DRAFT Guidelines and Curriculum Framework for Environment Education at Undergraduate level

ज्ञान-विज्ञान विमुक्तये

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Contents

Preface

The National Education Policy (NEP) 2020 underlines the importance of making environmental education an integral part of curricula and encouraging environmental awareness and sensitivity towards its conservation and sustainable development. NEP also advocates the attainment of holistic and multidisciplinary education, through flexible and innovative curricula for all Higher Education Institutions (HEIs) which shall include credit-based courses and projects in the areas of community engagement and service, environmental education, and value-based education.

Global attention to the deteriorating condition of our environment was drawn in the United Nations Conference on Environment and Development held in Rio de Janerio in 1992 and World Summit on Sustainable Development at Johannesburg in 2002. In 2015, United Nations Members adopted the 2030 Agenda for Sustainable Development, which provides a "blueprint for peace and prosperity for people and the planet, now and into the future." Continuing problems of pollution, loss of forests, solid waste disposal, degradation of the environment, issues like economic productivity and national security, global warming, the depletion of the ozone layer and loss of biodiversity have made everyone aware of environmental issues. Out of the 17 Sustainable Development Goals (SDGs), six goals are directly linked to environmental protection and resource conservation. In the National Statement at UNFCCC CoP 26 Global Leaders' Summit in Glasgow, the Hon'ble Prime Minister's mantra was Lifestyle for Environment, and he also stressed setting a target for Net Zero Carbon Emissions by 2030. On October 20th, 2022 the Prime Minister launched Mission Life, a global movement to safeguard our environment from the impact of climate change.

Environment Education, therefore, needs to include areas such as climate change, pollution, waste management, sanitation, conservation of biological diversity, management of biological resources and biodiversity, forest and wildlife conservation, and sustainable development.

Earlier in 2003, UGC had come out with a core module syllabus for compulsory implementation of Environmental Studies at the undergraduate level as per directives of the Hon'ble Supreme Court of India. Further, in 2017, UGC framed an 8 unit's module syllabus for the Ability Enhancement Compulsory Course (AECC-Environmental Studies) under the Choice Based Credit System (CBCS).

The present document is an outcome of the UGC's initiative to implement the National Education Policy, 2020 which has emphasised the need to formulate guidelines and curriculum framework for environmental education. The document is expected to cater to students from diverse disciplinary backgrounds and also includes topics to sensitise students about the commitment of the nation towards achieving sustainable development goals.

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Chairman
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Curriculum Framework Outline

Unit	Title	Teaching Hours
I	Humans and the Environment	4
II	Natural Resources and Sustainable Development	6
III	Environmental Issues: Local, Regional and Global	6
IV	Conservation of Biodiversity and Ecosystems	6
V	Environmental Pollution and Health	6
VI	Climate Change: Impacts, Adaptation and Mitigation	6
VII	Environmental Management	6
VIII	Environmental Treaties and Legislation	6
IX	Case studies and fieldwork	30

Total credits of the Course = 4*

***As per UGC Curriculum and Credit Framework for Undergraduate Programmes (https://www.ugc.ac.in/e-book/FYUGP/mobile/index.html), a one credit of tutorial work means one-hour engagement per week. In a semester of 15 weeks duration, a one credit tutorial in a course is equivalent to 15 hours of engagement.**

A one credit course in practicum or lab work, community engagement and services, and field work in a semester means two-hour engagement per week.In a semester of 15 weeks duration, a one credit practicum in a course is equivalent to 30 hours of engagement.

The proposed number of credits per course and the credit distribution are suggestive and the HEIs may decide on course credits and distribution over 6/8 semesters in a manner that will facilitate the students to meet the minimum credit requirements.

Unit I. Humans and the Environment

Learning Outcomes

After completing this unit, students will be able to:

- Appreciate the historical context of human interactions with the environment.
- Gain insights into the international efforts to safeguard the Earth's environment and resources.

