Course Structure along with credit distribution for P.G Diploma in Environmental Management (From batches 2026-27 and onwards)

First Semester for 1-year P.G. Diploma program

P.G. Diploma program First Semester						
Course Code	Course Category		Course Title	Credits		Total Credit
				T	P	
SOLS/PGDEM -C-001	DSC-1		Basics of Environmental Sciences	**3**	**2**	**5**
SOLS/PGDEM - C-002	DSC-2		Natural Resource Management	**3**	**2**	**5**
SOLS/PGDEM -C-003	DSC-3		Environmental Monitoring and Pollution Control	**3**	**2**	**5**
SOLS/PGDEM - SEC-001	SEC-1	Opt any one out of two	Community Based Conservation and Management	**3**	**2**	**5**
SOLS/PGDEM - SEC-002	**SEC-1 Vocational**		Field Visit	**5**	**0**	**5**
SOLS/PGDEM - DSE-001	DSE-1	Opt any one out of two	Ecosystem Restoration and Management	**3**	**1**	**4**
SOLS/PGDEM - DSE-002			Mountain Ecology	**3**	**1**	**4**
OR						
SOLS/PGDEM - MDE-001	MDE-1	Opt any one out of two	Wetland ecosystem and management	**3**	**1**	**4**
SOLS/PGDEM - MDE-002			Himalayan Bioresources and Management	**3**	**1**	**4**
OR						
SWAYAM 1	Opt any one out of two		Climate and Environmental Protection	**4**	**0**	**4**
SWAYAM 2			Rural Water Resource Management	**4**	**0**	**4**
AEC	**AEC (Non-CGPA Course)**		Indian Knowledge System	**1**	**0**	**1**
Total Credit				**15**	**09**	**24**

Note: ***1. In lieu of SEC the departments may offer any one course i.e. skill-based courses/Vocational Course work of 5 credits.***

2. In lieu of DSE the departments may offer any one course i.e. Field work based/Swayam Course work of 4 credits.

3. The University shall provide a common syllabus for the course titled **"Indian Knowledge System.***"*

Second Semester for 1-year P.G. Diploma program

P.G. Diploma program Second Semester						
Course Code	Course Category		Course Title	Credits		Total Credit
				T	P	
SOLS/PGDEM -C-004	DSC-4		EIA and Environmental Management	**3**	**2**	**5**
SOLS/PGDEM -C-005	DSC-5		Waste Management	**3**	**2**	**5**
SOLS/PGDEM -C-006	DSC-6		Biodiversity Conservation and Management	**3**	**2**	**5**
SOLS/PGDEM -C-007	DSC-7		Research Methodology and Environmental Statistics	**3**	**2**	**5**
OR						
Optional Component (Research / Skill Oriented) in lieu of DSC			**Option–I: Minor Dissertation / Project Work** *(in lieu of any **one** DSC)*	**5**		**5**
			Option–II: Major Dissertation / Project Work *(in lieu of any **two** DSCs)*	**10**		**10**
SOLS/PGDEM - DSE-003	DSE-2	Opt any one out of two	Disaster Management	**3**	**1**	**4**
SOLS/PGDEM - DSE-004			Traditional Ecological Knowledge	**3**	**1**	**4**
OR						
SOLS/PGDEM - MDE-003	MDE-2	Opt any one out of two	Forest ecology and management	**3**	**1**	**4**
SOLS/PGDEM - MDE-004			Environmental Laws, Ethics and Policies	**3**	**1**	**4**
SEC	**SEC (Non-CGPA Course)**		Community outreach activities	**1**	**0**	**1**
Total Credit				**15**	**09**	**24**
NHEQF Level-6.5	***Student on successfully completing one-year PG Diploma programme (i.e., securing minimum required 48 credits will be awarded "Postgraduate Diploma in Environmental Management***					

Note: 1. ***In lieu of* DSC *the departments may offer any one course i.e. core paper course/ Minor Dissertation / Project Work of 5 credits. Or Major Dissertation / Project Work*** *(in lieu of any **two** DSCs)* ***of 10 credit***

2 . In lieu of* SEC Non-CGPA Course) *the departments may offer Community outreach activities of 1 credit.

First Semester for 1-year P.G. Diploma program

Course Code: SOLS/PGDEM-C- 001
Course Title: DSC-1 Basics of Environmental Sciences (03 credits)

Unit I. Environment

1.1 Definition, scope and importance of Environmental Sciences
1.2 Components of environment: atmosphere, hydrosphere, lithosphere and biosphere
1.3 Concept of Biosphere-2, Technosphere and Noosphere
1.4 Various activities under national environment awareness Campaigns (NEAC)

Unit II. Man and Environment Relationship

2.1 Pre-historic man and Environment
2.2 Hunting and Gathering society and Environment
2.3 Pastoralism and Environment
2.4 Agro-society, Industrial society and Environment
2.6 Future Society (Sustainable Society)

Unit III. Religion, Culture and Environment

3.1 Role of religion, culture and traditions in conserving environment
3.2 Hinduism and Environment
3.3 Buddhism and Environment
3.4 Islam and Environment
3.5 Christianity and Environment

Unit IV. Ecosystem

4.1 Structure and types of an ecosystem
4.2 Energy pathways and ecological processes
4.3 Ecosystem productivity (primary and secondary)
4.4 Biogeochemical cycles: Nitrogen, Carbon, Phosphorus, Sulphur, Water and Oxygen
4.5 Food chain, food web and ecological pyramids
4.6 Ecological succession: primary and secondary succession, climax communities and trends in succession

Course Code: SOLS/PGDEM -C-P-001

Course Title: DSC -1 Practical **(02 Credits)**

Exercise 01: Analysis of various components of ecosystems.

