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Programme Project Report (PPR)

(As Per Annexure V, UGC Regulation 2020)

Name of Programme: M.A. (Environmental Studies)
Programe Code: MAES23
Total Credits: 64

i) **Programme mission and objectives:** The programme on Environmental Science is an interdisciplinary program that focuses on the state of the environment and serious environmental problems that the world faces. Through a series of academic courses, laboratory exercises and project/ dissertation activities, students will be able to learn about the human activities which adversely impact the environment and will also be able to develop critical thinking and problem-solving skills necessary to find out appropriate solutions for region specific local problems and global problems. The Environmental Program mission also supports the directive of hon'ble Supreme Court on the environmental education. Further, environmental protection, including forests, wildlife, lakes and rivers has been identified as **'Fundamental duty'** of every citizen through Indian Constitution through its 42nd amendment (Article 48-A and Article 58-A (g).

After successful completion of the programme, the learners will be:

- well-equipped with latest knowledge, technologies, policies, legal initiatives and experience-based skills for enabling environment and sustainable development
- make a critical analysis of local, national, regional and global agendas and policies for environment in context of sustainable development,
- able to apply the principles of ecology, environmental science and tools of environmental management to design and develop a project or enterprise or extend consulting services
- to work in technical and/ or administrative fields related to environmental management, clean technologies, environmental laws and policies, and environmental communication

ii) **Relevance of the program with HEIs Mission and Goals:** One of the mission of higher education particularly Open and Distance Learning Institutions is to provide greater opportunities of access to Higher Education with equity to all the eligible persons and in particular to the vulnerable sections. At present, there are very few Universities and colleges that provide Masters level education on environment. Therefore, majority of the aspirants remain devoid of environmental education at this level. Therefore, M.A (Environmental Studies) in ODL mode will provide opportunity to majority of the aspirants particularly residing in far flung remote areas and in particular to weaker and deprived sections of the society. Another mission of the Higher education Institutions is to initiate policies and programmes for strengthening research and innovations, and encourage institutions - public or private to engage in stretching the frontiers of knowledge. By bringing such an interdisciplinary programme in Open and Distance Learning mode will also help to achieve this mission.

iii) **Nature of prospective target group of learners:**

- Environmental Studies is compulsory at School level and at Undergraduate level by hon'ble Supreme Court. At present teachers from life sciences are usually engaged whereas faculties with Masters degree in Environmental Studies / Science are very few. Therefore, learners who wish to take up teaching environmental studies at school level or at higher education level are targeted through this programme.
- Environment Studies being a multidisciplinary subject has its usefulness and applicability in every sphere of life, society, culture and organization. Those learners who wish to opt career in Environment related Government organizations such as Ministry of Environment, Forests and Climate Change, State Forest Department, Forest Research Institute, Forest Management, Environmental Management etc. and or/ Non-Government organizations such as The Energy Resource Institute (TERI), World Wildlife Fund (WWF),

International Union for Conservation of Natural Resources (IUCN), Food and Agriculture Organisation (FAO), International Fund for Agricultural Development (IFAD) and other Environmental Conservation and Sustainable development based organizations, will be the target group of learners. Further, consultants are required for Industrial audits and Environmental Impact assessments, etc. In addition to this, faculties are required to teach compulsory foundation course on Environmental Studies at Under Graduate level in conventional Universities and professional/ technical Universities or Colleges.

iv) **Appropriateness of programme to be conducted in Open and Distance Learning mode to acquire specific skills and competence:** There are very few institutions/ Universities/ Colleges in India that impart Master level education on environment. Therefore, access to knowledge on the subject is not accessible easily to those aspirants who reside in far remote areas and those who belong to weaker and marginal sections of the society. Therefore, initiating such programme in Open and Distance Learning (ODL) mode will help aspirants particularly residing in far-flung areas and those who belong to weaker sections, to acquire skill and knowledge on the subject area. In order to communicate effectively with the learners University has adopted the following tools:

- self-instructional printed material
- audio / video cassettes and CDs
- audio-video programmes transmitted through FM Radio and EduSat
- face-to- face counselling at study centres by academic counselors
- reference library at study centre
- web based academic support
- assignments
- Filed / Project Activity

v) **Instructional design**

a) **Curriculum design**

Programme Code: MAES-23 Total Credits: 64

COURSE CODE	TITLE OF THE COURSE	CREDITS	Total Marks (Th. / Assign.)
	SEMESTER I		
CORE COURSES (Compulsory)			
ENS 501	Environment and Ecology	4	100 (70/30)
ENS 502	Land, Water and Bio-Resources	4	100 (70/30)
ENS 503	Energy Resources	4	100 (70/30)
ENS 505	Environmental Ethics and Philosophy	4	100 (70/30)
	SEMESTER II		
CORE COURSES (Compulsory)			
ENS 506	Environmental Pollution and Health	4	100 (70/30)
ENS 507	Environmental Planning, Policies and Acts	4	100 (70/30)
ENS 508	Environmental Economics and Sustainable Development	4	100 (70/30)
ENS 509	Environmental Impact Assessment and Environmental Auditing	4	100 (70/30)
	SEMESTER III		
ENS 601	Atmosphere and Climate Change	4	100 (70/30)
ENS 602	Research Methodology for Environmental Studies	4	100 (70/30)
	Elective Course	4	100 (70/30)
	Elective Course	4	100 (70/30)
	SEMESTER IV		
N.B. 1. A learner has two options available in this semester - **Option A** OR **Option B**.			

2. OPTION B is available for only those learners who secure more than 75% marks in the first year (Semester I and II) of the programme.			
	OPTION A		
ENS 622	Project Activity and Viva Voce	8	100
	Elective Course	4	100 (70/30)
	Elective Course	4	100 (70/30)
	OPTION B		
ENS 623	Dissertation and Viva Voce	12	200
	Elective Course	4	100 (70/30)
	LIST OF ELECTEIVE COURSES		
ENSE 651	Eco-development and Eco-tourism	4	100 (70/30)
ENSE 655	Clean Technologies	4	100 (70/30)
ENSE 656	RS, GIS and GPS: Basics and Applications	4	100 (70/30)
ENSE 657	Disaster management	4	100 (70/30)
ENSE 658	Occupational Health Hazards	4	100 (70/30)
ENSE 659	Hazardous Wastes and their Management	4	100 (70/30)
ENSE 660	Environmental Quality Management: Standards and Practices	4	100 (70/30)
ENSE 662	Urban Ecosystems and Environment	4	100 (70/30)
ENSE 663	Gender, Resources and Environment	4	100 (70/30)
ENSE 664	Social Environment and Human Ecology	4	100 (70/30)
ENSE 665	Environmental History and Resource Utilization	4	100 (70/30)
ENSE 666	Resource Management	4	100 (70/30)
ENSE 667	Environmental Communication	4	100 (70/30)

Th.= Theory; Assign.= Assignment

b) Detailed syllabus (Annexure II)

c) **Duration of the programme:** Minimum duration of programme is two (02) years and maximum duration is four (04) years. * The existing staff structure includes one (01) Director of School (SoESS), one (01) Programme coordinator (Assistant Professor) and two (02) Contractual faculty (Assistant Professors) -

d) **Faculty and support staff requirement:** ~~Five (05) faculty members are available in the Department of Forestry and Environmental Science, of which 03 Faculty members are Permanent whereas (One at Professor level and two at Assistant Professor level), two faculty members are working on contract (Assistant Professor level).~~ Keeping in view the workload and smooth functioning of the Department, there is an urgent and essential need of one Professor, one Associate Professor and 02 Assistant Professors at regular basis.

e) **Instructional delivery mechanism:** The programme will be offered in the Open and Distance Learning (ODL) mode. Guided self-study using print (SLM) and electronic media; lecture/ counseling sessions; special counseling sessions and group interactions in Workshop at cluster level; debate on key environmental issues; self-reliant study activities; individual / group work assignment; through MOOC; Project work; Lab sessions and excursion. The delivery material will include printed SLM, assignment, Face to face counseling at the designated study centres during Saturday and Sundays. Laboratory workshop will be conducted for 10 days at designated Study Centres.

vi) **Procedure for admission, curriculum transaction and evaluation**

Eligibility: Bachelor's degree in any discipline.

Fee structure: Rs. 8000 per annum (Rs. 4000 per semester)

Evaluation norms: A learner will be evaluated through continuous evaluation (Assignments) and term end evaluation (Term end examination) at the end of semester. Continuous evaluation will carry 30% weightage whereas term end evaluation will carry 70% weightage

vii) **Requirement of the laboratory support and Library Resources:** Being a Master of Arts level programme, field studies on Environment and related issues will be conducted. Therefore, there is no laboratory requirement for conducting this programme.

viii) **Cost estimates for development of the programme**: For own SLM development an amount of Rs. 10 Lakh will be required.

ix) **Quality assurance mechanism and expected programme outcomes:** The programme will help in the development of professionally skilled and sound indigenous human capital with interdisciplinary perspective for services related to rural development, urban planning, sustainable development, natural resource management, biodiversity development, wasteland rehabilitation, disaster management and environmental management, in general, and in corporate sector, in particular.

