

SAINT CLARET COLLEGE (AUTONOMOUS), ZIRO

(Affiliated to Rajiv Gandhi University, Doimukh)

ARUNACHAL PRADESH



VALUE ADDED COURSE

ENVIRONMENTAL SCIENCE (I AND II)

(Offered as per NEP 2020)

SYLLABUS

(Effective from the academic year 2024 – 2025)

SAINT CLARET COLLEGE (AUTONOMOUS), ZIRO,
(Affiliated to Rajiv Gandhi University, Doimukh, Arunachal Pradesh)

UNDERGRADUATE DEGREE: VALUE ADDED COURSE (VAC 1)

SYLLABUS

(Effective from the Academic Year 2024-2025)

(As per NEP 2020)

ENVIRONMENTAL SCIENCE 1

CODE: 24EV/VA/ES12

CREDITS: 2

L T P: 2 0 0

TOTAL TEACHING HOURS: 30

Marks: 100 (End term examination=80 and internal examination/Project Report=20)

LEARNING OBJECTIVES:

1. Have a solid foundation in environmental science by understanding Human and environment, Natural resources, biodiversity and ecosystem
2. Analyse environmental problems critically and develop effective problem-solving skills.

COURSE OUTCOMES:

1. Gain insights into the international efforts to safeguard the Earth's environment and resources.
2. Describe the main types of ecosystems and their distribution in India and the world.
3. Discuss the factors impacting biodiversity loss and ecosystem degradation in India and the world.
4. Explain major conservation strategies taken in India.

Unit 1: Humans and the Environment:

(10 hrs)

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.

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. Water resources in North-East India. 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. Sustainable development: Sustainable Development Goals (SDGs)- targets and indicators, challenges and strategies for SDGs, Natural resources potential in North East India.

Unit 2: Environmental Issues:

(10 hrs)

Local, Regional and Global Environmental issues and scales: Concepts of micro, meso, synoptic and planetary scales; Temporal and spatial extents of local, regional, and global phenomena. Pollution: Types of Pollution- air, noise, water, soil, municipal solid waste, hazardous waste; Trans-boundary air pollution; Acid rain; Smog. Land use and Land cover change: land degradation, deforestation, desertification, urbanization. Biodiversity loss: past and current trends, impact. Global climate change: Ozone layer depletion; Climate change. - Natural and Man-made (Anthropogenic)

Conservation of Biodiversity and Ecosystems: Biodiversity - definition, 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. Conservation policies: in-situ and ex-situ conservation approaches; Major protected areas in India; National and International Instruments for biodiversity conservation; the role of traditional knowledge, concept of biodiversity related IPR.

Unit 3: Case Studies and Field Work:

(10 hrs)

In this module, the students have to be engaged in one activity on of the category listed below and they have to submit a report on the activity he/she has done.

Ecological Surveys: Students may conduct ecological surveys in various habitats, such as forests, wetlands, or coastal areas. They learn to identify different species, assess biodiversity, measure environmental parameters, and understand the ecological dynamics of the area.

Water Quality Assessment: Students may collect water samples from rivers, lakes, or groundwater sources to assess water quality parameters such as pH, dissolved oxygen, turbidity, and nutrient levels. They learn about water pollution sources, the impacts on

aquatic ecosystems, and potential remediation strategies.

Air Pollution Monitoring: Students may measure air quality in urban or industrial areas using air quality monitoring equipment. They learn about the sources and impacts of air pollution, analyze data, and explore strategies for air pollution control.

Environmental Impact Assessment: Students may engage in conducting environmental impact assessments for development projects. They learn to evaluate potential environmental impacts, identify mitigation measures, and consider the social and ecological consequences of different development options.

Waste Management and Recycling: Students may visit waste management facilities, recycling centers, or landfill sites to understand waste management practices. They learn about waste generation, recycling processes, waste treatment technologies, and the importance of waste reduction and resource conservation.

