

HNB Garhwal University
(A Central University)
Srinagar-Garhwal, Uttarakhand
School of Life Sciences

Syllabus
Pre-Ph.D. Environmental Sciences
(Effective from Academic Session 2022-23)

Compulsory Course Credits

SOLS/EVS-C/PhD/101: Fundamentals of Environmental Sciences	04
SOLS/EVS-C/PhD/102: Research Methodology and Publication Ethics	04

Total 08

Elective course: (Any two courses may be opted)

SOLS/EVS-E/PhD/103: Ecology and Ecosystem Services	04
SOLS/EVS-E/PhD/104: Natural Resource Management	04
SOLS/EVS-E/PhD/105: Environmental Impact Assessment	04
SOLS/EVS-E/PhD/106: Mountain Ecology	04
SOLS/EVS-E/PhD/107: Traditional Ecological Knowledge	04
SOLS/EVS-E/PhD/103: Climate Change and the Himalayas	04

Total 08

Grand Total 16

Unit I. Introduction and scope of Environmental Sciences

- 1.1 Definition principles and scope of Environmental Sciences
- 1.2 Interaction between man and environmental
- 1.3 Components of environment: atmosphere hydrosphere, lithosphere and biosphere
- 1.4 Current Environmental problems (Regional, National and intentional)

Unit II. Ecosystem processes

- 2.1 Ecosystem organization and homeostasis
- 2.2 Succession- Stability and diversity
- 2.3 Primary production and secondary production
- 2.4 Energy flow and efficiencies
- 2.5 Disruption of biogeochemical cycles – perturbation disturbance and stress
- 2.6 Response of ecosystem to deforestation, fire and ecological invasion
- 2.7 Restoration of degraded ecosystem

Unit III. Biodiversity: Basic principles

- 3.1 Concept and value of biodiversity
- 3.2 biodiversity at different levels (genetic, species and ecosystem)
- 3.3 Threats to biodiversity
- 3.4 Hotspots of biodiversity
- 3.5 conservation of biodiversity

Unit IV. Natural Resources: General Principle

- 4.1 Natural resources-concepts, kinds and their values
- 4.2 Process of resource depletion
- 4.3 Resource management: preservation, conservation and restoration

SOL/EVS-C/Ph.D./102: Research Methodology and Publication Ethics (Credits 04)

Unit I Scientific Process

- 1.1 Meaning and Definition, a brief history of scientific process.
- 1.2 Introduction of Research Methodology: Meaning of research, objectives of research, types of research, significance of research, problems encountered by researchers in India.
- 1.3 Research Problem: Definition, necessity and techniques of defining research problem, Formulation of research problem, Objectives of research problem.
- 1.4 Research Design: Meaning, need and features of good research design, Types of Research Designs, Basic Principles of Experimental Designs, Design of experiments, and Synopsis design for research topic.

Unit II Sampling Designs and Data collection

- 2.1 Census and Sample surveys, Different types of sample designs, Characteristics of good sample design, Techniques of selecting a random sample.
- 2.2 Editing, Data Collection and Validation: Primary and secondary data, Methods of collecting primary and secondary data, Importance and methods of editing and data validation.
- 2.3 Hypothesis: Definition, testing of hypothesis, procedures of hypothesis testing, flow diagram for hypothesis testing, Parametric and non-parametric tests for testing of hypothesis, Limitations of tests of hypothesis.
- 2.4 Paper/Thesis Writing and Report Generation: Basic concepts of paper their writing and report generation, review of literature, Concepts of Bibliography and References, significance of report writing, steps of report writing, Types of Research reports, Methods of presentation of report.

Unit III Computer applications and Statistics

- 3.1 Use of word processing, spread sheet and database software. Plotting of graphs.
- 3.2 Use of software - MS Office - Power Point, WORD and EXCEL and ACCESS.
- 3.3 Internet and its application: E-mail, WWW, Web browsing, acquiring technical skills, drawing inferences from data
- 3.4 Introduction to Statistics – Probability Theories - Conditional Probability, Poisson distribution, Binomial Distribution and Properties of Normal Distributions, Estimates of Means and Proportions; Chi Square Test, Association of Attributes t Test – Anova, Standard deviation Coefficient of variations. Co-relation and Regression Analysis.

Unit IV – Research Ethics and Ethical Issues

- 4.1 Ethical Committees, Commercialization, copy right, royalty
- 4.2 Intellectual Property rights and patent law, Track Related aspects of intellectual property Rights
- 4.3 Reproduction of published material, Plagiarism, Citation and Acknowledgement, Reproducibility and accountability.

Unit V Safety Measures

- 5.1 Lab Safety Measures: Introduction, Code of conduct - while entering in the lab, while working with the chemicals, while disposal of chemicals, Storage and disposal of chemical wastes - aqueous wastes, organic wastes and radioactive wastes, Human contribution to reduce hazardous wastes.
- 5.2 Field Safety Measures: Food security during field trip/expedition, safety measures during field trip/expedition - self- care, avoid in fields, and care from wild animals, hazard warnings, Safety measures during visit to library and villages, first aid in the fields.