The programme will be implemented through Model Learning Support Centers at University and Verious Government Degree Colleges/ Universities / Institutions which have adequate facilities for learner's support.. Further, the Programme and SLM developed will be continuously upgraded and necessarily be revised after a period of 5 years.

Expected Programme outcomes

- Professionally- sound indigenous human capital with interdisciplinary perspective for services related to rural development, urban planning, sustainable development, natural resource management, biodiversity development, wasteland rehabilitation, disaster management and environmental management, in general, and in corporate sector, in particular
- Promotion of responsible consumerism from home to market, and holistic humanistic marketing and business
- Bridge the flow of information between civil society, professionals, corporates, and policy and decision-makers

ANNEXURE I

ENS 501 ENVIRONMENT AND ECOLOGY (Credits 04)

OBJECTIVE

To provide substantive knowledge and understanding of environment, environmental science, and ecology with system's perspective so that the learners acquire analytical perspective and technical skills for conservation and quality of environment

SYLLABUS

Environmental Science and Education: Environment- Definition, types and importance; Limiting factors; The multidisciplinary nature and need of public awareness; Environmental Education- Principles, objectives and approaches; Role of Government and Non-Governmental Organizations in environmental protection

Ecology: Definition, types, its relationship with other disciplines of science and humanities; Ecosystem- Concept, structure, cybernetics and functions; Ecological pyramids; Ecosystem perturbations; Development and evolution of ecosystem; Global ecosystems; Population dynamics; Ecosystem modelling and ecological engineering

UNIT SCHEDULE

BLOCK 1: ENVIRONMENTAL SCIENCE AND EDUCATION

Unit 1:Introduction to Environment: Definition; Types; Importance; Scope
Unit 2:The Earth's Environment: Components; Human activities on earth
Unit 3:Environmental Factors: Physical environment; Limiting factors
Unit 4:Introduction to Environmental Science: The Multidisciplinary nature; Need of public awareness
Unit 5: Environmental Education: Principles, objectives and approaches; Role of adult and women education

BLOCK 2: ENVIRONMENTAL PROTECTION

Unit 6: Basics of Environmental Protection: Protection vs. Conservation; Institutional apparatus- Local, National and International; Role of information and communication technology (ICT)
Unit 7: Sustainability: The concept; Principles; Approaches; Role of ethics; Globalization and sustainable development

BLOCK 3: ECOLOGY AND ECOSYSTEM

Unit 8:Ecology: Definition; Types; Importance; Scope; Relationship with disciplines of science and humanities
Unit 9: The Ecosystem: Concept; Types; Importance; Structure; The emergent property principle; Gaia hypothesis; Cybernetics and stability
Unit 10: Ecosystem Functions and Perturbations: Biogeochemical cycles (C, N, P and S); Productivity and energy flow; Information flow; Ecological pyramids; Ecosystem perterbations- grazing and browsing, fire and burning, industrialization
Unit 11:Global Ecosystems and Ecosystem Development: Biomes- types, distribution and characteristics; Ecosystem development- concept, types, processes and applications; Evolution of ecosystems

BLOCK 4: POPULATION DYNAMICS

Unit 12: Ecological Interactions and Ecological Niche: Types of interactions and application; Ecological niche
Unit 13: Population: Properties; Growth; Structure; Population – resource relationship
Unit 14: Ecosystem Modelling and Ecological Engineering: Basic concepts; Approaches; Applications

SUGGESTED READINGS

Principles of Environmental Science - W.P. Cunningham and M.A. Cunningham, Tata McGraw Hill Pub. Co. P. Ltd., New Delhi.
Principles of Environmental Science and Engineering – P. Venugopal Rao, Prantice Hall of India P. Ltd., New Delhi.
Environmental Science- G.T. Miller, Thomson Asia, Singapore.
Environmental Studies – R. Rajagopalan, Oxford University Press, New Delhi.
Environmental Studies – Benny Joseph, Tata McGraw Hill, Pub. Co. P. Ltd., New Delhi.
Environmental Studies – D.L. Manjunath, Pearson Education.
Fundamentals of Ecology– Eugene P. Odum, W. Saunders, Philadelphia, U.S.A.
Plant Ecology – Ernst- Detlef Schulze, Erwin Beck and Lkaus Miller- Hohenstein, Springer- Verlag, Berlin.
Concepts of Ecology – E.J. Kormondy, Prentice- Hall of India, P. Ltd., New Delhi.
Ecology, Environment and Resource Conservation – J.S. Singh, S.P. Singh and S.R. Gupta, Anamaya Publishers, New Delhi.
Introduction to Environmental Science- Y. Anjaneyulu B. S. Publications, New Delhi.
Environmental Science- D. Daniel Chiras, Jones and Bartlett Publishers, London.
Fragile Environment- ShormilaMukherji, Manak Publication Pvt. Ltd., New Delhi.
Environment - Peter H. Raven, Linda R. Berg andGoerge B. Johnson, Saunders College Publishing, U.S.A.
A Text Book in Environmental Science – V. Subramanian, Narosa Publishing House, New Delhi.
Environmental Science (8th edn.) - R.T. Wright and B.J. Nebel, Prentice Hall India P.Ltd., New Delhi.

ENS 502 LAND, WATER AND BIODIVERSITY RESOURCES (Credits 04)

OBJECTIVE

To familiarize the learners about land, water and biological resources; their extent, importance and cause of degradation; and measures for their conservation and sustainable use

SYLLABUS

Land Resources:	Characteristics; Landuse pattern and land utilization; Wetlands; Landcover changes; Land degradation and wastelands; Soil amelioration and conservation of wastelands; Land-related hazards and mitigation; Assessment of landuses
Water Resources:	Forms and status; Characteristics and utilization; Major threats to water resources; Development and conservation of water resources
Biodiversity Resources:	Concept, status, types and importance; Biodiversity measurement; Loss of biodiversity; Conservation and sustainable use of biodiversity

UNIT SCHEDULE

BLOCK 1: THE LAND RESOURCES

Unit 1: The Land Resources: Characteristic patterns and importance
Unit 2: The Mineral Resources: Defination, Mineral resources, origin, types, importance and uses, Mineral recourse mining, Mineral resources in India
Unit 3: The Water resources: Wetlands **Case study: The Sundarbans; The Bharatpur Sactuary:** Wetlands, types, characteristics, importance, functions, Wetlands in India, Ramsar convention.
Unit 4: The Landcover Changes: Definition, Land cover, Land cover change in India, reasons and effects

BLOCK 2: LAND DEGRADATION AND MANAGEMENT

Unit 5: Causes and Consequences of Land Degradation: Land degradation, Natural and Manmade, Consequences of Land degradation.
Unit 6: Wastelands: Definition of wastelands, Genesis; Types; Extent; Conservation and Management
Unit 7: Land-related Hazards and Mitigation: Landslides; Landslips; Earthquakes; Droughts.
Unit 8: Land Husbandry: Soil amelioration; Rehabilitation; Restoration of wastelands

BLOCK 3: THE WATER RESOURCES

Unit 9:Water and Water Resources- An Introduction: Status; Characteristics; Utilization
Unit 10:**Water Resources Development:** Dams- the necessary evil
Unit 11: **Water Resources Conservation Case study:** The Pani Panchayat: Watershed Management; Rainwater harvesting; Micro irrigation

BLOCK 4: THE BIODIVERSITY RESOURCES

Unit 12: **Biological Diversity:** Concept; Status; Types; Importance; Life zones;Biogeographical regions of India; Biodiversity and ecosystem functioning; Biodiversity Assessment
Unit 13: **Global Biodiversity:**Hotspots of biodiversity; Loss of biodiversity; Extinction of Species and IUCN Red List categories

BLOCK 5: CONSERVATION AND SUSTAINABLE USE OF BIODIVERSITY

Unit 14: **Biodiversity Conservation:***In-situ* and *ex-situ* conservation; Role of IKT;
Unit 15: **Biodiversity Conservation Outside the Protected Areas and Managed Plantations:** The concept; Approaches; Issues
Unit 16: **Conservation and Sustainable Use of Biodiversity:** National and international initiatives

