

# **UNIVERSITY GRANTS COMMISSION**

## **(Value Added Compulsory Course (VAC) - Environmental Studies)**

**Total credits of the Course = 2**

### **Unit 1: Humans and the Environment**

**(2 lectures)**

- The man-environment interaction: multidisciplinary nature of environmental studies. Environmental Ethics and emergence of environmentalism; Concept of sustainability; Indic Knowledge and Culture of sustainability.
- Introduction to sustainable development: Sustainable Development Goals (SDGs)- targets and indicators, challenges and strategies for SDGs.

### **Unit 2: Ecosystem**

**(4 lectures)**

- Concepts of ecosystem; Structure and function of ecosystem; Food chains, Food webs, Energy flow in an ecosystem.
- Indicator species, keystone species and their role in ecosystem.
- Major ecosystem types in India and their basic characteristics;
  - a) Forest ecosystem
  - b) Grassland ecosystem
  - c) Desert ecosystem
  - d) Aquatic ecosystems (Fresh water & marine water ecosystem)
    - Importance of Wetland, Mangroves, Coral reef.

### **Unit 3: Natural Resources and Sustainable Development**

**(4 lectures)**

- Overview of natural resources: renewable and non-renewable.
- Water resources; Water scarcity and stress; issues and challenges; Conflicts over water. Water conservation methods; Rain water harvesting, check dams and other traditional methods.
- Mineral resources; important minerals of Jharkhand; Environmental problems due to extraction of minerals.
- Soil as a resource and its degradation; Soil erosion, effects of soil erosion, remedial measures of soil erosion. Desertification; effects of desertification, remedial measures of Desertification.
- Forest Resources: Importance, deforestation, Afforestation

- Energy resources: Conventional energy sources- coal, oil, natural gas, nuclear energy; non-conventional energy sources- solar, wind, tidal, hydro, biomass, hydrogen and fuel cells.

#### **Unit 4: Biodiversity and its Conservation**

**(5 lectures)**

- Biodiversity and its distribution: Biodiversity as a natural resource; Levels and types of biodiversity; genetic, species and ecosystem diversity.
- Hot spots of biodiversity; Biodiversity hot spots of India; endemic species; microbes and biodiversity.
- Threats to biodiversity; Habitat loss, poaching of wildlife, man-wildlife conflicts, Invasive species.
- Conservation of biodiversity; In--situ and Ex--situ conservation approaches; Project Tiger; Cheetah reintroduction and translocation program; Major protected areas of Jharkhand.
- Role of traditional knowledge in conservation, Gender and conservation.
- IUCN and its role in biodiversity conservation, Endangered species of India.
- Ecosystem and Biodiversity services: Aesthetic, Ethical, Economic, Informational, social value.

#### **Unit 5: Environmental Pollution and Health**

**(5 lectures)**

- Definition of pollution; Point sources and non-point sources of pollution; Structure of atmosphere.
- Types 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.
- National Ambient Air Quality Standards.; Indoor air pollution; Adverse health impacts of air pollutants
- Elementary idea about Ozone layer, Ozone layer depletion and its harmful effects
- Water pollution: Sources of water pollution; marine pollution, Water quality parameters and standards; Biomagnifications, Eutrophication.
- 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 and impact on human health.

## **Unit 6: Climate Change: Impacts, Adaptation and Mitigation** (5 lectures)

- Understanding global warming and climate change: Natural variations in climate; 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; Carbon capture and storage.
- National climate action plan and Intended Nationally Determined Contributions (INDCs); Mission LIFE, Climate justice.

## **Unit 7: Environmental Management** (2 lectures)

- Introduction to environmental laws and regulation: Constitutional provisions- Article 48A, Article 51A (g) and other derived environmental rights.
- Concept of Circular Economy, Life cycle analysis; Cost-benefit analysis (elementary).
- Waste Management- Concept of 3R (Reduce, Recycle and Reuse).

## **Unit 8: Environmental Treaties and Legislation** (5 lectures)

- An overview of instruments of international cooperation; bilateral and multilateral agreements; conventions and protocols; adoption, signature, ratification and entry into force; binding and nonbinding measures; Conference of the Parties (CoP).
- Major International Environmental Agreements:

- United Nations Framework Convention on Climate Change (UNFCCC); Kyoto Protocol; Paris Agreement; Intergovernmental Panel on Climate Change (IPCC), International Solar Alliance (ISA).
- Convention on Biological Diversity (CBD); Nagoya Protocol on Access and Benefit-sharing.
- Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES).
- 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; Status phase-out of production and consumption of Ozone Depleting Substances by India.
- India's status as a party to major conventions.
- Major Indian Environmental Legislations: The Wild Life (Protection) Act, 1972; The Forest (Conservation) Act, 1980; The Environment (Protection) Act, 1986; The Biological Diversity Act, 2002; The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006.
- National Green Tribunal; Some landmark Supreme Court judgments.

### **Case Studies and Field Work**

- The students are expected to be engaged in some of the following or similar identified activities:
  - **In each unit as prescribed, wherever possible, references and examples from the State Jharkhand should be considered**
  - Discussion of FLAGSHIP programs of Indian government
  - 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.
  - Participation in plantation drive and nature camps.
  - Documentation of campus biodiversity.
  - Campus environmental management activities such as solid waste disposal, water
  - Management and sanitation, and sewage treatment.

**Suggested Readings:**

1. A text book of Environmental Studies- E. Bharucha (English/ Hindi)
2. Fundamental Concepts in Environmental sciences DD Mishra- Sultan Chand publication
3. Fundamental of ecology; by MC Dash
4. A textbook of environmental studies; C. Rajgopalan
5. Comprehensive environmental studies- Laxmi publication
6. Environmental studies: Asthann
7. A text book of environmental studies: SVS Rana
8. 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.
9. Odum, E.P., Odum, H.T. & Andrews, J. 1971. Fundamentals of Ecology. Philadelphia
10. Sengupta, R. 2003. Ecology and economics: An approach to sustainable development. OUP
11. Singh, J.S., Singh, S.P. and Gupta, S.R. 2014. Ecology, Environmental Science and Conservation. S. Chand Publishing, New Delhi
12. World Commission on Environment and Development. 1987. Our Common Future. Oxford University Press.
13. Thapar, V. 1998. Land of the Tiger: A Natural History of the Indian Subcontinent
14. Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. Environmental and Pollution Science. Academic Press