Exercise 02. Determination of soil texture in different terrestrial habitats.

Exercise 03. Calculation of frequency, density and abundance of different ecosystem.

Exercise 04. Calculation of Importance Value Index (IVI) for grassland ecosystems/forest patches.

Exercise 05. Monitoring of biological diversity and calculation of Shannon Wiener diversity index in aquatic/ terrestrial habitats.

Course Code: SOLS/PGDEM-C- 002
Course Title: DSC-2 Natural Resource Management (03 credits)

Unit I. Principles of Natural Resource Management

1.1. Natural resources- concepts, types and their values
1.2. Process of resource depletion
1.3. 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, over exploitation and management practices
2.3 Wildlife resources: Current status, services and threats
2.4 Human-wildlife conflict and its resolution
2.5 Principles and practices of wildlife management: Need for wild life planning

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

Unit IV. Energy Resources and their Management

4.1 Definition, concept and classification of energy resources
4.2 Non-renewable energy resources
4.3 Renewable energy resources
4.4 Energy Management: Energy crisis, energy audit and sustainable use of energy resources

Course Code - SOLS/PGDEM-C- P-002

Course Title: DSC -2 Practical (02 Credits)

Exercise 01: To inventory of natural resources of any forest ecosystem located in nearby area.

Exercise 02: To study the ecosystem services by various natural resources.

Exercise 03: To study the effects of dams on the forest resources and tribal communities.

Exercise 04: To understand the drainage systems of river Ganga, Yamuna and Ramganga.

Exercise 05: To study the measure Renewable energy resources of Uttarakhand.

Course Code: SOLS/PGDEM-C- 003
Course Title: DSC-3 Environmental Monitoring and Pollution Control (03 credits)

Unit I. Environmental Monitoring

1.1 Concept and objectives of environmental monitoring
1.2 Global environmental monitoring system (GEMS)
1.3 National environmental monitoring programmes
1.4 Bio-indicators and biological monitoring

Unit II. Air Pollution

2.1 Sources of air pollution
2.2 Effects of pollutants on human beings, plants and animals
2.3 Methods of monitoring of gaseous and particulate pollutants
2.4 Control of air pollution

Unit III. Water Pollution

3.1 Major sources of water pollution
3.2 Effects of water pollution on animals, plants and human beings
3.3 Sewage and wastewater treatment and recycling
3.4 Industrial effluent treatment

Unit IV. Noise Pollution

4.1 Sources of noise pollution
4.2 Measurement of noise, exposure levels and standards
4.3 Impact of noise on human health
4.4 Noise control and abatement measures

Course Code- SOLS/PGDEM-C- P-003
Course Title – DSC 3 Practical (02 credits)

Exercise 01: Determination of temperature, pH and electrical conductivity of a given sample of water and soil samples

Exercise 02: Determination of dissolved oxygen (Modified Winkler's method), BOD and COD in a given sample of water

Exercise 03: Determination of Total solid, Total dissolved solids (TDS) and total suspended solids (TSS) in a water sample

Exercise 04: Determination of Total hardness and alkalinity of a given water sample

Exercise 05: Determination of chloride in a given water sample

Course Code - SOLS/PGDEM -SEC-001
Course Title -SEC-1 - Community Based Conservation and Management (03 Credit)

Unit I. Introduction of community based approaches

1.1 Fundamental concepts and structure of indigenous and local communities
1.2 Evolution of conservational attitude in communities and TEK
1.3 Concept of protection, conservation, preservation and management
1.4 Principles of participatory management
1.5 Difference between government based and community based conservation

Unit II. Natural resource management and biodiversity conservation

2.1 Community based practices in forest, water, land, grassland, pasture, agriculture, healthcare, wildlife management and sustainable use and conservation of biodiversity
2.2 Participatory rural appraisal and urban community conservation
2.3 Gender and social inclusion in resource management
2.4. Community reserves and sacred groves
2.5 Human-wildlife conflict management

Unit III. Sustainable livelihoods and conservational approaches

3.1 Eco-development and community participation
3.2 Eco-tourism and livelihood security
3.3 Sustainable agriculture and agro-forestry
3.4 Utilization of non-timber forest products
3.5 Climate resilience and community adaptation strategies

Unit IV. Policy framework and governance

4.1 Community institutions and self-help groups
4.2 Panchayti raj institutions, van panchayat system and community conserved areas
4.3 Role of governmental institutions and NGOs and co-management approaches
4.4 Legal initiatives (Biological Diversity Act 2002, Forest Right Act 2006, Forest Conservation Act, Joint Forest Management, Protected Area Network and Mision LiFE)
4.5 Case study (Chipko movement, Bishnoi movement, Appiko movement, Narmada Bachao Andolan, Chilka Bachao Andolan etc,)

Course Code - SOLS/PGDEM -SEC-P-001
Course Title -SEC-1 – Practical **(02 Credit)**

Exercise 01: To study socioeconomic structure of communities in your locality.