SUGGESTED READINGS

Environmental Studies: Crisis to Cure- R. Rajagopalan, Oxford University Press, New Delhi.
Energy, Environment and Resource Conservation- J.S. Singh, S.P. Singh and S.R. Gupta, Anamaya Publishers, New Delhi.
Biodiversity and Global Change- O.T. Solbring, H.M. Van Emden and P.G.W.T. Van Oordt (eds.), CAB International, UK and IUBS, Paris, France.
Biodiversity and Ecosystem Functions- Ernst-Detlef Schulze and Harold A. Money (eds.), Springer-Verlag, Berlin.
Global Biodiversity Assessment- V.H. Heywood (Ex ed.), Published for the UNEP by Cambridge University Press, Cambridge.
Hot Spots of Endemic Plants of India, Nepal and Bhutan- M.P. Nayar, TBGRI, Tiruvanantpuram.
Bankin on Biodiversity- P. Shengji (ed.), ICIMOD, Kathmandu, Nepal.
Wetlands, Biodiversity and The Ramsar Convention- A.J. Hails (ed.), Ramsar Convention Bureau, Ministry of Environment and Forests (GOI), New Delhi.
Planning A Wildlife Protected Area Networks in India- W.A. Rodgers and H.S. Panwar, India: Establishment of Wildlife Institute of India, Dehradun and FO, Rome.
Conserving Biodiveristy Outside Protected Areas- P. Hallday and D.A. Gilmour (eds.), IUCN, Gland, Switzerland.
Biological Diversity Conservation and the Law- C.de Klemn and C. Shine, Environmental Policy and Law Paper No. 29, IUCN, Gland, Switzerland.

ENS 503 ENERGY RESOURCES (Credits 04)

OBJECTIVE

To develop broad understanding of energy sources, energy utilization and energy-economy-environment-health linkage enabling learners to meet the challenge of optimum energy needs and quality environment

SYLLABUS

The Energy Scenario:	Introduction; Interactions: E^3H
Energy Resources and Conservation:	Renewable and non-renewable; Conservation; Policies; Conservation of energy through demand management and technology development

UNIT SCHEDULE

BLOCK 1: THE ENERGY SCENARIO

Unit 1: Energy and Human Civilization: Energy types; Energy use through human civilization
Unit 2: Energy Production and Consumption: Energy crisis and its implications
Unit 3: Global and National Status:Energy-Economy-Environment-Health; Interactions; Energy related environmental issues; Impact of energy production on health

BLOCK 2: ENERGY SOURCES

Unit 4: Conventional Energy Sources I: Biomass based energy resources- firewood/ fuelwood, dung cake and agricultural residues
Unit 5: Conventional Energy Sources II: Hydropower; Coal; Oil; Natural gas
Unit 6: Non-conventional Energy Sources I: Solar; Wind; Tidal (ocean); Wave (water)
Unit 7: Non-conventional Energy Sources II: Geo-thermal (earth); Nuclear (nuke); Hydrogen

BLOCK 3: ENERGY CONSERVATION

Unit 8: The Policies: Global and national (India: National Energy Policy, National Biodiesel Policy; National Energy Mission and Climate Change)
Unit 9: Energy Conservation I: Demand management; Improving efficiency
Unit 10: Energy Conservation- Development of Renewable Energy Resources and Related Technologies I: Bio-energy: Wastes from municipal and sectors; Biogas/methane; Agro-and wood wastes for power generation
Unit 11: Energy Conservation- Development of Renewable Energy Resources and Related Technologies II:Dendrothermal energy (Energy plantations) and Ethanol
Unit 12: Energy Conservation- Development of Renewable Energy Resources and Related Technologies III: Bio-fuel farming - *Euphorbia*, Ratanjot and Karanj, etc.
Unit 13: Repercussions of Switching to Bio-fuels: The controversy; Alternate options
Unit 14: The Future Energy: Hydrogen economy; Fuel cells; Hybrid cars

SUGGESTED READINGS

Environmental Studies: From Crisis to Cure- R. Rajagopalan, Oxford University Press, New Delhi.
Agricultural Residues on Fuel in the Third World-G. Barnard and L.Kristoferson, Earthscan, London.
Energy and Environment: Some Key Issues- T. Vukina, The Economic Development Institute, The World Bank, Washington D.C.
Environmental Considerations in Renewable Energy Policy and Investment Planning- W.K. Foell, M.E. Hanson and C.W. Green, The Economic Development Institute, The World Bank, Washington, D.C.
Improved Cooking Stoves in Developing Countries- G. Foley and P. Moss, Earthscan, London.

ENS 504 ENVIRONMENTAL PHYSICS AND CHEMISTRY (Credits 04)

OBJECTIVE

To explain physical, physiographic and chemical aspects of environment and generate awareness for quality outdoor and indoor environment

SYLLABUS

Environmental Physics: Physical and physiographic factors and their effects
Environmental Chemistry: Chemistry of external environment – Air, Water and soil; Chemistry of internal environment

UNIT SCHEDULE

BLOCK 1: PHYSICAL FACTORS AND THEIR EFFECTS

Unit 1: Light and Temperature: Sources; Response of plants, animals and microbes; minimizing adverse influences
Unit 2: Precipitation and Humidity: Sources and forms; Effects; Minimizing adversities
Unit 3: Wind and Pressure: Influences on physical and biological environment
Unit 4: Visibility and Transparency: The concept; Role in ecosystem
Unit 5: Fire: Sources; Effects on physical and chemical components; Minimizing adverse influences

BLOCK 2: PHYSIOGRAPHIC FACTORS AND THEIR EFFECTS

Unit 6: Topography and Relief: Role in ecosystem; Managing adversities
Unit 7: Latitude and Longitude: The concept; Role in ecosystems
Unit 8: Land Forms: Types; Influences on environment

BLOCK 3: CHEMISTRY OF EXTERNAL ENVIRONMENT

Unit 9: Chemistry of Air: Composition; Concentration; Influences
Unit10: Chemistry of Water:Composition; Concentration; Influences
Unit 11: Chemistry of Soil:Composition; Concentration; Influences

BLOCK 4: CHEMISTRY OF INTERNAL ENVIRONMENT

Unit 12: Foods and Food Additives: Scenario; Influences on physical and biological environment; Mitigating adversities
Unit 13: Drugs and Antioxidants: Scenario; Influences on physical and biological environment; Mitigating adversities
Unit14: Colours and Flavours: Scenario; Influences on physical and biological environment; Mitigating adversities
Unit15: Sweeteners and Sequesters: Scenario; Influences on physical and biological environment; Mitigating adversities
Unit16: Emulsifiers and Preservatives: Scenario; Influences on physical and biological environment; Mitigating adversities
Unit17: Use and Abuse of Chemicals in Foods and Beverages: Types of chemical added to food and beverages, food additives, types and uses. Effects of food additives. Safety tests for food additives.

ENS 505 ENVIRONMENTAL ETHICS AND PHILOSOPHY (Credits: 04)

OBJECTIVES

To familiarize learners with the broad theories and parameters of environmental philosophy that contribute as basis of conservation and environmentalism supporting sustainable development

SYLLABUS

Environmental Ethics:	Introduction; Ethics in society; Cross-cultural views on nature; Types of school of thoughts; Values in eastern and western culture
Deep Ecology:	Concept; Environmental rights and racism; Changing nature of environmental ethics; Resource consumption patterns; Traditional values and environmental conservation

UNIT SCHEDULE

BLOCK 1: ENVIRONMENTAL ETHICS AND PHILOSOPHY

Unit 1: Environmental Ethics- An Introduction: Definition; Ethics in society; Responsibility for Environmental degradation
Unit 2: Cross-cultural Views on Nature: Relationship between humans, nature and adaptation; The culture / nature divide; Theoretical frameworks of cultural and social ecology
Unit 3: Theory of Environmental Ethics:Types of school of thoughts

Unit 4: Values in Modernity and Antimodernity: Nature and religion; Eastern and western culture

BLOCK 2: DEEP ECOLOGY

Unit 5: Introduction to Deep Ecology:The concept; Evolution; Merits and demerits
Unit 6: Environmental Racism and Environmental Rights: The concept; Theories of human and animal rights

BLOCK 3: PARADIGMS OF ENVIRONMENTAL ETHICS

Unit 7: National and International Governance: Changing nature of environmental ethics
Unit 8: Resource Consumption Patterns: Historical perspective; Patterns in Developed and Developing countries; Technology and resource consumption
Unit 9: Equitable Utilization: The concept, need and governing factors; Equity disparity in north and south countries; Urban and rural equity
Unit 10: The Gender Equity: The concept; nRole of gender; The issues of neglect / misinterpretation
Unit 11: Traditional Value Systems and Environment: Role of traditional values; Indian experiences
Unit 12: The ethical basis of environmental awareness:The concept of awareness; Role of ethics

SUGGESTED READINGS

GlobalWarming in Unequal World: A Case of Environmental Colonism- Anil Aggarwal and SunitaNarain, CSE, New Delhi.
The Environment in Question: Ethics and Global Issues- D.E. Cooper and J.A. Palmer (eds.) , *Routledge, London.*
Environmental Ethics –An Invitation to Environmental Philosophy (3rdedn.), Wasdsworth Publ. Belmont, California.
Indigenous Traditions and Ecology – J.A. Grim (ed.), Harward Univ. Press, Harward.
The Environmental Ethics and Policy: Philosophy, Ecology and Economics- D.C.P. Vandeveer and D. Vandeveer, Wadsworth Publ., Belmont, California.