Restoration Projects: Students may participate in ecological restoration projects, such as reforestation, wetland restoration, or habitat enhancement. They learn about the importance of ecosystem restoration, restoration techniques, and the role of ecological succession.

Environmental Policy Analysis: Students may analyze and evaluate environmental policies and regulations at the local, national, or international levels. They learn to assess policy effectiveness, identify gaps, and propose recommendations for improved environmental governance.

Community Engagement and Environmental Awareness: Students may collaborate with local communities, NGOs, or government agencies to raise environmental awareness and promote sustainable practices. They may organize community clean-up campaigns, tree plantations, or awareness workshops.

RECOMMENDED 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*.
4. Routledge, J., and Common, M. (2003). *Role in the Community of Life*. 2nd Edition. Natural Resource and Environmental Economics. Pearson Education.
5. Simmons, I. G. (2008). *Global Environmental An introduction to ordinary differential equations*. E.A. Coddington. 2009. PHI learning.
6. 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.
7. John W. Twidell and Anthony D. (2015). *Renewable Energy Sources*. 3rd Edition. Weir Publisher (ELBS)
8. William P. Cunningham and Mary A. (2015). *Cunningham Environmental Science: A Global Concern*. Publisher (Mc-Graw Hill, USA)
9. Gilbert M. Masters and W. P. (2008). *An Introduction to Environmental Engineering*

and Science. Ela Publisher (Pearson).

SCHEME OF EVALUATION:

CONTINUOUS INTERNAL ASSESSMENT: 20 marks

Written Test : 20 marks

Duration of test : 1 hour

Third Component : Assignment / Quiz /Seminar / Project work, etc. (Any one only)

END SEMESTER EXAMINATION: 80 marks

QUESTION PAPER PATTERN:

Duration of Examination: 3 hrs

Section A: 4 x 5 = 20 marks (4 out of 6 questions to be answered in 200 words)

Section B: 3 x 10= 30 marks (3 out of 5 questions to be answered in 500 words)

Section C: 2 x 15 = 30 marks (2 out of 4 questions to be answered in 800 words)

SAINT CLARET COLLEGE (AUTONOMOUS), ZIRO,
(Affiliated to Rajiv Gandhi University, Doimukh, Arunachal Pradesh)

UNDERGRADUATE DEGREE: VALUE ADDED COURSE (VAC 1)

SYLLABUS

(Effective from the Academic Year 2024-2025)

(As per NEP 2020)

ENVIRONMENTAL SCIENCE 2

CODE: 24EV/VA/ES22

CREDITS: 2

L T P: 2 0 0

TOTAL TEACHING HOURS: 30

Marks: 100 (End term examination=80 and internal examination/Project Work=20)

LEARNING OBJECTIVES:

1. Have a strong foundation in environmental science by studying topics like Human and Environment, Natural Resources, Biodiversity, and Ecosystem.
2. Critically analyse environmental issues and have a strong growth in problem-solving abilities.
3. Gain a comprehensive knowledge of climate change, its science and response measure.

COURSE OUTCOMES:

1. Sensitize themselves to adverse health impacts of pollution.
2. Have an overview of national and global efforts to address climate change adaptation and mitigation.
3. Develop a critical understanding of the complexity of environmental management.
4. Describe different methods of assessing environmental quality and associated risks.
5. Analyse how the nations across the globe work together for the environment.

Unit 1: Environmental Pollution and Health: (10 hrs)

Production processes and generation of wastes; Assimilative capacity of the environment; Definition of pollution; Point sources and non-point sources of pollution. 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 (VOCS, PAN, PAHs, POPs), Indoor air pollution; Adverse health impacts of air pollutants; National Ambient Air Quality Standards. Water pollution: Sources of water pollution in river, lake, marine and ground water, 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 humanhealth. Thermal and Radioactive pollution: Sources and impact on human health and ecosystems.