Exercise 02: To study resource conservation and management attitude in various societies.

Exercise 03: To study causes and impacts of human-wildlife conflicts on society.

Exercise 04: To study livelihood security through resource conservation and management in various communities.

Exercise 05: To study implementation of legal and policy framework for conservation and management.

Course Code - SOLS/PGDEM -SEC-001
Course Title -SEC-1 – Field Visit (Vocational) (05 Credit)

Field Visit: Opt any one of following:

1. **Ecosystem Study Tour**

   1.1 Field visit to any National Parks, wetlands, forests, rivers, disaster prone areas

   1.2 Preparation and submission of a detailed field study report including observations, data collection, analysis, findings, and recommendations.

2. **Industrial Environmental Management**

   2.1 Visit to industries or industrial areas to study pollution control systems, effluent treatment plants (ETP), and environmental management practices.

   2.2 Preparation and submission of a detailed field study report including observations, data collection, analysis, findings, and recommendations.

3. **Sustainable Agriculture and Rural Ecology**

   3.1 Visit to organic farms, agroforestry systems, and rural communities to understand sustainable farming and natural resource management.

   3.2 Preparation and submission of a detailed field study report including observations, data collection, analysis, findings, and recommendations.

4. **Waste and Water Management Study**

   4.1 Visit to solid waste management facilities, sewage treatment plants (STP), rainwater harvesting sites, and water treatment plants for practical understanding of resource management.

   4.2 Preparation and submission of a detailed field study report including observations, data collection, analysis, findings, and recommendations.

Course Code: SOLS/PGDEM -DSE-001

Course Title: DSE-1 Ecosystem Restoration and Management (03 Credits)

Unit–I-Fundamentals of Ecosystems and Ecological Restoration

- **1.1** Concept, structure, and functions of ecosystems
- **1.2** Types of ecosystems: Forest, grassland, wetland, freshwater, marine, agro-ecosystems, and mountain ecosystems
- **1.3** Causes and processes of ecosystem degradation
- **1.4** Relationship between conservation, restoration, and sustainable development

Unit–II-Ecosystem Degradation, Assessment, and Restoration Techniques

- **2.1** Land degradation and desertification
- **2.2** Deforestation, habitat fragmentation, and biodiversity loss
- **2.3** Afforestation, reforestation, and revegetation methods
- **2.4** Restoration of degraded forests, grasslands, wetlands, rivers, and mined areas

Unit–III- Ecosystem Restoration and Community Participation

- **3.1** Principles and objectives of ecosystem management
- **3.2** Role of local communities, NGOs, and other stakeholders in restoration programs
- **3.3** Joint Forest Management (JFM) and participatory approaches
- **3.4** Ecosystem restoration for livelihood enhancement and sustainable development

Unit–IV- Policies, Planning and Case Studies in Ecosystem Restoration

- **4.1** Convention on Biological Diversity (CBD), UN Decade on Ecosystem Restoration, Sustainable Development Goals (SDGs)
- **4.2** Indian environmental policies, Forest Policy, Biodiversity Act, CAMPA, and restoration initiatives
- **4.3** Case studies of successful restoration programs in India and the Himalaya
- **4.4** Restoration of degraded Himalayan ecosystems and mountain landscapes

Course Code: SOLS/PGDEM -DSE-P-001
Course Title: DSE-1 Practical **(01 Credits)**

Exercise 01: Field assessment of degraded ecosystems

Exercise 02: Vegetation analysis and biodiversity assessment

Exercise 03: Analyse causes and impacts of ecosystem degradation.

Exercise 04: Preparation of restoration plans for degraded landscapes

Exercise 05: Visits to restoration sites, wetlands, forests, and watershed projects

Course Code: SOLS/PGDEM -DSE-002
Course Title: DSE-1 Mountain Ecology (03 Credits)

Unit I. Introduction to Mountain Ecology

- **1.1** Definition, importance and scope of Mountain Ecology
- **1.2** Characteristics and specificity of mountain ecosystems
- **1.3** Environmental importance of mountains
- **1.4** Indigenous communities of mountains and their livelihood security

Unit II. Mountain Ecosystem

- **2.1** Structure and components of Mountain Ecosystem
- **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
- **3.3** Flash floods and river blockades
- **3.4** Avalanches and Glaciers Lake Outburst Floods (GLOF)
- **3.5** Earthquakes
- **3.6** Forest fires

Unit IV. Conservation and Management of Natural Resources of Mountains

- **4.1** Natural resources of mountains (Forest, Water, Wildlife and Minerals)
- **4.2** Sustainable exploitation of natural resources
- **4.3** Traditional knowledge for management of natural resources
- **4.4** Social and Economic dimension of mountain's natural resources
- **4.5** National and international efforts for management natural resources of mountains

Course Code: SOLS/PGDEM -DSE-P-002

Course Title: DSE-1 Practical **(01 Credits)**

Exercise 01: Analysis of various components of mountain ecosystem.

Exercise 02: To study the environmental degradation in mountain ecosystem.

Exercise 03: Assessment of threats to biodiversity in mountain region.

Exercise 04: To study the geological formations of mountains.

Exercise 05: To study the socio-economic status of mountain's natural resources.