ENS 506 ENVIRONMENTAL POLLUTION AND HEALTH (Credits 04)

OBJECTIVE

To develop understanding and technical skills in pollution of environment and its consequences on health of biota including human-beings with emphasis on globalized human well-being

SYLLABUS

Environmental Pollution:	Definition; Historical understanding; Types of pollution and pollutants; Scope of the study
Air and Noise Pollution:	Definition and types of air pollution;Types of air pollutants and sources of indoor and outdoor air pollution; Air pollution and meteorology; Effects of air pollution on plants, animals and human health, and archaeological sites; Control of air pollution; Noise pollution- sources, effects and control measures
Water Pollution:	Definition; Types and sources of water pollutants; Effects of water pollution; Control of water pollution
Soil Pollution:	Definition;Types and sources of soil pollution; Impacts of soil pollutants; Control of soil pollution
Pollution problems of Global Dimension:	Climate change; Depletion of ozone layer; Acidic precipitation; Pollution of international water; Solid waste

UNIT SCHEDULE

BLOCK 1: BASICS OF ENVIRONMENTAL POLLUTION

Unit 1: Environmental Pollution: Definition; Historical development; Types and classification of pollutants; Scope of the study

BLOCK 2: AIR AND NOISE POLLUTION

Unit 2: Air Pollution: Definition; Types; Classification of air pollutants; Indoor and outdoor air pollutants and their sources;Air pollution and meteorology

Unit 3: Effects and Control of Air pollution: Effects on plants, animals, human health and archaeological sites and buildings; Control measures

Unit 4: Noise Pollution: Causes; Consequences; Control measures

BLOCK 3: WATER AND SOIL POLLUTION

Unit 5: Water Pollution I: Definition and types, classification of water pollutants; Fresh water and marine water pollution and their sources; Transformation in nature and water quality

Unit 6: Effects and Control of Water Pollution: Effects on water ecosystem, water life and human-beings; Control measures

Unit 7: Soil Pollution: Definition and types; Classification of soil pollutants and their sources

Unit 8: Impacts and Control of Soil Pollution: Effects on soil, soil biota; Control measures

BLOCK 4: POLLUTION PROBLEMS OF GLOBAL DIMENSION

Unit 9: Climate Change: The concept; Causes; Effects; Mitigation measures

Unit 10: Depletion of Ozone Layer and Acidic Precipitation: Importance of ozone layer; Causes and effects of depletion; Control measures

Unit 11: Pollution of International Water: The issue; Causes; Consequences; Control measures

Unit 12: Solid Waste: Types; Sources of solid wastes; The hazardous wastes; The solid waste problem; Management of solid wastes

SUGGESTED READINGS

Environmental Studies: From Crisis to Cure – R. Rajagopalan, Oxford University Press, New Delhi.
Ecology, Environment and Resource Conservation- J.S. Singh, S.P. Singh and S.R. Gupta, Anamaya Publishers, New Delhi
The Gita of Waste- Dengel, Et al., Auroville Health Centre, Auroville, Tamil Nadu
Global Environmental Issues – E. El- Hinnawi and M.H. Hashmi (eds.), UNEP by Tycooly, International Publishing Ltd., Dublin.

ENS 507 ENVIRONMENTAL PLANNING, POLICIES AND ACTS (Credits 04)

OBJECTIVE

To impart knowledge of environmental planning, policies and acts at global and national level, and their application as instruments to maintain the quality of environment

SYLLABUS

Environmental Planning: The planning apparatus; The principle of environmental protection; Constitutional perspective in India; Environmental boards and authorities

Environmental Policies: Perspectives; International and national environmental policies

Environmental Acts: Legislative measures established by India for protection of quality of environment, air and water; Legal measures for control of noise and hazardous waste pollution and conservation of biodiversity

UNIT SCHEDULE

BLOCK 1: ENVIRONMENTAL PLANNING AND CONSTITUTIONAL PROVISIONS

Unit 1: Introduction to Environmental Planning: The need; Historical perspective from ancient Indian to post LPG era; The environmental planning apparatus- global and Indian

Unit 2: Environmental Protection: The principles; The Brundtland Report 1987, Public trust doctrine, Indian judicial responses

Unit 3: Environment in Indian Constitution: Constitutional provisions for environment; Fundamental right and duty; Directive principles of state policy

Unit 4: Judicial Remedies and Procedures: Tort law; Public nuisance; The writ jurisdiction; Statuary remedies; Public interest litigation; Freedom of information and right to know

BLOCK 2: THE ENVIRONMENTAL AUTHORITIES AND BOARDS

Unit 5: The Environmental Authorities: The Ganga Action Plan Authority; The Biodiversity Authority of India; The Plant Varieties and Farmers' Rights Authority of India; National Environmental Tribunal; National Appellate Environmental Authority; The Central Authorities

Unit 6: **The Environmental Boards:** Central Pollution Control Board; State Pollution Control Board; The Wildlife Board

BLOCK 3: THE ENVIRONMENTAL POLICIES

Unit 7: **International Environmental Policies and Protocols:** The Millennium development goals; World conservation strategy; Clean development mechanism; Convention on Biodiversity; Kyoto protocol; Montreal Protocol; Trans-regional environmental policies

Unit 8: **Indian Environmental Policies:** The Environment Policy 2006; National Conservation policy; National Action plan for climate change; Forest Conservation policy, 1988; National Agroforestry policy, 2014; Green India mission; Trans-national environmental policies

BLOCK 4: THE ENVIRONMENTAL PROTECTION LEGISLATIONS

Unit 9: **International Environmental Laws- Basic Aspects:** Introduction; Necessity for International Environmental Court; Role of UNEP on International Environmental Laws; Case studies of international environmental disputes

Unit 10: **International Environmental Laws in Practice:** Basel consortium on hazardous wastes; Principles of "no fault' and 'absolute liability' for biomedical wastes, genetic wastes, e-wastes and industrial accidents; CITES, Rasmsar Convention; Regional acts

Unit 11: **Indian Environmental Legislations:** The Wildlife Protection Act, 1972 (amendment 2013); The Water (Prevention and control of pollution) Act, 1974 (and amendment); The Water Cess Act, 1962; THe Air (Prevention and control of Pollution) Act 1981 (and amendment); The Environmet Protection Act, 1986; Hazardous Wastes (Management and Handling) Rules, 1989; Bio-medical Waste (Management a Handling) Rules, 1989; Noise Pollution (Regulation) 2000

Unit 12: **Forest and Biodiversity Acts:** The Forest Act, 1927; The Forest Conservation Act, 1980; Biodiversity Act, 2002; Plant Varieties and Farmers' Rights Act, 2004

Unit 13: **Environment Related acts:** The Atomic Energy Act, 1962; The Factories Act, 1948; The National Environmental Appellate Authority Act, 1927; THe Public Liability Insurance Act, 1991; The National Environment Tribunal Act, 1995; The Mines and Minerals Act, 1957

SUGGESTED READINGS

Environmental Laws- D. Hughes, Butterworths, Lexin Nexis.

Environmental Justice – C.M. Jariwala, APH Publishing Corporation Ltd. New Delhi.

Environmental Law Case Book- P. Leelakrishnan, Butterworths, Lexis Nexis.

Environmental Laws in India- G. Singh, McMillan & Co., New Delhi.

Environmental Laws and Policy in India- S. Diwan and A. Rosencrany, Oxford University Press, New Delhi.

*Environmental Management in Practice, Vol.*1- B. Nath, L. Hens, P. Compton and D. Devuyst, Routlede, London.

Global Environmental Issues – E. El- Hinnawi and M.H. Hashmi (eds.), UNEP by Tycooly, International Publishing Ltd., Dublin.

