**Course title: Environmental science (CORE)**

**Duration: All semesters (1st to 6th )**

**Eligibility: B.Sc.**

**Learning objectives:**

1. **Intellectual rigor:** aims to train students to cater to the need for ecological citizenship through developing a strong foundation on the critical linkages between ecology-society-economy
2. **Discipline knowledge:** to promote coherent knowledge of environmental science and management
3. **Critical analysis & application:** to inculcate the skills of critical analysis, and application of scientific methods in finding solutions to environmental crisis.
4. **Creativity:** Respond creatively to intellectual, professional, environmental and social challenges

**Learning outcomes:**

The course will empower the undergraduate students to:

1. Appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems.
2. Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.
3. Master core concepts and methods from ecological and physical sciences and their application in environmental problem solving.
4. Understand the transnational character of environmental problems and ways of addressing them, including interactions across local to global scales.

**Syllabus**

**Semester 1 Fundamentals of Environmental Science**

|  |  |
| --- | --- |
| Understanding the Environment | Environment: Concept, importance and historical root  Nature and scope of environmental science  Man-environment interrelationships  Environmental perspectives  Moral and ethical issues in Environmental science |
| Matter, Energy and Life | Elements: the material basis of life  Origin and evolution of life on earth  Evolution theories (modern) and speciation mechanism  characteristics of living cells (prokaryotic and eukaryotic)  Energy in biosphere - sources, energy forms and energy acquisition mechanisms in living systems. |
| Components of Environment | Environment: components  Atmosphere: composition and stratification  Hydrosphere: global water resources and distribution  Lithosphere: stratification and composition  Biosphere: a brief account |
| Human population and Environment | Human population: Growth, Decline and migrations  Consequences of high population growth on environment  Concept of carrying capacity  Wastes from human societies  Population growth and distribution in India with special reference to J&K |

Credit V and VI: Laboratory Course

1. Collection and Identification of rocks

2. Soil texture by feel method

3. Collection and identification of aquatic plants

4. Collection and identification of terrestrial plants

5. Calculation of density, diversity and abundance by quadrat method

6. Collection and identification of Soil macrofauna

7. Collection and identification of aerial insect fauna

8. Collection and identification of local fishes

9. Visit to an aquatic ecosystem

10. Visit to a grassland ecosystem

**Semester 2 Ecosystem Dynamics**

|  |  |
| --- | --- |
| Credit I: Ecosystem | * 1. Ecosystem: Concept and Definition   2. Structure and function of ecosystem   3. Concept of Food chain, food web andtrophic level   4. Ecological pyramids   5. Energy flow in ecological systems, energy efficiencies |
| Credit II: Major Ecosystems | 2.1 Forest ecosystem  2.2 Grassland ecosystem  2.3 Wetland ecosystem  2.4 Agro-ecosystem  2.5 Aquatic ecosystem |
| Credit III: Energy and Environment | 3.1Renewable and Non-renewable energy resources: world scenario wrt India  3.2Hydro Power  3.3Wind Power  3.4Thermal Power  3.5 Nuclear Power |
| Credit IV Natural Resources | 4.1 Concept and classification of natural resources  4.2 Forest resources of JK  4.3 Fisheries resources of India  4.4 Mineral resources of JK  4.5 Medicinal wealth of JK |

Credit V and VI: Laboratory Course

1. Estimation of primary productivity in a terrestrial ecosystem
2. Estimation of standing biomass in a terrestrial ecosystem
3. Determination if IVI
4. Collection and identification of medicinal plants
5. Estimation of chlorophyll content
6. Estimation of speed and velocity of lotic ecosystems
7. Estimation of secchi disc transparency in lotic systems
8. Estimation of depth of a lotic systems
9. Identification of basic rock forming minerals
10. Study of different soils with special reference to Karewa soils

**Semester 3 Environmental Pollution-I**

|  |  |
| --- | --- |
| Credit I:Air Pollution - I | * 1. Air pollution: concept   2. Sources of air pollution,   3. Impacts of major air pollutants (CO, SOX, NOX and HC and Particulates) on living and non-living things.   4. Photochemical Smog   5. Indoor air pollution |
| Credit II:Air pollution - II | 2.1 Lapse rate of temperature and atmospheric stability  2.2 Temperature inversion  2.3 Dispersion of gaseous pollutants  2.4 Effects of atmospheric stability on pollutant dispersion  2.5 Control of gaseous and particulate pollutants |
| Credit III:Water Pollution-I | 3.1 Water pollution: concept  3.2Sources of water pollution  3.3Types of water pollutants.  3.4. Surface and Ground water pollution  3.5Effects of water pollution on aquatic life, vegetation and human health |
| Credit IV:Water Pollution- II | 4.1 Water Quality Criteria  4.2 Drinking water quality standards  4.3Waste water treatment - Primary, Secondary and Tertiary Treatment  4.4 Eutrophication  4.5 Lake Acidification, salt water intrusion |