Course Code: SOLS/PGDEM -MDE-001
Course Title: MDE -1 Wetland Ecosystem and Management (03 Credits)

Unit 1: Wetland Fundamentals

1.1. Definitions of wetlands, including hydroperiod, hydric soils, and hydrophytic vegetation.
1.2. Types of wetlands: marshes, swamps, bogs, fens, lotic/lentic, estuarine, and mangroves.
1.3. Wetland formation: geological, climatic, and hydrological controls; global distribution and biomes.
1.4. Water balance, groundwater-surface water interactions, and Ghyben-Herzberg relation.

Unit 2: Ecological Processes

2.1. Biotic components: wetland flora (adaptations), fauna (birds, amphibians, invertebrates), and food webs.
2.2. Abiotic factors: nutrient cycling (biogeochemistry of C, N, P, S), redox processes, and stratification.
2.3. Ecosystem functions: primary productivity, decomposition, energy flow, and succession.
2.4. Biodiversity: species diversity, keystone species, edge effects, and ecotones in wetlands.

Unit 3: Threats and Impacts

3.1. Anthropogenic threats: drainage, filling, pollution (nutrients, toxics), invasive species, and climate change.
3.2. Impacts on services: provisioning (fish, plants), regulating (flood control, water purification), cultural, and supporting roles.
3.3. Valuation methods: economic (market/non-market), ecological integrity indices, and hotspot identification.

Unit 4: Management Strategies

4.1. Conservation policies: Ramsar Convention, National Parks, Sanctuaries, and Protected Areas in India.
4.2. Restoration techniques: Rehydration, Revegetation, Artificial Wetlands, and Ecological Engineering.
4.3. Management tools: Treatment Wetlands, Bio-remediation (plants/microbes), and adaptive strategies.
4.4. Case studies: Indian wetlands (e.g., Chilika, Keoladeo), Global examples, and Community-based approaches.

Course Code: SOLS/PGDEM -MDE-P-001
Course Title: MDE-1 Practical **(01 Credits)**

Exercise 1: Wetland Morphology and Classification Study

Exercise 2: Economic Valuation of Wetland Resources

Exercise 3: Wetland Biodiversity Assessment

Exercise 4: Assessment of Wetland Ecosystem Services and Threats

Exercise 5: Wetland Conservation and Restoration Planning

Course Code: SOLS/PGDEM -MDE-002
Course Title: MDE-1 Himalayan Bioresources and Management (03 Credits)

Unit I: Introduction to Himalayan Bioresources

- **1.1** Concept, classification and Socio-economic importance of bioresources for mountain communities
- **1.2** Himalayan ecosystem: geography, climate and
- **1.3** Forest, agricultural, medicinal, aromatic and wild edible bioresources of the Himalaya
- **1.4** Indigenous and traditional knowledge systems related to bioresource utilization

Unit II: Diversity and Utilization of Himalayan Bioresources

- **2.1** Medicinal and aromatic plants, Wild edibles, and non-timber forest products (NTFPs)
- **2.2** Agro-biodiversity and traditional farming systems in the Himalaya
- **2.3** Ethnobotanical and ethnomedicinal importance of Himalayan flora

Unit III: Conservation and Sustainable Management

- **3.1** Threats to Himalayan bioresources: climate change, habitat degradation, overexploitation and invasive species
- **3.2** In-situ and ex-situ conservation approaches
- **3.3** Community-based natural resource management and participatory conservation

Unit IV: Emerging Approaches and Policy Perspectives

- **4.1** Bioprospecting, bioeconomy and sustainable entrepreneurship
- **4.2** Intellectual Property Rights (IPR), traditional knowledge and biopiracy issues
- **4.3** Case studies on successful bioresource management initiatives and sustainable development practices

Course Code: SOLS/PGDEM -MDE-P-002
Course Title: MDE-1 Practical **(01 Credits)**

Exercise 01: Identification and Documentation of Bioresources

Exercise 02: Resource Assessment and Sustainable Utilization

Exercise 03: Conservation and Management Techniques

Exercise 04: Field-Based Skill Development and Case Studies

SWAYAM 1: Climate and Environmental Protection

By Prof. B S Balaji, Chairperson, Special Centre for E-Learning and Professor in School of Biotechnology| Jawaharlal Nehru University, New Delhi
https://onlinecourses.swayam2.ac.in/ugc25_ge08/preview

Course layout

Week wise schedule (including the assignment to be kept in the week):

Week 1

- Introduction to Arctic
- Arctic-definition
- Arctic overview-part-1

Week 2

- Arctic overview-part-2
- Arctic expedition-Part 1
- Arctic expedition-Part 2

Week 3

- Solar irradiance and Albedo
- Albedo, Evapotranspiration
- Arctic-amplification

Week 4

- Arctic-amplification-contributors
- Arctic Aerosols and Mechanisms-Part 1
- Arctic Aerosols and Mechanisms-Part 2: Short-lived climate forcers (SLCFs)

Week 5

- Arctic Cryosphere and Glacier Change Mechanism
- Plant-biodiversity-Part-1
- Plant-biodiversity-Part-2

Week 6

- Animal-biodiversity-Part-1
- Animal-biodiversity-Part-2

Week 7

- Marine biodiversity
- Biogeochemical cycle and arctic-Part-1

Week 8

- Biogeochemical cycle and arctic-Part-2
- Carbon cycle and Arctic
- Anti-freeze proteins Part 1