ENS 508 ENVIRONMENTAL ECONOMICS AND SUSTAINABLE DEVELOPMENT (Credits 04)

OBJECTIVE

To understand the basics of welfare economics, the importance of sustainability, value and valuation of environmental and ecosystem goods and services so that the learners are able to ecologise economy in development planning and decision-making

SYLLABUS

Basics of Welfare Economics: Producer and consumer surplus, market failure, Parato optimality, law of diminishing returns and national income

Environmental Economics: Theory and applications; Valuation techniques and valuation in practice

Sustainable Development: The tragedy with development, The concept of sustainability; Sustainable development- The concept, principles and challenges

UNIT SCHEDULE

BLOCK 1: WELFARE ECONOMICS: AN INTRODUCTION

Unit 1: Basics of Welfare Economics: The producer consumer surplus; Market failure, Externalities; Public goods; Pareto optimality,The Law of diminishing returns; National income

BLOCK 2: THE ENVIRONMENTAL ECONOMICS (EE): CONCEPTS, TECHNIQUES AND PRACTICES

Unit 2: Environmental Economics (EE) I: The concept; Ecology, economics and environmental Economics; Emerging issues

Unit 3:Environmental Economics (EE) II: Why value the nature and environment?; National resource accounting; Green national accounts: Policy issues; Environmental economics and valuation in development decision-making

Unit 4: Techniques of Environmental Valuation: C:B analysis; Cost effectiveness analysis; Environmental benefit estimates;- Effect on production, Preventive expenditure and replacement cost, Human capital, Hedonic method, Travel cost and contingent valuation, Relative usefulness of different valuation methods

Unit 5: Methodological Problems and Issues: Distribution of cost and benefit; Discounting; Future generations; Irreversible effects; Uncertainty and risks; Unmeasurable items

Unit 6: Environmental Valuation in Practice: Deforestation; Pollution; Biodiversity; Global climate change; Ecosystem goods and services; Farm forestry and agro-forestry

BLOCK 3: SUSTAINABLE DEVELOPMENT

Unit 7: The Tragedy with Development: Inequality; Displacement of population; industrial insecurity and cruelty with earth

Unit 8: Sustainability: The concept; Principles; Limitations

Unit 9: Sustainable Development I:Policies; Strategies

Unit 10: Sustainable Development II: Demographic dynamics; The developed and developing countries; International contributions

Unit 11: Sustainable Development III: Role of judiciary system; Future perspective; Case studies

SUGGESTED READINGS

The Price of Forests- Anil Agarwal (ed.), Centre for Science and Environment, New Delhi.

Green National Accounts: Policy Uses and Empirical Experience- K. Hemilton and E. Lutz, Environment Department, The World Bank, Washington D.C.

Values for the Environment- J.T. Winpenny, ODI, London.

Valuing Forest: A Review of Methods and Applications in Developing Countries- J.T. Bishop, IIED, London

Environmental Economics: An Indian Perspective- R.N. Bhattachaya (ed.), Oxford University Press, New Delhi.

Environmental Economics and Practices- G.K. Kadekodi (ed.), Oxford University Press, New Delhi.

Environmental Economics – Charles Kolstad, Oxford University Press, New Delhi.

Environmental Economics and Natural Resource Economics- (VI ed.)Tom Titenberg, Pearson Education Inc.

Sustainability and Environmental Economics – An Alternative Text- J. Bowers, Longman, London.

Managerial Economics (IX edn.) – R.L. Varshney and K.L. Maheshwari, Sultan Chand and Sons, New Delhi.

Our Common Future- The World Commission on Environment and Development- Oxford University Press, Oxford.

Sustainable Development- J. Kirky, O. Keefe and P. Timberlake, Earthscan, London.

ENS 509 ENVIRONMENTAL IMPACT ASSESSMENT (EIA) AND ENVIRONMENTAL AUDITING (EA) (Credits 04)

OBJECTIVE

To understand EIA and EA as preventive processes for environmentally-sound planning of development with sustainability perspective

SYLLABUS

EIA: Basic concept; Process; Methodologies; Notifications; Assessment and preparation in practice

EA: Basic concept and emerging issues; Stages and on-site activities; Data evaluation and reporting; Post-audit activities and management

UNIT SCHEDULE

BLOCK 1: EIA: CONCEPTS AND PROCESS

Unit 1: **Basic Concepts I:**Origin and development; Purpose and aims; Core values and guiding principles; Advantages and applications; EIA and Project cycle; Dimensions of EIA
Unit 2: **Components of EIA Process:**Identification; Prediction; Evaluation; Mitigation; Communication
Unit 3: **Preparation and Writing of EIA Report;**Participants in EIA; Report writing; Improving effectiveness of EIA process

BLOCK 2: EIA: DECISION MAKING AND IMPLIMENTATIONS

Unit 4: **Decision Making:**Implementation of consultation and review of environmental impacts; Planning, licensing and authorization process
Unit 5: **Project Implementation:**Construction and commissioning; Monitoring of compliance and impacts; Auditing of performance and post implementation surveys
Unit 6: **EIA Notification in India:** Study of EIA notification 2004 and amendments

BLOCK 3: EIA METHODOLOGIES AND PRACTICE

Unit 7: EIA **Methodologies I: Steps , advantages, hierarchy,** criteria for selection of methodologies, choosing the object and methodology requirement..
Unit 8: EIA **Methodologies II:** Major methodologies for EIA: Adhoc methods; check list method; Matrix method, Network method; Overlay method.
Unit 09: **Assessment of Socio-economic Impacts:** Definition and rationale; Social impact and change in community and institutional arrangements; Impact assessment
Unit 10: **Sectoral EIA :** Development activities and landuse; Mineral exploitation; Surface water; Biodiversity; Air
Unit 11: **EIA for Some Typical Development Projects:** Industrial projects; Thermal power; River valley and hydro-electric projects; Highways and road projects

BLOCK 4: ENVIRONMENTAL AUDITING

Unit 12: **Basic Concepts of Environmental Auditing:** Definition; Types; General Audit Methadologys
Unit 13 **EA Process, Strategies and Management:** Element of Audit process, waste audit and pollution prevention , EA of Industrial projects, Liability and site assessment.

SUGGESTED READINGS

Environmental Auditing- Hugh Barton and Noel Bruder, Earthscan, London.

Ecology, Environment and Resource Conservation- J.S. Singh, S.P. Singh and S.R. Gupta, Anamaya Publishers, New Delhi.

Environmental Impact Assessment Methodologies – Y. Anjaneyula, B.S. Publications, Hyderabad.

ENS 521 & ENS 522 LABORATORY-CUM-FIELD STUDIES I & II Credits 04

OBJECTIVE

Study of environment and environment-related aspects in laboratory and under real-life conditions

SYLLABUS

Laboratory Studies: Study of environmental laboratory- Its organization and structure; Instrumentation for environmental studies; Role of environmental laboratory; Basic ecological and environmental studies

Field Studies: Significance of field studies; Preparation for field studies; Study of basics of ecology and environment under real-life situations in natural and human- engineered ecosystems

UNIT SCHEDULE

BLOCK 1: THE LABORATORY STUDIES

Unit 1: **Environmental Laboratory**: Definition, Concept; Applications
Unit 2: **Organization of Environmental Laboratory:** Structure, Functioning
Unit 3: **Instrumentation for Environmental Studies:** Requirements, Organization

BLOCK 2: EXPERIMENTAL ECOLOGICAL AND ENVIRONMENTAL STUDIES

Unit 4: Sampling: Sample and sample collection
Unit 5: Methods for Natural Outdoor Environment and Ecological Analysis in Practice: Flora
Unit 6: Methods for Natural Outdoor Environment and Ecological Analysis in Practice: Fauna and microbes
Unit 7: Environmental Studies I:Basic air monitoring
Unit 8: Environmental Studies II: Basic water monitoring
Unit 9: Environmental studies III: Basic soil analysis
Unit 10: Environmental studies IV: Bioassay

BLOCK 3: FIELD STUDIES

Unit 11: Field Studies: Purpose; Importance; Guidelines
Unit 12: Holistic Field Study of Environment and Ecological Linkages: In rural, urban, shanty and industrial ecosystems and mining sites
Unit 13: Field Study of Natural and Human-Engineered Ecosystems: Such as forest, grassland, agriculture, agroforestry, community forest, Industrial plantation, lake, river, wetland, pond and dam
Unit 14: Field Study of Conservation Site:National Park; Sanctuary; Biosphere Reserve; Zoo and Botanical Garden; Vanvihar (*Abhyaranya*)
Unit 15: Field Study of Environment–friendly Technologies: such as, solar energy, energy plantations and crops, gasifier, biogas technology, rainwater harvesting, watershed management and aquaculture, observatory
Unit 16: Visit to Environmental Institutions: Such as Research and Development Institutes; Ecology and environmental education-related Departments in Universities, Post Graduate Colleges and Non-governmental organizations, Museum and Sacred grooves

ENS 601 ATMOSPHERE AND CLIMATE CHANGE (Credits 04)

OBJECTIVE

To recognize dynamic nature of earth's atmosphere in terms of global energy balance, and appraise climate change and policy initiative