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. Water resources in North-East India. 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. Sustainable development: Sustainable Development Goals (SDGs)- targets and indicators, challenges and strategies for SDGs, Natural resources potential in North East India.

Climate Change: Impacts, Adaptation and Mitigation

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 of climate change: Observed impacts 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; Energy efficiency measures; Renewable energy sources; Carbon capture and storage, National climate action plan and Intended Nationally Determined Contributions (INDCS); Climate justice.

Unit 2:Introduction to environmental laws and regulation:

(10 hrs)

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 Concept of Circular Economy, 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 /Eco mark scheme

Environmental Treaties and Legislation: An overview of major international environmental agreements and programmes: adoption, ratification, binding and non-

binding measures. Conference of the Parties (COP) to UNFCCC, Convention on Biological Diversity (CBD), 1992; Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES); Ramsar Convention, 1971; United Nations Convention to Combat Desertification (UNCCD), 1994; Vienna Convention, 1985; Kigali Amendment, 2016; Basel Convention, 1989; Minamata Convention, 2013; United Nations Framework Convention on Climate Change (UNFCCC), 1992; Kyoto Protocol, 1997; India's status as a party to major conventions.

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 Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006; India's National Action plan on 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 and National Green Tribunal.

Unit 3: Case Studies and Field Work:

(10 hrs)

In this module, the students have to be engaged in one activity on of the category listed below and they have to submit a report on the activity he/she has done.

Ecological Surveys: Students may conduct ecological surveys in various habitats, such as forests, wetlands, or coastal areas. They learn to identify different species, assess biodiversity, measure environmental parameters, and understand the ecological dynamics of the area.

Water Quality Assessment: Students may collect water samples from rivers, lakes, or groundwater sources to assess water quality parameters such as pH, dissolved oxygen, turbidity, and nutrient levels. They learn about water pollution sources, the impacts on aquatic ecosystems, and potential remediation strategies.

Air Pollution Monitoring: Students may measure air quality in urban or industrial areas using air quality monitoring equipment. They learn about the sources and impacts of air pollution, analyze data, and explore strategies for air pollution control.

Environmental Impact Assessment: Students may engage in conducting environmental impact assessments for development projects. They learn to evaluate potential environmental impacts, identify mitigation measures, and consider the social and ecological consequences of different development options.

Waste Management and Recycling: Students may visit waste management facilities, recycling centers, or landfill sites to understand waste management practices. They learn about waste generation, recycling processes, waste treatment technologies, and the importance of waste reduction and resource conservation.

Restoration Projects: Students may participate in ecological restoration projects, such as reforestation, wetland restoration, or habitat enhancement. They learn about the importance of ecosystem restoration, restoration techniques, and the role of ecological succession, Environmental Policy Analysis: Students may analyze and evaluate

environmental policies and regulations at the local, national, or international levels. They learn to assess policy effectiveness, identify gaps, and propose recommendations for improved environmental governance.

Community Engagement and Environmental Awareness: Students may collaborate with local communities, NGOs, or government agencies to raise environmental awareness and promote sustainable practices. They may organize community clean-up campaigns, tree plantations, or awareness workshops.

RECOMMENDED 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., & Spool man, S. (2015) Environmental Science. Cengage Learning.

SCHEME OF EVALUATION:

CONTINUOUS INTERNAL ASSESSMENT: 20 marks

Written Test : 20 marks
Duration of test : 1 hour
Third Component : Assignment / Quiz /Seminar / Project work, etc. (Any one only)

END SEMESTER EXAMINATION: 80 marks

QUESTION PAPER PATTERN:

Duration of Examination: 3 hrs

Section A: 4 x 5 = 20 marks (4 out of 6 questions to be answered in 200 words)

Section B: 3 x 10= 30 marks (3 out of 5 questions to be answered in 500 words)

Section C: 2 x 15 = 30 marks (2 out of 4 questions to be answered in 800 words)