Credit V and VI: Laboratory Course

1. Study of sampling techniques.

2. Study of preservation of water samples.

3. Determination of BOD and COD of water sample.

4. Determination of dissolved oxygen of water sample.

5. Determination of Suspended solids of water sample.

6. Determination of dissolved solids of water sample.

7. Determination of total solids of water samples.

8. Determination of Oil & Grease in polluted water.

9. Determination of Free CO2 in water sample.

10. Determination of Alkalinity in water samples

**Semester 4 Environmental Pollution-II**

Credit I: Soil Pollution

1.1Soil Pollution: concept and definitions

1.2 Physical, Chemical, Mineralogical and Biological properties of soil

1.3 Sources and types of soil pollution

1.4 Biomagnification and Bioconcentration

1.5 Soil erosion and land degradation

Credit II: Noise Pollution

2.1 Basic physics of sound

2.2 Measurement of noise

2.3 Noise pollution: concept and definitions

2.4 Source of noise pollution and its effects on human health

2.5 Control of noise pollution

Credit III: Radioactive Pollution

3.1 Radioactive pollution: concept and definitions

3.2 Radioactive materials and Radiation hazards

3.3 Sources of radioactive pollutants in our environment

3.4 Effects of radioactive pollutants on plants and animals

3.5 Safety measures at the time of working with radioactive substances

Credit IV: Solid waste and Thermal Pollution

4.1 Solid Waste – Sources and characterization

4.2 Disposal and management of solid wastes

4.3 Thermal pollution: concept and definitions

4.4 Causes, effects and control of thermal pollution

4.5 Health Impacts of thermal pollution on animals and plant

Credit V and VI: Laboratory Course

1. Determination of temperature of soil samples.

2. Determination of pH of soil samples.

3. Determination of conductivity of soil samples.

4. Determination of calcium content in soil samples.

5. Determination of magnesium content in soil samples.

6. Determination of chloride content in soil samples.

7. Determination of organic carbon soil samples.

8. Determination of moisture content in soil samples.

9. The presumptive, confirmatory and completed tests for determination of sewage contamination.

10. Measurement of Noise indices

**Semester 5 Management of Environment**

Credit I: Management of Major Ecosystems

1.1 Conservation and management of Forest ecosystem

1.2 Management of grassland ecosystem

1.3 Ecotourism: Advantages and disadvantages

1.4 Agro-ecosystem: Conservation practices

1.5 Modern conservation practices for management of freshwater ecosystems

Credit II: Water Management

1.1 Water scarcity and its consequences

1.2 Traditional and modern strategies for water management

1.3 Rain water harvesting: Components, types and importance

1.4 Management of surface and ground water quality

1.5 Current scenario of fresh water management in India

Credit III: Soil Management Strategies

1.1 Measures for controlling soil erosion

1.2 Land degradation: causes and control

1.3 Desertification: Various control strategies

1.4 Rangelands: Importance and management

1.5 Role of meso fauna in soil quality conservation

Credit IV: Waste Management

1.1 Disposal and Management of Municipal solid wastes

1.2 Disposal and Management of Hazardous wastes

1.3 Disposal and Management of Biomedical wastes

1.4 Disposal and Management of Agriculture wastes

1.5 Disposal and Management of electronic wastes

Credit V and VI: Laboratory Course

1. IVI of forest ecosystem

2. IVI of grassland ecosystem

3. IVI of freshwater ecosystem

4. Point and non-point sources of pollution

5. Rainwater harvesting: Case studies

6. Waste audit of college campus

7. Green audit of college campus

8. Soil organic carbon and organic matter

9. Land use and land cover pattern: Case studies

10. Ecosystem restoration: Case studies

**Semester 6 Environment impact assessment, Environmental Education and laws**

Credit I: Environmental Impact Assessment

1.1 EIA: Concept, Components and Objectives

1.2 Need for Environmental Impact Assessment

1.3 Stages of EIA

1.4 Concept of Environment Impact Statement

1.5 EIA Methodology: Checklists and Matrices

Credit II: Sustainable development

2.1 EIA of hydroelectric power project

2.2 EIA of cement industries

2.3 Analysis of alternatives-Cost benefit analysis

2.4 Public participation

2.5 Concept of Eco-labelling and Eco-mark

Credit III: Environmental Education

3.1 Environmental Education: Goals, Objectives and Guiding principles

3.2 Benefits of Environmental education at the global level

3.3 Environmental education organizations, programmes and role of individual

3.4 National Environmental movements: Chipko and Narmada Andolan

3.5 Environmental ethics and awareness

Credit IV: Environmental Laws and Policies

4.1 Environmental protection act, 1986

4.2 Water Pollution act, 1974

4.3 Air Pollution act, 1981

4.4 Forest conservation act, 1980

4.5 J & K Wildlife (protection) act, 1978

Credit V & VI: Laboratory course

1. Case studies based on EIA of hydroelectric power project

2. Case studies based on EIA of cement industries

3. Case studies based on environmental laws

4. Environmental education (Seminar)

5. Visit to hydroelectric power plant

6. Visit to cement industry plant

7. Preparation of posters for environmental awareness

8. National environment case studies: Chipko movement and Narmada andolan

9. Study of green belt

10. Case study: Leopold matrix