Unit Outline

The man-environment interaction: Humans as hunter-gatherers; Mastery of fire; Origin of agriculture; Emergence of city-states; Great ancient civilizations and the environment; Middle Ages and Renaissance; Industrial revolution and its impact on the environment; Population growth and natural resource exploitation; Global environmental change.

The emergence of environmentalism: Anthropocentric and eco-centric perspectives (Major thinkers); The Club of Rome- Limits to Growth; UN Conference on Human Environment 1972; World Commission on Environment and Development and the concept of sustainable development; Rio Summit and subsequent international efforts.

Suggested readings

1. Fisher, Michael H. (2018) An Environmental History of India- From Earliest Times to the Twenty-First Century, Cambridge University Press.
2. Headrick, Daniel R. (2020) Humans versus Nature- A Global Environmental History, Oxford University Press.
3. Hughes, J. Donald (2009) An Environmental History of the World- Humankind's Changing Role in the Community of Life, 2nd Edition. Routledge.
4. Perman, R., Ma, Y., McGilvray, J., and Common, M. (2003) Natural Resource and Environmental Economics. Pearson Education.
5. Simmons, I. G. (2008). Global Environmental History: 10,000 BC to AD 2000. Edinburgh University Press

Unit II. Natural Resources and Sustainable Development

Learning Outcomes

After completion of this unit students would be able to:

- Understand the concept of natural resources; identify types of natural resources, their distribution and use with special reference to India.
- Discuss the factors affecting the availability of natural resources, their conservation and management.
- Explain sustainable development, its goals, targets, challenges and global strategies for sustainable development.

Unit Outline

Overview of natural resources: Definition of resource; Classification of natural resources- biotic and abiotic, renewable and non-renewable.

Biotic resources: Major type of biotic resources- forests, grasslands, wetlands, wildlife and aquatic (fresh water and marine); Microbes as a resource; Status and challenges.

Water resources: Types of water resources- fresh water and marine resources; Availability and use of water resources; Environmental impact of over-exploitation, issues and challenges; Water scarcity and stress; Conflicts over water.

Soil and mineral resources: Important minerals; Mineral exploitation; Environmental problems due to extraction of minerals and use; Soil as a resource and its degradation.

Energy resources: Sources of energy and their classification, renewable and non-renewable sources of energy; Conventional energy sources- coal, oil, natural gas, nuclear energy; Non-conventional energy sources- solar, wind, tidal, hydro, wave, ocean thermal, geothermal, biomass, hydrogen and fuel cells; Implications of energy use on the environment.

Introduction to sustainable development: Sustainable Development Goals (SDGs)- targets and indicators, challenges and strategies for SDGs.

Suggested readings

1. Chiras, D. D and Reganold, J. P. (2010). Natural Resource Conservation: Management for a Sustainable Future.10th edition, Upper Saddle River, N. J. Benjamin/Cummins/Pearson.
2. John W. Twidell and Anthony D. (2015). Renewable Energy Sources, 3rd Edition, Weir Publisher (ELBS)
3. William P.Cunningham and Mary A. (2015) Cunningham Environmental Science: A Global Concern, Publisher (Mc-Graw Hill, USA)
4. Gilbert M. Masters and W. P. (2008). An Introduction to Environmental Engineering and Science, Ela Publisher (Pearson)
5. Singh, J.S., Singh, S.P. & Gupta, S.R. 2006. Ecology, Environment and Resource Conservation. Anamaya Publications https://sdgs.un.org/goals

Unit III. Environmental Issues: Local, Regional and Global

Learning Outcomes

After completion of this unit students would be able to:

- develop a critical understanding of the environmental issues of concern
- understand the concepts of spatial and temporal scales and their importance
- understand the sectoral effects on the local, regional, and global environmental issues

Unit Outline

Environmental issues and scales: Concepts of micro-, meso-, synoptic and planetary scales; Temporal and spatial extents of local, regional, and global phenomena.

Pollution: Impact of sectoral processes on Environment, Types of Pollution- air, noise, water, soil, municipal solid waste, hazardous waste; Transboundary air pollution; Acid rain; Smog.