SYLLABUS

Earth System:	Geological history; Development and evolution of atmosphere; Atmosphere and climate; Air-sea interaction; Global energy balance; Wind, monsoon and cyclones
Climate Change and Policies:	Natural climate change; Human impacts on climate; Impacts of climate change; Climate change policies

UNIT SCHEDULE

BLOCK 1: THE EARTH SYSTEM

Unit 1: The Earth: Interspheric linkages; Geological history
Unit 2: Development and Evolution of Earth; Gaia hypothesis

BLOCK 2: ATMOSPEHRE AND CLIMATE

Unit 3: The Atmosphere: Basic properties; Movement in the atmosphere: Global, regional and local scale
Unit 4: The climate: Definition; Classification and variability; Climate control
Unit 5: Global Energy Balance: Source; Transfer and Distribution; Energy balance of atmosphere
Unit 6: Oceans: General circulation patterns; Air-sea interactions
Unit 7: Wind and Climate: Wind stability and turbulence; Monsoons, En-nino, Southern oscillations and cyclones

BLOCK 3: CLIMATE CHANGE

Unit 8: Natural Climate Change: Records of climate changes- glacial cycles, ocean sediments, corels and tree rings
Unit 9: Human and Climate: Human activities influencing climate; Global warming and green house effects; Global and regional trends in green house gas emissions
Unit10: Sea-level Rise: Scenario; Role of oceans as carbon sinks
Unit 11: Forests and Climate: Interaction; Role of forests as carbon sink; Carbon forestry

Unit 12: Ozone and Climate: Ozone as shield; Ozone depletion and climate change

BLOCK 4: CLIMATE CHANGE: IMPACTS AND POLICIES

Unit 13: Effects on Ecosystems: Species distribution ranges; Productivity; Extinction risk of thermo-sensitive species; Spread of diseases
Unit 14: Effects on Organisms: Microbes; Plants; Animals and Human-beings
Unit15: Institutions and Protocols: IPCC; Clean development mechanism (CDM); Kyoto protocol, Montreal Protocol
Unit 16: Indian Initiatives: The National mission on climate change

SUGGESTED READINGS

Atmosphere, Weather and *Climate* – R.G.Barry, Routledge Press, UK.
The Earth System - L.R. Kump, J.F. Kastaig and R.G. Carne (eds.), Prentice-Hall India P. Ltd., New Delhi.
General Climatology- J.H. Critchfield, Prentice-Hall India, P.Ltd., New Delhi.
Climate and Global Climate Change – D. Harrey, Prentice-Hall India P. Ltd., New Delhi.

ENS 602 RESEARCH METHODOLOGY FOR ENVIRONMENTAL STUDIES (Credits: 04)

OBJECTIVES

To familiarize learners with the important dimensions relating to research, research methodology, experimental designs and statistical methods, and interpretation and communication of results to enable them in identifying a research problem,developing the most appropriate methodology for research study and to make them familiar with the art of using different research methods and techniques.

SYLLABUS

Introduction to research methodology; Defining a research problem; Designing research and surveys; Measurement and scaling; Data collection and data interpretation; Descriptive statistics; Sampling and statistical inference; Testing of hypothesis; Chi-square test, analysis of variance, correlation and regression analysis, factor analysis, discriminate analysis, ordination, cluster analysis; Data interpretation; Writing research report and research paper

UNIT SCHEDULE

BLOCK 1: RESEARCH METHODOLOGY AND RESEARCH PROBLEM

Unit 1: Research Methodology:Meaning; Objectives; Types; Approaches and Process; Criteria of good research
Unit 2: Research Problem: Definition; Selection and techniques of defining a problem

BLOCK 2: DESIGNING RESEARCH, SAMPLE SURVEYS AND MEASUREMENT

Unit 3: Research Design: Meaning; Needs and features of a good design; Important concepts related to research design; Different research designs; Principles of experimental designs and important experimental designs
Unit 4: Design of Sample Surveys:Sample design and sampling and non-sampling error; Types of sampling designs-non-probability; Probability and complex random sampling designs
Unit 5: Measurement and Scaling: Quantitative and qualitative data; Classification and goodness of measurement scales; Sources of error in measurement; Techniques of developing measurement tools; Scaling; Classification bases, techniques and multi-dimensional scaling; Deciding the scale

BLOCK 3: DATA COLLECTION AND PREPARATION, DESCRIPTIVE STATISTICS AND SAMPLING

Unit 6: Data Collection: Introduction; Collection of primary and secondary data; Selection of appropriate method for data collection; Case study method
Unit 7: Data Preparation:Process and problems in preparation process;

Unit 8: Descriptive Statistics:Measures of central tendency(Mean, median, mode, other averages); Measures of dispersion (range, mean deviation and standard deviation0; Measures of skewness and relationship; Association in case of attributes and other measures (index numbers and time series)

Unit 9: Sampling and Statistical Inference: Parameter, sampling and non-sampling error; Sampling distribution, degree of freedom, standard deviation and error; Correlation and regression; Statistical inference (point and internal estimation, sample size determination and hypothesis testing)

BLOCK 4: HYPOTHESIS TESTING, DATA ANALYSIS AND MODELLING

Unit 10: Testing of Hypothesis: Basic concepts, procedures and testing of hypothesis; Limitations of the tests of hypotheses

Unit 11: Tests of Hypothesis: Chi-square, t, F and z tests, Tukey's Q test; ANOVA and ANOCOVA

Unit 12: Linear Regression Analysis: Factor analysis; Discriminate analysis; Using SPSS

Unit 13: Cluster Analysis and Multivariate Analysis: Cluster analysis, cluster in algorithms, hierarchical cluster analysis, multivariate cluster analysis, characteristics and classification.

Unit 14: Application of Remote Sensing and GIS in Environmental Studies: Case study of landuse and land cove change; Urban sprawling; Mining hazards, etc.

BLOCK 5: DATA INTERPRETATION AND RESULT COMMUNICATION

Unit 15: Data Interpretation: Meaning; Techniques and precautions required

Unit 16: Result Communication: Significance of results communication as report; Report writing- steps and layout; Types of reports; Mechanics of writing a research report and research paper; Precautions for writing; Oral presentation: preparation and practice

SUGGESTED READINGS

Research Methodology: Methods and Techniques – C.R. Kothari and Gaurav Garg, New Age International Publichers P. Ltd., New Delhi.

Biostatistics – Alvin E. Levis, Affiliated East – West Press P.Ltd., New Delhi.

Statistical Methods – Allen Edwards; Holt, Rinehart and Winston, New York.

Statistical Methods – G.W. Snedecor and W.C. Cochran, Oxford and IBH Pub.Co. P. Ltd., New York.

ENS 621(L) LBORATORY-CUM-FIELD STUDIES III (Credits 04)

OBJECTIVE

Study of environmental parameters applicable to environmental decision-making

SYLLABUS

Experimental studies on major pollution indicators; Monitoring of weather and nutrients budgets; Resource mapping using RS, GIS and GPS; Environmental factor (s)- led adaptations in plants, animals, microbes and human; Bioindicators

UNIT SCHEDULE

BLOCK 1: EXPERIMENTAL STUDIES ON MAJOR POLLUTION INDICATORS

Unit 1: Monitoring of Weather and Climate: Use of meteorological data

Unit 2: Monitoring of Air: Pollutants selected – CO, SO_2, NO_X and SPM

Unit 3: Monitoring of Water: Pollutants selected- TDS, BOD and COD

Unit 4: Monitoring of Soil: Selected pesticides, toxins and heavy metals

Unit 5: Bio-monitoring: Application of bio-indicators in pollution measurement

Unit 6: Study of Morphological Adaptations: In plants and animals to environmental factors

BLOCK 2: ECOSYSTEM BUDGET STUDIES

Unit 7: Estimation of Productivity

Unit 8: Study of Energy Budget

Unit 9: Study of Carbon Budget

Unit 10: Study of Nitrogen Budget

Unit 10: Environmental Planning: Role of public policies
Unit 11: Management Plan for Disturbed Ecosystems: such as, abandoned arable land, waste land, derelict land, industrially-overburdened sites and deforested sites
Unit 12: Disaster Management Planning: for earthquake, landslide, drought, floods, floodplain areas and dam-induced disasters
Unit 13: Environmental Management in Industries: Such as Pulp and Paper; Automobiles, Food products, Sugar, Distillery, Rice milling, Mineral-based and Software
Unit 14: Industry-based Study:Corporate Social Responsibility and Sustainable Development
Unit 15: Management of Environment and Workplace: Application of gender diversity

SUGGESTED READINGS

According to project identified from the above suggestive list.