Unit I. Fundamentals of Freshwater Ecology

- 1.1 Definition, concept and scope of Freshwater Ecology
- 1.2 Goods and services of freshwater ecosystem
- 1.3 Freshwater: distribution and depletion

Unit II. Terrestrial Ecology

- 2.1 Structure, function and distribution of terrestrial ecosystem
- 2.2 Forest ecology, Grassland ecology, Desert ecology
- 2.3 Goods and services provided by terrestrial ecosystems

Unit III. Agro-ecosystem and their Management

- 3.1 Agriculture in India and the World
- 3.2 Key concepts of Agro-ecosystems
- 3.3 Functional basis for the sustainable management of Agro-ecosystems

Unit I. Principles of Natural Resource Management

- 1.1 Natural resources- concepts, types and their values
- 1.2 Factors influencing resource availability, distribution and uses
- 1.3 Process of resource depletion
- 1.4 Ecosystem services by various natural resources

Unit II. Forest and Wildlife Resources and their Management

- 2.1 Forest resources: Major Forest types, their characteristics and distribution status of forest cover
- 2.2 Forest use and over exploitation: Timber extraction, mining, dams and their effects on forest and tribal people
- 2.3 Forest management practices
- 2.4 Wildlife resources: Current status, services and threats
- 2.5 Human-wildlife conflict and its resolution
- 2.6 Principles and practices of wildlife management: Need for wildlife planning
- 2.7 Human dimensions in wildlife management: Project Planning, Monitoring and Evaluation.

Unit III. Water Resources and their Management

- 3.1 Water resources: Historical background, world scenario and current challenges, status of surface and groundwater
- 3.2 Use and over exploitation of surface and ground waters
- 3.3 Integrated Water Resource Management (IWRM): Key challenges and issues
- 3.4 Legal aspects of water resources and management: Water legislations in India, Water Governance, Policies and legal frameworks

Unit I. Environmental Impact Assessment (EIA)

- 1.1 Concept, scope, objectives and procedure of EIA
- 1.2 Evolution of EIA and developmental projects under EIA
- 1.3 Protocol for Environmental Impact Statement (EIS)
- 1.4 EIA guidelines 1994, 2006 and subsequent modifications
- 1.5 Impact assessment methodologies (Ad-hoc, Simple Checklist, Overlays, Matrices, Network, Combination Computer aided)
- 1.6 Cumulative Environmental Impact Assessment (CEIA)

Unit III. Statuary Clearance Procedure and Public Consultation

- 3.1 Expert Appraisal Committee(EAC)
- 3.2 Environmental Clearance, Wildlife Clearance and Forest Clearance
- 3.3 State Expert Appraisal Committee (SEAC) and State EIA Authority (SEIAA)
- 3.4 Concept, objectives and procedures of Public Consultation

Unit IV. Post-Project Monitoring and Environmental Auditing

- 4.1 Principles and guidelines of environmental auditing
- 4.2 General Audit: Methodology and basic structure of environmental auditing
- 4.3 ISO 14000 series: ISO 9001, 9002

Unit V. Environmental Management and Management Plan

- 5.1 Concept, objectives and scope of environmental management.
- 5.2 Guidelines for EMP
- 5.3 Development of EMP- air, water, groundwater, noise, land and biodiversity
- 5.4 Rehabilitation and resettlement
- 5.5 Compensatory Afforestation
- 5.6 Green belt development

Unit I. Introduction

- 1.1 Definition, importance and scope of Mountain Ecology
- 1.2 Specificity of mountain ecosystems
- 1.3 Environmental importance of mountains

Unit II. Mountain Ecosystem

- 2.1 Structure and its components
- 2.2 Geological formations of mountains
- 2.3 Vulnerability of mountain ecosystems
- 2.4 Environmental degradation in mountains

Unit III. Environmental Hazards in the Mountains

- 3.1 Landslides, soil erosion and sedimentation
- 3.2 Cloud bursts, Flash floods and river blockades
- 3.3 Earthquakes
- 3.4 Forest fires
- 3.5 Avalanches and Glaciers Lake Outburst Floods (GLOF)

Unit IV. Mountains and People

- 4.1 Indigenous people of mountains
- 4.2 Livelihood of mountain people
- 4.3 Migration of mountain people

Unit V. Conservation and Management of Natural Resources of Mountains

- 5.1 Natural resources of mountains (Forest, Water, Wildlife and Minerals)
- 5.2 Traditional wisdom for management of natural resources
- 5.3 National and international efforts for management of mountains

Unit I. Introduction

- 1.1. Definition, concept, and scope of TEK
- 1.2. Traditional ecological knowledge as a science
- 1.3. Traditional technology of subsistence (artifacts, crafts *etc.*)

Unit II. Cultural, Sacred, Myth, Rituals and Beliefs

- 2.1. Basic concept of society, culture and religion
- 2.2. Nature, aims and objectives of comparative religion (caste, community and their culture).
- 2.3. Myths, rituals and beliefs associated with TEK in Hinduism, Buddhism, Islam and Christianity
- 2.4. TEK in Indian Himalayan states

Unit III. TEK and Natural Resources Management

- 3.1. TEK for forest conservation, water harvesting, wildlife case study, conservation of biodiversity
- 3.2. TEK related with medicinal plants.
- 3.3. TEK related with agriculture and cattle rearing
- 3.4. TEK related with horticulture

Unit IV. Documentation and Preservation of TEK

- 4.1 Need for Documentation and Preservation
- 4.2 International laws and policy of TEK
- 4.3 Laws and policy in India for TEK

Unit I. Introduction of Himalayan Climate

- 1.1 Definition, brief history and importance of Himalaya
- 1.2 Meteorological parameters: temperature, pressure, precipitation, humidity, radiation, wind and clouds
- 1.3 Climate Change in the Himalaya
- 1.4 Natural and atmospheric extreme events: flood, cloud burst, landslide, avalanches, GOLF, global warming

Unit II. Regional Climatology

- 2.1 Definition, microclimate and meso-climate scale
- 2.2 Climate and distribution of flora and fauna
- 2.3 Mid-latitude and high land climate
- 2.4 Natural and Anthropogenic (man- made) causes of climate change

Unit IV. Responses to Climate Change: Adaptation and Mitigation

- 3.1 Consequences of climate change
- 3.2 Climate Change: Biodiversity and agriculture
- 3.3 Human response to climate
- 3.4 Adaptation concepts and strategies