Land use and Land cover change: land degradation, deforestation, desertification, urbanization.

Biodiversity loss: past and current trends, impact.

Global change: Ozone layer depletion; Climate change.

Suggested Readings

1. Harper, Charles L. (2017) Environment and Society, Human Perspectives on Environmental Issues 6th Edition. Routledge.
2. Harris, Frances (2012) Global Environmental Issues, 2nd Edition. Wiley- Blackwell.
3. William P. Cunningham and Mary A. (2015). Cunningham Environmental Science: A global concern, Publisher (Mc-Graw Hill, USA)
4. Manahan, S.E. (2022). Environmental Chemistry (11th ed.). CRC Press. https://doi.org/10.1201/9781003096238
5. Rajagopalan, R. (2011). Environmental Studies: From Crisis to Cure. India: Oxford University Press.

Unit IV. Conservation of Biodiversity and Ecosystems

Learning Outcomes

After completion of this unit students would be able to :

- Understand the concepts of ecosystems, biodiversity and conservation.
- Describe the main types of ecosystems and their distribution in India and the world.
- Discuss the factors impacting biodiversity loss and ecosystem degradation in India and the world.
- Explain major conservation strategies taken in India.

Unit Outline

Biodiversity and its distribution: Biodiversity as a natural resource; Levels and types of biodiversity; Biodiversity in India and the world; Biodiversity hotspots; Species and ecosystem threat categories.

Ecosystems and ecosystem services: Major ecosystem types in India and their basic characteristics- forests, wetlands, grasslands, agriculture, coastal and marine; Ecosystem services- classification and their significance.

Threats to biodiversity and ecosystems: Land use and land cover change; Commercial exploitation of species; Invasive species; Fire, disasters and climate change.

Major conservation policies: in-situ and ex-situ conservation approaches; Major protected areas; National and International Instruments for biodiversity conservation; the role of traditional knowledge, community-based conservation; Gender and conservation.

Suggested Readings

1. Bawa, K.S., Oomen, M.A. and Primack, R. (2011) Conservation Biology: A Primer for South Asia. Universities Press.
2. Sinha, N. (2020) Wild and Wilful. Harper Collins, India.
3. Varghese, Anita, Oommen, Meera Anna, Paul, Mridula Mary, Nath, Snehlata (Editors) (2022) Conservation through Sustainable Use: Lessons from India. Routledge.
4. Bhagwat, Shonil (Editor) (2018) Conservation and Development in India: Reimagining Wilderness, Earthscan Conservation and Development, Routledge.
5. Krishnamurthy, K.V. (2003) Textbook of Biodiversity, Science Publishers, Plymouth, UK

Unit V. Environmental Pollution and Health

Learning Outcomes

After completing this unit, students would be able to:

- Develop an understanding of pollution and its types.
- Learn about sources of different kinds of pollution.
- Sensitize themselves to adverse health impacts of pollution.

Unit Outline

Understanding pollution: Production processes and generation of wastes; Assimilative capacity of the environment; Definition of pollution; Point sources and non-point sources of pollution.

Air pollution: Sources of air pollution; Primary and secondary pollutants; Criteria pollutants- carbon monoxide, lead, nitrogen oxides, ground-level ozone, particulate matter and sulphur dioxide; Other important air pollutants- Volatile Organic compounds (VOCs), Peroxyacetyl Nitrate (PAN), Polycyclic aromatic hydrocarbons (PAHs) and Persistent organic pollutants (POPs); Indoor air pollution; Adverse health impacts of air pollutants; National Ambient Air Quality Standards.

Water pollution: Sources of water pollution; River, lake and marine pollution, groundwater pollution; water quality Water quality parameters and standards; adverse health impacts of water pollution on human and aquatic life.

Soil pollution and solid waste: Soil pollutants and their sources; Solid and hazardous waste; Impact on human health.

