to Regional Meteorological Centre, Nagpur. 2) Visit to Nearby Forest to Study the Flora in its Natural Environment.
Semester I Paper I Environmental Chemistry (1T1)	Unit I Fundamentals of Chemistry General Chemistry: Basic Concepts from Quantitative Chemistry: Physical Chemistry: Unit II Introduction to Environmental Chemistry: Green Chemistry for Sustainable Future: Unit III Soil Chemistry: Soil Pollution: Unit IV Industrial Chemistry:
Semester I Paper II Atmospheric Science (1T2)	Unit I Fundamentals of Atmospheric Science: Unit II Climatology: Unit III Meteorology: Unit IV Global Climate Change:
Semester-I Paper III Environmental Biology (1T3)	Unit I Introduction to Ecology: Environmental Factors: Ecological Relationship: Unit II Population Ecology: Unit III Community Ecology: Unit IV Environmental Toxicology: Ecotoxicology: Testing: Chemical Toxicology:
Semester-I Paper IV Environmental Microbiology and Biotechnology (1T4)	Unit I Introduction to Environmental Microbiology: Unit II Microbial Methods: Unit III Environmental Biotechnology: Unit IV Environmental Biotechnology for Environmental Protection:
SEMESTER - I PRACTICAL	1. ENVIRONMENTAL CHEMISTRY AND ATMOSPHERIC SCIENCE 2. ENVIRONMENTAL BIOLOGY, ENVIROMENATAL MICROBIOLOGY AND BIOTECHNOLOGY
Semester II Paper V Environmental Ecosystem and Biodiversity (2T1)	Unit I Introduction to Ecosystem: Unit II Wildlife Conservation in India: Biomes and Conservation of Forest:

	Status of India's Biodiversity: Unit IV Biodiversity Conservation Strategies:
Semester II Paper VI Natural Resources Management (2T2)	Unit I Natural Resources: Renewable (Non Conventional Source of Energy): Non Renewable (Conventional Source of energy): Unit II Conservation of Energy: Mineral Resources: Unit III Water Resources: Unit IV Land & Forest Resources:
Semester II Paper VII Environmental Sampling and Research Methodology (2T3)	Unit I Air Sampling: Unit II Water Sampling: Unit III Soil and Solid Waste Sampling: Unit IV Research Methodology & Errors in Environmental Analysis:
Semester II Paper VIII Analytical Techniques for Environmental Monitoring (2T4)	Unit I Chromatography: Liquid Chromatography: Unit II Absorption Spectrophotometry: Unit III Electro Chemical Techniques: Unit IV Modern Instrumental Techniques:
SEMESTER II PRACTICAL – III (2P1)	Environmental Ecosystem And Management Natural Resources and Management Industrial chemistry Analytical techniques
Semester III Paper IX Physico- Chemical Treatment of Water & Waste Water (3T1)	Unit I Wastewater Sources: Quantity of Sanitary Sewage: Unit II Wastewater Collection: Wastewater Characteristic: Relative Stability: Unit III Classification of Wastewater Treatment Methods: Unit IV Physical Methods of Wastewater Treatment: Chemical Methods of Wastewater Treatment: I
Semester III Paper X Biological Process in Wastewater Treatment (3T2)	Unit I Anaerobic Treatment: Unit II Aerobic Treatment : Activated Sludge Process:

	Unit III Operation & Maintenance of Wastewater Treatment Plant: Unit IV Waste water treatment & Reuse :
Semester- III Paper XI (ELECTIVE – I) Water and Water Treatment (3T3)	Unit I Water Treatment Process: Water Treatment: Unit II Filtration: Disinfection: Unit III Water Softening: Unit IV Modern Water Treatment Techniques:
Semester- III (ELECTIVE-II) Paper XII Water Supply and Resources (3T3)	Unit I Sources of Water Supply: Unit II Surface & Ground Water Quality: Unit III Quantity and Quality of Water: Unit IV Distribution of Water:
Semester III Paper XIV Core (Subject Centric) 1 Advanced Water & Waste Water Treatment (3T4)	Unit I: Introduction to advanced treatment in water and waste water: Unit II: Advancement in Water Treatment: Unit III Advancement in Waste Water Treatment : Unit IV Cost Economics of Modern Technologies:
SEMESTER III Practical -V	1. Physico- Chemical Treatment of water & Waste Water and Biological Process in Waste Water Treatment 2. Visit and Case Studies:
Semester III Practical – ELECTIVE – I (3P2)	1. Water & Water Treatment: 2. Visit and Case Studies:
Semester III Practical – ELECTIVE – II (3P2)	1. Water Supply and Resources: 2. Visit and Case Studies:
Semester IV Paper XV Air and Noise Pollution Control Technology (4T1)	Unit I Atmosphere & Air Pollution: Unit II Air Sampling & Monitoring: Unit III Industrial Air Emission Control: Unit IV Noise Pollution:
Semester IV Paper XVI Solid and Hazardous Waste Management (4T2)	Unit I Nature of Solid Waste: Unit II Solid Waste Management: Unit III Hazardous Waste:

	Unit IV Hazardous Waste Treatment & Management:
Semester IV (ELECTIVE-I) Paper XVII Environmental Impact Assessment and Legislation (4T3)	Unit I Environmental Impact Assessment: Unit II EIA Procedure: Unit III Environmental Audit and EMS: Unit IV Environmental Legislation:
Semester IV (ELECTIVE-II) Paper XVIII Environmental Management (4T3)	Unit I Ecosystem Management: Wildlife Management: Unit II Remote Sensing and GIS: Application of GIS: Unit III Environmental Geoscience: Unit IV Current Issues and Environmental Problems:
Semester IV Paper XX Core (Subject Centric) - II Disaster Management (4T4)	Unit I: Disasters: Unit II: Nuclear disaster: Unit -III Natural disasters: Earthquake: Landslides: measures. Drought: Unit IV: Disaster Response:
Semester IV Practical - VII (4P1)	A) Air and Noise Pollution Control Technologies B) Solid and Hazardous Waste Management C) Environmental Impact Assessment and Legislation & Environmental Management D) Visit and Case Studies:
Semester IV PROJECT WORK (4P2)	A) VISIT TO ATLEAST TWO CENTERS OF THE FOLLOWING i) National Environmental Engineering Research Institute (NEERI), Nagpur ii) Remote Sensing Center iii) Regional Meteorological Center, Nagpur iv) Maharashtra Pollution Control Board, Nagpur B) FIELD DIARY The student shall prepare their field diary under the following heads i) Issue on local/regional/national problem of environmental interest (Case Studies). ii) About famous personalities in environmental movements. iii) New Acts and Judgments of environmental interests. C) GUEST LECTURE SERIES:
M.Sc (Zoology) Semester -III Core (Subject Centric)- I Paper-3T4 Wild Life and Avian Biology	Unit I- Wild life Ecology and Behaviour Unit- II- Wild life Population and Pest Management Unit- III- Avian Systematic Unit- IV- Bird diversity and Breeding

<p>B.Sc- I (Zoology) Semester – I Paper – II : Environmental Biology</p>	<p>Unit – I 1.1 Atmosphere: 1.2 Hydrosphere: 1.3 Lithosphere: 1.4 Renewable and non- renewable energy sources Unit – II 2.1 Ecosystem 2.2 Detailed study of pond ecosystem 2.3 Food chain, food web and ecological pyramids 2.4 Energy flow in an ecosystem Unit – III 3.1 Biodiversity and its conservation 3.2 Causes of reduction of biodiversity 3.3 Wildlife conservation acts and sanctuaries 3.4 Hot spots of biodiversity in India Unit – IV 4.1 Air pollution and green house effect, global warming 4.2 Sources, effect and control measures of water pollution 4.3 Sources effect and control measures of noise pollution 4.4 Toxic effect of heavy metals</p>
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