Week 9

- Anti-freeze proteins Part 2
- Persistent Pollutants in the Arctic
- Methanogenesis, Mechanisms, Pathways, and its Relevance to the Arctic

Week 10

- Ocean Acidification
- Ocean Acidification and trace metal biogeochemistry
- Organic Carbon Recycling and its Influence on the Arctic

Week 11

- Marine Contamination in the Arctic
- Permafrost and Biogeochemistry Relationship

Week 12

- Arctic Chemical and Climate Stressors
- Chemolithotrophy and Arctic Ecosystems

Week 13

- Greenhouse Gases and Climate Change Mechanism in the Arctic
- Halogens and Atmospheric Chemistry in the Arctic

Week 14

1. Influence of Ozone and UV Radiation in the Arctic
2. Arctic Water and Carbon Cycle and Climate Change Mechanisms
3. Northern Sea route and climate change

Week 15

- Asian countries working in the Arctic region
- NCPOR and arctic studies a brief overview
- Interaction with researchers, opportunities for student

SWAYAM 2: Rural Water Resource Management
By Prof. Pennan Chinnasamy | IIT Bombay

https://onlinecourses.nptel.ac.in/noc22_ce45/preview

Course layout

Week wise schedule (including the assignment to be kept in the week):

Week 1

- Importance of water resource management in India and Introduction to Hydrological Cycle and representations

Week 2

- Key Hydrological Parameters 1

Week 3

- Key Hydrological Parameters 2

Week 4

- Introduction to Groundwater hydrology

Week 5

- Groundwater components

Week 6

- Surface water hydrology

Week 7

- Water Mass Balance Equation

Week 8

- Rural water management issues, data challenges and observation records.

Week 9

- Rural water resource management infrastructure (engineered)

Week 10

- Rural water resource management infrastructure (nature based)

Week 11

- Rural hydrological databases for India

Week 12

- Remote Sensing data bases for Rural water resources

Second Semester for 1-year P.G. Diploma program

Course Code: SOLS/PGDEM-C- 004
Course Title: DSC-4 Course Title: DSC-1 EIA and Environmental Management (03 credits)

Unit I. Environmental Impact Assessment (EIA)

1.1 Concept, scope and objectives of EIA

1.2 Developmental projects under EIA

1.3 Impact assessment methodologies and Procedure of EIA

1.4 EIA law, policy and notifications

1.5 Public consultation

1.6 Concept of cumulative impact assessment

1.7 Statuary clearance procedure

Unit II. Environmental Management

2.1 Concept, objective and scope of environmental Management

2.2 Environmental management in terms of developmental projects

2.3 Environmental management and sustainability

Unit III. Environmental Management Plan

3.1 Concept, scope, objectives and guidelines for EMP

3.2 Development of EMP- air, water, groundwater, noise and land

3.3 Rehabilitation and resettlement

3.4 Compensatory afforestation

Unit IV. Environmental Auditing

4.1 Principles, objectives and guidelines of environmental auditing

4.2 Methodology and basic structure of environmental auditing

4.3 Procedure of environmental auditing

4.4 ISO: 9001, ISO:14001, ISO 19011, ISO: 45001series

Course Code: SOLS/PGDEM -C-P-004

Course Title: DSC-04 Practical **(02 Credits)**

Exercise 01: Presentation of procedure of Environmental Impact Assessment (EIA) through flowchart

Exercise 02: Presentation of procedure of Environmental Clearance through flowchart

Exercise 03: Presentation of procedure of Environmental Auditing through flow chart

Exercise 04: Presentation of procedure of Environmental Management Plan (EMP) through flow chart

Course Code: SOLS/PGDEM -C-005
Course Title: DSC-5 Waste Management (03 Credits)

Unit I: Introduction to Waste and Its Classification

- **1.1** Concepts, Scope, historical development, and need for sustainable waste management
- **1.2** Types of Waste Solid, liquid, hazardous, biomedical, and e-waste
- **1.3** Sources and Characteristics of municipal, industrial, agricultural, commercial, and domestic Waste
- **1.4** Waste Generation trends

Unit II: Solid Waste Management

- **2.1** Collection and transportation and storage of Municipal Solid Waste (MSW)
- **2.2** Segregation and Recycling: Source segregation, material recovery, and recycling processes.
- **2.3** Aerobic and anaerobic composting, vermin-composting, organic waste management, biogas
- **2.4** Types of landfills, sanitary landfills, incineration technologies, and environmental concerns

Unit III: Hazardous and Biomedical Waste Management

- **3.1** Industrial, chemical, hazardous and toxic waste categories and sources
- **3.2** Waste treatment and disposal methods (physical, chemical, and biological method)
- **3.3** Biomedical Waste Management Rules and Practices
- **3.4** Occupational hazards and safety measures, risk to waste workers, PPE, training, and emergency protocols.