Noise pollution: Definition of noise; Unit of measurement of noise pollution; Sources of noise pollution; Noise standards; adverse impacts of noise on human health.

Thermal and Radioactive pollution: Sources and impact on human health and ecosystems.

Suggested Readings

1. Jackson, A. R., & Jackson, J. M. (2000). Environmental Science: The Natural Environment and Human Impact. Pearson Education.
2. Masters, G. M., & Ela, W. P. (2008). *Introduction to environmental engineering and science* (No. 60457). Englewood Cliffs, NJ: Prentice Hall.
3. Miller, G. T., & Spoolman, S. (2015) Environmental Science. Cengage Learning.
4. Central Pollution Control Board Web page for various pollution standards. https://cpcb.nic.in/standards/
5. Ahluwalia, V. K. (2015). *Environmental Pollution, and Health*. The Energy and Resources Institute (TERI).

Unit VI. Climate Change: Impacts, Adaptation and Mitigation

Learning Outcomes

After completing this unit, students would be able to :

- gain a comprehensive knowledge of climate change, its science and response measures
- have an overview of national and global efforts to address climate change adaptation and mitigation.

Unit Outline

Understanding climate change: Natural variations in climate; Structure of atmosphere; Anthropogenic climate change from greenhouse gas emissions– past, present and future; Projections of global climate change with special reference to temperature, rainfall, climate variability and extreme events; Importance of 1.5 °C and 2.0 °C limits to global warming; Climate change projections for the Indian sub-continent.

Impacts, vulnerability and adaptation to climate change: Observed impacts of climate change on ocean and land systems; Sea level rise, changes in marine and coastal ecosystems; Impacts on forests and natural ecosystems; Impacts on animal species, agriculture, health, urban infrastructure; the concept of vulnerability and its assessment; Adaptation vs. resilience; Climate-resilient development; Indigenous knowledge for adaptation to climate change.

Mitigation of climate change: Synergies between adaptation and mitigation measures; Green House Gas (GHG) reduction vs. sink enhancement; Concept of carbon intensity, energy intensity and carbon neutrality; National and international policy instruments for mitigation, decarbonizing pathways and net zero targets for the future; Energy efficiency measures; Renewable energy sources; Carbon capture and storage, National climate action plan and *Intended Nationally Determined Contributions* (INDCs); Climate justice.

Suggested Readings

1. Pittock, Barrie (2009) Climate Change: The Science, Impacts and Solutions. 2nd Edition. Routledge.
2. www.ipcc.org; https://www.ipcc.ch/report/sixth-assessment-report-cycle/.
3. Adenle A., Azadi H., Arbiol J. (2015). Global assessment of technological innovation for climate change adaptation and mitigation in developing world, Journal of Environmental Management, 161 (15): 261-275.
4. Barnett, J. & S. O'Neill (2010). Maladaptation. Global Environmental Change—Human and Policy Dimensions 20: 211–213.
5. Berrang-Ford, L., J.D. Ford & J. Paterson (2011). Are we adapting to climate change ? Global Environmental Change—Human and Policy Dimensions 21: 25-33.

UNIT VII. Environmental Management

Learning Outcomes

After completion of this unit students would be able to:

- Develop a critical understanding of the complexity of environmental management.
- Understand broad aspects of environmental management systems.
- Understand different methods of assessing environmental quality and associated risks.

Unit Outline

Introduction to environmental laws and regulation: Constitutional provisions- Article 48A, Article 51A (g) and other derived environmental rights; Introduction to environmental legislations on the forest, wildlife and pollution control.