ELECTIVE COURSES

ENSE 651 ECO-DEVELOPMENT AND ECO-TOURISM (Credits 04)

OBJECTIVE

To impart knowledge of science and practice of eco-development and ecotourism to manage the human-nature and human-wildlife conflicts on sustainable basis

SYLLABUS

Eco-development: Origin and concept; Factors governing eco-development in practice; Importance of eco-development; Eco-development planning-case studies

Ecotourism: Concept, objectives, classification and benefits; Eco-tourism planning, Eco-tourism marketing, product designing; Impacts of eco-tourism; Management of eco-tourism

UNIT SCHEDULE

BLOCK 1: ECODEVELOPMENT: THEORY AND PRACTICE

Unit 1: Introduction to Eco-development: Origin; Concept; Objective; Scope; Factors governing eco-development
Unit 2: Eco-development Planning: Requirements; Ecosystem analysis methods for planning; Analysis of data; Developing eco-development plans; Limitations
Unit 3: Management of eco-development: Necessity and practices
Unit 4: Eco-development in Practice: Status in India, Environmental initiatives; Role of NGOs, corporate and society; Case studies- Western Ghats, Silent Valley, Sundarban, Himalayan region

BLOCK 2: THE SCIENCE OF ECO-TOURISM

Unit 5: Eco-tourism- An Introduction: Origin of the concept, definition, objectives, classification and benefits
Unit 6: Eco-tourism- The Basic Concepts: Types of eco-tourists; Concept of carrying capacity; Role of socio-cultural, economic and institutional factors; Gender dimension in eco-tourism

BLOCK 3: ECOTOURISM PLANNING AND MANAGEMENT

Unit 7: Planning and Management Criteria: Management of visitors and other resources including human and natural; Quality control and code of conduct; GIS and ICT in planning and management; Sustainability issue in tourism; Ecotourism certification
Unit 8: Ecotourism Markets I: Role of local institutions and other grassroot agencies; Paradigm shift due to climate change and possible influence of carbon economy on existing eco-tourism markets
Unit 9: Ecotourism Markets II: Eco-circuits of Western ghats, Rainforest (Silent Valley), Mountains (Himalaya), Coastal (Goa, Andmans), National Park (Kanha, Corbett), Sanctuary (Bhartpur, Satpura), Biosphere Reserve (Nilgiris, Nadadevi) and village rural eco-tourim; TQM in ecotourism resorts
Unit10: Designing Ecotourism Products: Use of traditional knowledge and technology; Case studies

BLOCK 4: ECO-TOURISM: IMPACTS AND INSTITUTIONAL INITIATIVES

Unit 11: Impacts of Eco-tourism: Socio-cultural, economic and environmental impacts; Role of ethics in eco-tourism

Unit 12: Institutional Aspects: Eco-tourism policy; Eco-branding and eco-labelling of eco-tourism products

SUGGESTED READINGS

Ecotourism and Sustainable Development- M. Honey, Iceland Press, London.

Global Ecotourism Policies and Case Studies – M. Luck and T. Kirstges, Channel View Publ., New Delhi.

The Encyclopedia of Ecotourism- D.B. Weaver, CABI Pub., U.K.

Global Ecotourism- P. Chandra, Kaniskha Publishers, New Delhi.

Tourism Marketing- M. Chaudhary, Oxford University Press, New Delhi.

Environmental Impacts of Ecotourism (Ecotourism Series-2)- R. Buckley (ed.), CABI Pub., U.K.

Indigenous Ecotourism, Sustainable Development and Management (Ecotourism Series 3)- H.D. Zeppel, CABI Pub., U.K.

Marine Ecotourism: Between the Devil and the Deep Blue Sea (Ecotourism Series 6)-C. Cater and E. Cater, CABI Pub. U.K.

Wildlife Tourism-D. Newsome, R. Dowling and S. Moore, CBS Publishers & Distributors, New Delhi.

EVS 652 ENVIRONMENTAL GEOLOGY (Credits 04)

OBJECTIVES

To understand environment and ecology in the fabric of geology, the natural hazards resulted from quickened earth processes and the engineering geology and geotectonics for planning strategy and methodology of economic development supporting earth and basic resource base

SYLLABUS

Planet Earth and Earth Processes:	Earth in solar system; Differentiation of earth; Processes; Hydrologic weathering and erosion processes; Physiographic features; Erosional, transformational and depositional processes of water, air, waves and glaciers
Earth Resources:	Land, soil, minerals and water; Geological constraints in resource availability and use; Environmental consequences of resource exploitation
Natural Hazards:	Floods, landslides, earthquakes, cyclone, coastal erosion and sea-level changes, volcanic; Hazard zoning and risk management
Geo-technology and Development:	Scope of engineering geology and geotechnics; Geoclinal considerations in building dams and reservoirs, roads and canal construction, foundation of buildings and bridges; and Gerotechnics of tunnels; Landscape geochemistry and human health

UNIT SCHEDULE

BLOCK 1: SPECTRUM OF ENGINEERING GEOLOGY

Unit 1: The Earth: Earth in solar system; Differentiation of earth

Unit 2: Earth Processes: Plate tectonic rock-forming and ore-forming; Hydrologic weathering and erosional processes; Physiographic features (Ocean, land, mountain, plateau, floodplain, delta and rivers); Erosional, transportational and depositional processes of water, air, waves and glaciers

BLOCK 2: EARTH RESOURCES

Unit 3: Concept of Resources and Reserves: Land and Resources; Soil and Water resources; Environmental consequences of exploitation

Unit 4: The Mineral Resources: Rock-forming, ore-forming and soil-forming minerals; Geologic constraints in resource availability and use; Environmental consequences of resource exploitation

BLOCK 3: NATURAL HAZARDS

Unit 5: Floods and Landslides: Causes; Consequences; Control measures

Unit 6: Earthquakes and Seismic Hazards: Tsunami, volcanism- Causes; Consequences; Control measures

Unit 7: Cyclone, Coastal Erosion and Sea-Level Changes: Causes; Effects; Control measures

Unit 8: Hazard Zoning and Risk Management: The concept; Techniques; Constraints

BLOCK 3: ECOLOGICAL ADAPTATIONS

Unit 9: Environmental Factors and Eco-Physiological Responses: Light; Temperature; Gravitation and magnetic field; Water; Salt; Nutrients (nitrogen and phosphorous); Fire and Grazing

BLOCK 4: BASICS OF ECOTOXICOLOGY

Unit10: Ecotoxicology: Origin and history; Branches and interdisciplinary significance in modern living
Unit 11: The Ecotoxicants:Classification and types; Nature; Significance

BLOCK 5: ECOTOXICANTS: FATE AND MONITORING

Unit 12: Toxiceffects: Dose– response relationship; Teratogens; Carcinogens; Mutagens; Estrogens
Unit13: Toxicants and Earth Environment:Interchange of toxicants in atmosphere, geosphere, hydrosphere and biosphere; Bioaccumulation, biomagnification and bioconcentration of toxicants
Unit14: Distribution and Fate of Ecotoxicants: The concept; Transport and biochemical transformation
Unit15: Ecophysiological Monitoring: The concept; Approaches; Ecological risk assessment

SUGGESTED READINGS

Allelopathy- E.L. Rice, Academic Press, New York.
Ecology, Environment and Resource Conservation- J.S. Singh, S.P. Singh and S.R. Gupta, Anamaya Publications, New Delhi.

ENSE 655 CLEAN TECHNOLOGIES (Credits 04)

OBJECTIVE

To impart knowledge of technologies that avoid waste generation, re-building clean environment and utilize the environment-decay promoting substances

SYLLABUS

Environment and Technology:	The problem; Remedial technologies; Contaminated site management; Attenuation
Clean Technologies:	Waste water treatment; Sludge management; Solid wastes management; Waste gases treatment
Ecological Sanitation:	Treatment of human excreta and grey water

UNIT SCHEDULE

BLOCK 1: ENVIRONMENT AND TECHNOLOGY

Unit 1: Technology for Development:The environmental problems; Effects of technology on environment; Technology transfer, trade and development
Unit 2: Clean Production and Sustainable Sanitation: Concept and approaches; Green chemistry; Sustainability issue

BLOCK 2: REMEDIATION TECHNOLOGIES

Unit 3: *In-situ* Remediation Technologies: Venting; Bio-venting; Air sparging; Bio-sparging; Bioremediation; Pump and treatment; Resistance heating; Soil washing; Surfactant enhancement; Stabilization and bio-stabilization
Unit 4: *Ex-situ* Remediation Techniques: Slurry phase system; Soil washing; Air stripping; Bioremediation of soil; Biofilteration; Incineration; Solidification; Stabilization
Unit 5: Contaminated Site Remediation: Monitoring of contaminated sites; Evaluation of results; Selection of most suitable technique (s), risk assessment, remediation methods.