Unit IV: Liquid Waste, E-Waste, and Plastic Waste

- **4.1** Wastewater and Sewage Management: Urban and rural systems, decentralized treatment (DEWATS), reuse options
- **4.2** E-Waste: Generation and Impacts: Composition, toxic components, and informal recycling issues.
- **4.3** Plastic Waste Management: Single-use plastics, Extended Producer Responsibility (EPR), recycling technologies.
- **4.4** Policy Framework and Rules: Plastic Waste Management Rules, E-Waste Rules, and CPCB guidelines

Course Code: SOLS/PGDEM -C-P-005
Course Title: DSC-5 Practical (02 Credits)

Exercise 01: Segregation and composition analysis of municipal solid waste

Exercise 02: Vermi-composting – preparation, maintenance and product analysis

Exercise 03: Assessment of construction & demolition (C&D) waste composition

Exercise 04: Identification and classification of hazardous waste types

Exercise 05: Visit to a Sewage Treatment Plant (STP)/Effluent Treatment Plant (ETP)

Course Code: SOLS/PGDEM -C-006
Course Title: DSC-6 Biodiversity Conservation and Management (03 Credits)

Unit I. Introduction to Biodiversity

1.1 Concept and values of biodiversity
1.2 Biodiversity and ecosystem services
1.3 Biodiversity at different levels (genetic, species and ecosystem)
1.4 Magnitude and distribution of biodiversity
1.5 Biodiversity hotspots and keystone species
1.6 Threats to biodiversity: Habitat loss and fragmentation, Genetic drift, Inbreeding, Disturbance, Pollution, Climate Change, Overexploitation, Invasive Species, Disease, etc.

Unit II. Biodiversity: Conservation and Management

2.1 Need for biodiversity conservation and management
2.2 Biodiversity and livelihood security
2.3 Extinction to species: IUCN threatened species categories, causes of species extinction, endangered species, Red and Green Data Books.
2.4 *In -situ* and *Ex-situ* conservation
2.5 Current Trends in Biodiversity Conservation

Unit III. Biodiversity Policy and Climate Change

3.1 Biodiversity Policies, Act, Rules and Regulations
3.2 International efforts for conserving biodiversity *viz.*, CITES, CBD, IUCN, MAB, UNEP, UPOV and WTO
3.3 International treaty on Plant Genetic Resources
3.4 International Agreement for conserving biodiversity, wetland conservation, rangeland management.
3.5 Environmental and Climate change impacts on biodiversity and adaptation strategies

Unit IV. Environmental Monitoring and Biodiversity Assessment

4.1 Environmental Monitoring: Concept, objectives and types of environmental monitoring
4.2 Biodiversity Assessment: Biodiversity inventory and sampling methods for flora and fauna
4.3 Ecological Indices: Species richness, abundance and diversity indices
4.4 Bioindicators and Biomonitoring: Indicator organisms and biological monitoring techniques
4.5 Applications of Remote Sensing and GPS in environmental monitoring and biodiversity mapping
4.6 Role of biodiversity assessment in EIA and environmental management

Course Code: SOLS/PGDEM -C-P-006
Course Title: DSC-6 Practical **(02 Credits)**

Exercise 01: To calculate the Alpha ($\propto$) diversity, Beta (β) diversity and total diversity of given community.

Exercise 02: Survey of biological resources in your locality.

Exercise 03: Assessment of threats to biodiversity of a given region.

Exercise 04: Preparation of inventory of endangered and extinct species of plants/animals of Garhwal Himalaya.

Exercise 05: To study the role of key stone species in ecosystem.

Course Code: SOLS/PGDEM -C-007

Course Title: DSC-07 Research Methodology and Environmental Statistics (03 Credits)

Unit I. Introduction of Research Aptitude

1.1 Research: Meaning, Types and Characteristics
1.2 Positivism and post positivistic approach to research
1.3 Methods of research
1.4 Qualitative and Quantitative methods

Unit II. Various steps in the Research

2.1 Identification of research problems
2.2 Search of literature
2.3 Experimental design/construction of hypothesis
2.4 Materials and methods
2.5 Field study and collection of samples/questionnaire
2.6 Collection and analysis of data
2.7 Presentation of data in graphic and tabular form
2.8 Use of statistical tools
2.9 Discussion of results/ testing of hypothesis, Citation of references and bibliography

Unit III. Application of computer in Environmental Research

3.1 Use of different software for analysis of data- SPSS, Excel
3.2 Use of internet and search for literature
3.3 Format and styles of referencing
3.4 Writing of thesis and dissertation
3.5 Plagiarism and research ethics

Unit IV. Environmental Statistics

4.1 Measurement of central tendency- Mean, Mode and Median
4.2 Dispersion- Standard deviation, Standard error, Mean deviation and Coefficient of variation
4.3 Moments – measure of Skewness and Kurtosis
4.4 Distributions - Normal, log-normal, Binomial, Poisson
4.5 Simple and multiple correlation and regression coefficient
4.6 Basic laws and concept of probability
4.7 Test of hypothesis and significance.
4.8 t, F, chi square tests
4.9 ANOVA

Course Code: SOLS/PGDEM -C-P-007

Course Title: DSC-07 Practical **(02 Credits)**

Exercise 01: Experimental design/construction of hypothesis

Exercise 02: Methods of collection, presentation and analysis of data

Exercise 03: Measurement of Standard deviation, Standard error, Mean deviation correlation and regression

Exercise 04: Chi square tests

Exercise 05: ANOVA

Course Code: SOLS/PGDEM -DSE-003
Course Title: DSE-02 Disaster Management (03 Credits)