Environmental management system: ISO 14001

Life cycle analysis; Cost-benefit analysis

Environmental audit and impact assessment; Environmental risk assessment

Pollution control and management; Waste Management- Concept of 3R (Reduce, Recycle and Reuse) and sustainability; Ecolabeling /Ecomark scheme

Suggested Readings

1. Jørgensen, Sven Marques, Erik João Carlos and Nielsen, Søren Nors (2016) Integrated Environmental Management, A transdisciplinary Approach. CRC Press.
2. Theodore, M. K. and Theodore, Louis (2021) Introduction to Environmental Management, 2nd Edition. CRC Press.
3. Barrow, C. J. (1999). Environmental management: Principles and practice. Routledge.
4. Tiefenbacher, J (ed.) (2022), Environmental Management - Pollution, Habitat, Ecology, and Sustainability, Intech Open, London. 10.5772/
5. Richard A. Marcantonio, Marc Lame (2022). Environmental Management: Concepts and Practical Skills. Cambridge University Press.

Unit VIII. Environmental Treaties and Legislation

Learning outcomes

After completion of this unit students would be able to:

- Learn about how the nations of the world work together for the environment.
- Learn about the major international treaties and our country's stand on and responses to the major international agreements.
- Learn about major international institutions and programmes and the role played by them in the protection and preservation of the environment.

Unit outcomes

1. An overview of instruments of international cooperation; bilateral and multilateral agreements; conventions and protocols; adoption, signature, ratification and entry into force; binding and non-binding measures; Conference of the Parties (COP)
2. Major International Environmental Agreements: Convention on Biological Diversity (CBD); Cartagena Protocol on Biosafety; Nagoya Protocol on Access and Benefit-sharing; Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES); Ramsar Convention on Wetlands of International Importance; United Nations Convention to Combat Desertification (UNCCD); Vienna Convention for the Protection of the Ozone Layer; Montreal Protocol on Substances that Deplete the Ozone Layer and the Kigali Amendment; Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal; Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade; Stockholm Convention on Persistent Organic Pollutants; Minamata Convention on Mercury; United Nations Framework Convention on Climate Change (UNFCCC); Kyoto Protocol; Paris Agreement; India's status as a party to major conventions
3. Major Indian Environmental Legislations: The Wild Life (Protection) Act, 1972; The Water (Prevention and Control of Pollution) Act, 1974; The Forest (Conservation) Act, 1980; The Air (Prevention and Control of Pollution) Act, 1981; The Environment (Protection) Act, 1986; The Biological Diversity Act, 2002; The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006; Noise Pollution (Regulation and Control) Rules, 2000; Industry-specific environmental standards; Waste management rules; Ramsar sites; Biosphere reserves; Protected Areas; Ecologically Sensitive Areas; Coastal Regulation Zone; Status phase-out of production and consumption of Ozone Depleting Substances by India; National Green Tribunal; Some landmark Supreme Court judgements

Major International organisations and initiatives: United Nations Environment Programme (UNEP), International Union for Conservation of Nature (IUCN),World Commission on Environment and Development (WCED), United Nations Educational, Scientific and Cultural Organization (UNESCO), Intergovernmental Panel on Climate Change (IPCC), and Man and the Biosphere (MAB) programme.

Suggested Readings

1. UNEP (2007) Multilateral Environmental Agreement Negotiator's Handbook, University of Joensuu, ISBN 978-952-458-992-5
2. Ministry of Environment, Forest and Climate Change (2019) A Handbook on International Environment Conventions & Programmes. https://moef.gov.in/wp- content/uploads/2020/02/convention-V-16-CURVE-web.pdf
3. Kanchi Kohli and Manju Menon (2021) Development of Environment Laws in India, Cambridge University Press.
4. India Code – Digital repository of all Central and State Acts: https://www.indiacode.nic.in/
5. Bohra, Saroj, Judicial Intervention and Evolution of Environmental Principles and Doctrines (January 7, 2019). Available at SSRN: https://ssrn.com/abstract=3311406 or http://dx.doi.org/10.2139/ssrn.3311406

Unit IX. Case Studies and Field Work

The students are expected to be engaged in some of the following or similar identified activities:

- Discussion on one national and one international case study related to the environment and sustainable development.
- Field visits to identify local/regional environmental issues, make observations including data collection and prepare a brief report.
- Documentation of campus biodiversity.
- Campus environmental management activities such as solid waste disposal, water management, and sewage treatment.