Unit I. Disaster Introduction: an overview

1.1 Introduction and definition of vulnerability, risk, hazard, disaster and catastrophe

1.2 Hazards in Himalaya, costal region and plains

1.3 Impact of disaster on economy and society

1.4 Disaster management and sustainability

Unit II. Natural Disasters

2.1 Natural disasters: introduction, meaning and nature

2.2 Natural Disasters in Himalaya: Earthquake, cloudburst, Glacier lake outburst (GLOF), Landslides, Snow Avalanches, flesh-flood

2.3 Natural hazards Cyclone, volcanic eruptions, drought, floods, heat and cold waves and Tsunami

Unit III. Anthropogenic Disasters

3.1 Anthropogenic disasters: introduction, meaning and nature

3.2 Nuclear disaster, fires (Forest fire, Building, coal, and chemical fires), Desertification causes, effects, management

3.3 Transportation Accidents, war, stamped and riots: causes, effects, management

Unit IV. Disaster Mitigation and Management

4.1 Risk and Vulnerability assessment: Risk analysis techniques, vulnerability identification, concept and factors associated with vulnerability.

4.2 Disaster management cycle

4.3 Disaster preparedness: Concept and nature, Disaster preparedness plans, Role of Information, education, communication, & awareness.

4.4 Disaster mitigation: Concept, principles, mitigation approaches and strategies.

4.5 Disaster Response: Disaster response plans, Search, Rescue and evacuation, Community Health and Casualty Management and damage assessment.

4.6 Recovery: Rehabilitation, Its social and economic aspects, Housing to resist disasters

4.7 Community based disaster risk reduction strategies

Course Code: SOLS/PGDEM -DSE-P-003
Course Title: DSE-02 Practical **(01 Credits)**

Exercise 1: Understanding the occurrence of various hazards in Himalayas

Exercise 2: Role of various agencies in disaster management

Exercise 3: Rehabilitation of People from disaster affected areas

Exercise 4: Preparation of master plan for any Environmental Hazard mitigation

Exercise 5: To assess the disaster awareness preparedness in nearby communities

Course Code: SOLS/PGDEM -DSE-004
Course Title: DSE-2 Environmental Laws, Ethics and Policies (03 Credits)

Unit I. National and International Efforts for Environmental Protection

- **1.1** Brief introduction about the structure of Indian Constitution
- **1.2** Environmental protection in the Indian Constitution
- **1.3** International and national efforts related to environmental Pollution, Climate change, Green house Gas emission, Ozone layer depletion and biodiversity conservation)
- **1.4** REDD+ in India

Unit II. National Environmental Laws

- **2.1** Indian Forest Act 1927; The Forest Conservation Act 1980, and Forest conservation Rules 2003
- **2.2** Wildlife Protection Act 1972 and its successive amendments
- **2.3** Biological Diversity Act 2002 and Biological Diversity Rules 2004
- **2.4** Water (Prevention and Control of Pollution) Act 1974 and Rules 1975 and subsequent amendments
- **2.5** Air (Prevention and Control of Pollution) Act 1981 and Rules 1982 and successive amendments
- **2.6** The Environmental (Protection) Act 1986 and its amendment in 1991, The environment (Protection) Rules 1986
- **2.7** The scheduled tribes and other traditional forest dwellers (recognition of forest rights) act, 2006
- **2.8** The National Green Tribunal Act 2010
- **2.9** Disaster Management Act, 2005

Unit III. National Laws related to waste management

- **3.1** Biomedical Waste Management rules, 2016, as Amended 2019
- **3.2** Hazardous and other waste (Management & Transboundary movement) Rules,
- **3.3** Plastic waste management rules 2016, as amended 2021
- **3.4** Solid waste management rules 2016
- **3.5** E-waste rules 2016 and E-waste (Management) Amendment Rules, 2018

Unit IV. National Policies

- **4.1** National Environment Policy, 2006 (Approved by the Union Cabinet on 18 May, 2006
- **4.2** National Forest Policy, 1988, and New National Forest Policy Draft,2018
- **4.3** National Policy on Disaster Management (NPDM) and Disaster Management Act, 2005
- **4.4** National water policy (2012) and new national water policy-2021

Exercise 01: Presentation of salient features of Wildlife Protection Act 1972

Exercise 02: Presentation of salient features of Water (Prevention and Control of Pollution) Act 1974

Exercise 03: Presentation of salient features of the Air (Prevention and Control of Pollution) Act 1981

Exercise 04: Presentation of salient features of The Environmental (Protection) Act and Rules 1986

Exercise 05: Presentation of salient features of The Indian Forest Conservation Act 1980

Exercise 06: Disaster Management Act, 2005

Course Code: SOLS/PGDEM -MDE-P-003
Course Title: MDE-2 Traditional Ecological Knowledge (03 Credits)

Unit I. Introduction

- **1.1.** Definition, concept, and scope of TEK
- **1.2.** Traditional ecological knowledge as a science
- **1.3.** TEK in different forms (stories, legends, folklore, rituals, folk songs, and dictums)
- **1.4.** Traditional technology of subsistence (artifacts, crafts *etc.*)
- **1.5.** Language and traditional knowledge

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.** Basic feature of religion and principal sets of religion
- **2.4.** Myths, rituals and beliefs associated with TEK in Hinduism, Buddhism, Islam and Christainity
- **2.5.** TEK in Indian Himalayan states

Unit III. TEK and Natural Resources Management

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

Unit IV. Knowledge Transfer: Old Concepts and Barriers

- **4.1.** Old concepts and barriers in transferring indigenous traditional knowledge
- **4.2.** Old myths in transferring traditional knowledge
- **4.3.** God and man
- **4.4.** Ways of prayers, rituals in different communities

Unit V. Documentation and Preservation of TEK

- **5.1.** Need for Documentation and Preservation
- **5.2.** International laws and policy of TEK
- **5.3.** Laws and policy in India for TEK

Course Code: SOLS/PGDEM -MDE-P-003
Course Title: MDE-2 Practical **(01 Credits)**

Exercise 01: To study origin and evolution of various environmental movement.

Exercise 02: Preparation of an inventory of TEK for water conservation.

Exercise 03: Preparation of an inventory of TEK for biodiversity conservation.

Exercise 04: Preparation of an inventory of TEK related to medicinal plants.

Exercise 05: Documentation of traditional technology of subsistence (Artifacts, Crafts, Handlooms etc.)

Course Code: SOLS/PGDEM -MDE-004
Course Title: MDE-02 Forest ecology and management (03 Credits)

Unit I: Fundamentals of Forest Ecology

1.1 Introduction to Forest Ecology: Definition, scope, autecology and synecology, Levels of ecological organization and applications of forest ecology
1.2 Forest Ecosystem: Structure and functions, Ecosystem productivity, Forest biomes of the world, Forest types of India
1.3 Energy Flow and Ecological Processes, Nutrient dynamics in forest ecosystems and Ecological factors affecting forests
1.4 Ecological Succession: Types of succession, Hydrosere and xerosere, Climax theories Ecotone and edge effect

Unit II: Forest Soil, Climate and Hydrology

2.1 Forest Soil and Nutrient Cycling: Soil formation processes, Soil profile and horizons, Physico-Chemical properties of soil, Soil organic matter and microorganisms, Litter decomposition
2.2 Climate and Forests: Climate–vegetation interactions, Microclimate in forests,
2.3 Forest Hydrology: Watershed concept, Runoff and infiltration, soil erosion and conservation
2.4 Climate Change and Carbon Dynamics: Greenhouse gases, Carbon sequestration, Carbon stock estimation, Climate change impacts on forests, REDD+ mechanisms

Unit III: Forest Mensuration, Forest Protection and Disturbances

3.1 Tree Measurement: Diameter and Height measurement, Basal area calculation, Tree form and volume
3.2 Forest Inventory: Sampling methods, Fixed and variable plots, Inventory design, Stock mapping
3.3 Biomass and Carbon Estimation: Above-ground biomass, Below-ground biomass, Carbon stock estimation methods, Allometric equations
3.4 Statistical Applications: Descriptive statistics, Correlation and regression, Analysis of variance
3.5 Forest Insects and Diseases, Integrated pest management, Invasive Species
3.6 Anthropogenic Disturbances: Deforestation and Fragmentation, grazing and lopping, Fuelwood extraction, Shifting cultivation, Forest Fire, Mining and developmental activities

Unit IV: Forest Management, Silviculture and Forest Policy

4.1 Forest Management: Objectives, Multiple-use forestry, Forest management systems
4.2 Social Forestry and Agroforestry: Social forestry concepts, Farm forestry, Community forestry, Agroforestry systems and benefits
4.3 Plantation Forestry: Afforestation and reforestation, Plantation management, Urban forestry, forest restoration
4.4 Participatory Forest Management: Sustainable forest management, Joint Forest Management (JFM), Community participation
4.5 Principles of Silviculture: Scope and importance, Tree growth and development, Silvicultural practices
4.6 Forest Policy and Legislation: National Forest Policy, Indian Forest Act, Forest Conservation Act, Wildlife Protection Act, Biodiversity Act

Course Code: SOLS/PGDEM -MDE-P-004
Course Title: MDE-02 Practical **(01 Credits)**

Exercise 1. Study of forest structure and composition using quadrat method; calculation of frequency, density, abundance and Importance Value Index (IVI).

Exercise 2. Determination of soil texture, pH, moisture content, organic carbon and soil organic matter from forest soil samples.

Exercise 3. Estimation of tree volume using standard forestry instruments and formulae.

Exercise 4. Estimation of above-ground biomass and carbon stock using allometric equations.

Exercise 5. Field assessment of anthropogenic disturbances (grazing, lopping, fire, fragmentation) in forest areas.

Course Code: SOLS/PGDEM--SEC-002

Course Title: SEC- Community Outreach Activities (01 Credits)

1. Environmental Awareness Campaigns

- Awareness rallies on pollution control, **Solid Waste Management Programme**, biodiversity conservation, **Water Conservation Activities**, and climate change
- Public lectures and village awareness programmes

2. Tree Plantation and Green Belt Development

- Plantation drives in University, local area
- Monitoring survival and growth of planted saplings

3. Biodiversity Conservation Programmes

- Nature walks and biodiversity documentation with local communities
- Awareness on wildlife conservation and human–wildlife conflict

4. Report Writing

- Preparation of field reports on community outreach activities