BLOCK 3: WASTEWATER AND SLUDGE TREATMENT TECHNOLOGIES

Unit 6: Wastewater Treatment Technologies: Physico-chemical, chemical and biological processes; Treatment of water for (re)use as drinking water and aquaculture; Microbial fuel cell technology
Unit 7: Sludge Management: Sludge stabilization; Hygienization; Dewatering; Disposal and reuse

BLOCK 4: SOLID WASTES AND WASTE GASES TREATMENT

Unit 8: Solid Waste Management: The solid wastes- Municipal, agricultural and industrial; Waste processing technologies- Landfilling, agricultural processing, thermal treatment, physico-chemical processing

Unit 9: Hazardous waste management: Hazardous waste, characteristics, source, classification, collection and storage, segregation, treatment and disposal.

Unit 10: Waste Water Treatment: Reduction of carbon-di-oxide, oxides of nitrogen and sulphur emissions

Unit 11: Ecological Sanitation (ECOSAN): The concept and importance; Treatment of human excreta (urine and faeces) and grey water; Reuse of ECOSAN products; ECOSAN and urban water supply

SUGGESTED READINGS

Biofuels for Fuel Cells: Renewable Energy from Biomass Fermentation- P.Lens, P.Westermann, M. Haberbauer and A. Moreno (eds.), IWA Publishing, Swedon.

Clean Technology- A. Johansson, Lewis Publishers, Boca Ratan.

Design for Environment- T.E. Graedel and B.R. Allenby, Prentice-Hall, New Jersey.

Environmetnal Microbiology- E.L. Madsen, Blackwell Publishing, London.

Green Chemistry: Theory and Practice- P.T. Anastas and J.C. Warner, Oxford University Press, New York.

Introduction to Environmental Engineering- R.O. Mines and L.W. Lackey, Pearson College Division.

Introduction to Environmental Engineering Science-G.M. Masters and W.P. Ela, Pearson College Division.

Microbial Diversity and Biosprospecting – A.T. Bull, ASM Press, Washington, DC.

Microbial fuel cells: Novel Biotechnology for energy generation- K. Rabacy and W. Verstraete, *Trends in Biotechnology* 23 (6): 291-298

Physico-chemical Treatment of Water and Wastewater- *G.A. Sincero, IWA, Publishing, Swedon.*

Sludge into Biosolids- L. Spinosa and P.A. Vesilind, IWA Publishing, Swedon.

Sludge Reduction Technologies in Wastewater Treatment Plants- P. Folabori, G. Andreotola and G. Ziglio, IWA Publishing, Swedon.

ENSE 656 RS, GIS AND GPS: BASICS AND APPLICATIONS (Credits 04)

OBJECTIVE

To explain the concepts of remote sensing (RS), geographical information system (GIS) and geographical positioning system (GPS); data collection and interpretation; and application of these technologies in environmental management

SYLLABUS

Photogrammetry and Remote Sensing:	Meaning, scope and significance; Aerial photographs and RS technology; Data collection and interpretation; Application in environmental studies
GIS and GPS:	Fundamental concepts; Importance; Issues and trends; Database creation; Data editing and analysis; Applications in environmental studies

UNIT SCHEDULE

BLOCK 1: INTRODUCTION TO PHOTOGRAMMETRY

Unit 1: Photogrammetry-An Introduction: Meaning, scope and significance

Unit 2: Aerial photographs: Types; Scale; Properties; Aerial Photography

Unit 3: Remote Sensing: Fundamental concept; Electromagnetic radiation and atmospheric interactions; Energy interactions with earth surface materials

Unit 4: RS Platforms and Sensors I: Satellite orbits; Instrumentation and satellite system parameter; Sensor parameters; Resolution of remotely-sensed data

BLOCK 2: DATA ANALYSIS AND INTERPRETATION

Unit 5: Image interpretation: Elements; Processing techniques- visual and digital

Unit 6: Data Pre-processing: Operations; Corrections; Restoration; Enhancement

BLOCK 3: INTRODUCTION TO GIS AND GPS

Unit 7: Basics of GIS and GPS: Meaning; Components; Basic requirements; Scope

Unit 8: GIS database: Creation; Data editing and quality; GIS data analysis
Unit 9: Integration of RS, GIS and GPS Modelling

BLOCK 4: APPLICATIONS OF RS, GIS AND GPS IN ENVIRONMENTAL MANAGEMENT

Unit 10: Resource Mapping I: Land resources; Concept, Exercise
Unit 11: Resource Mapping II: Geo-science applications (Terrain and earth resources evaluation)
Unit 12: Resource Mapping III: Water resources
Unit 13: Biodiversity Measurement and Monitoring: Concept; Exercise
Unit 14: Forest Status: Area; Cover; State of degradation; Exercise
Unit 15: Watersheds Measurement; Concept; Exercise
Unit 16: Disaster Management; Concept; Exercise
Unit 17: Human Settlement Planning: Rural and urban; Concepts and exercise

ENSE 657 DISASTER MANAGEMENT (Credits 04)

OBJECTIVE

To explain disasters, demonstrate their effects and approaches to manage them for the well-being of humans and environment

SYLLABUS

Disasters:	Classification; Characteristics, old and new sources, risk assessment and vulnerability analysis, effects of disasters, mitigation and prevention measures
Disaster Management:	Concept, Policy and administrative structure, stakeholders in disaster management, planning for disaster management, disaster management plans
Disaster Preparedness:	Concept, disaster preparedness planning, writing action plan for disaster preparedness, disaster mitigation strategies, emerging technologies for disaster preparedness

UNIT SCHEDULE

BLOCK 1: INTRODUCTION TO DISASTERS

Unit 1: The Disasters: Concept; Classification; Characteristics; Causes; Nature and extent; Development vs disasters
Unit 2: The Effects of Disasters: Social; Economic; Environmental
Unit 3: Disaster Risks: Concept; Elements of risk; Risk assessment, analysis and techniques; Disasters and refugee problems
Unit 4: Vulnerability Analysis: Techniques; Strategies for vulnerability reduction and survival; Warning system

BLOCK 2: DISASTER MITIGATION / PREVENTION MEASURES

Unit 5: Natural Disasters: Cyclone and Typhoon; Lightening; Tornedo; Avalanches; Wildfire; Volcanic eruption; Drought and famine; Earthquakes; Tsunami; Landslide and landslip; Floods; Heat and cold waves
Unit 6: Human-induced Disasters: Environmental decay (Population explosion, Occupational hazards, Climate change, Global warming, Sea-level rise, Depletion of ozone layer, Acidification); Accidents (Chemical, nuclear, fire, communication-related, e.g., road, rail and air accidents); Violence; Stress and strain; Insurgency; War and internal (Communal) conflicts; Corruption; New World order (globalization), Life-style diseases

BLOCK 3: DISATER MANAGEMENT

Unit 7: Basics of Disaster Management: The concept; Policy and administrative set-up; Institutional initiatives; The Indian scenario
Unit 8: Disaster Management-Actors and their Roles: Government; Non-governmental organizations; Corporate; Media; Community; Armed forces; Volunteer; International Organisations and Donor agencies; Funding mechanism for disaster management

Unit 9: Disaster Management Planning: Pre-disaster planning- toning of disaster prone areas; Prioritization: Regulation and protection measures during disaster; Post-disaster planning-survey and assessment, relief camp organization; Safety measures; Legal aspect

Unit 10: Disaster-specific Management Plans: Earthquake; Landscape; Avalanches; Wildfire; Drought; Tsunami; Flood; Cyclone; Climate Change; Accidents; Violence; Life-style diseases

Unit 11: Disaster Management: The human factors; Community-based disaster management; Learning from traditional responses; Role of IT

Unit 12: Rehabilitation, Reconstruction and Recovery: Damage assessment; Information management structure; Development of physical and economic infrastructures; Job opportunities and livelihood options; Water management; Monitoring and evaluation; Education and training

BLOCK 4: DISASTER PREPAREDNESS

Unit 13: The Fundamental Aspects: Concept; Nature; Actors and their roles; Education and training needs

Unit 14: The Disaster Preparedness Plan: Basic considerations; Writing action plan for disaster preparedness; Disaster preparedness plan for vulnerable group (s), housing, infrastructure and livestock

Unit 15: Mitigation and Technologies: Disaster mitigation strategies; Emerging technologies for disaster preparedness

SUGGESTED READINGS

Encyclopedia of Disaster Management Vols. I-III- S.L. Goel, Deep and Deep Publications, P. Ltd., New Delhi.

Disaster Management Vols. I-IV- G.K. Ghosh, A.P.H. Publishing Corporation, New Delhi.

Disaster Planning-The Preservation of Life and Property- H.D. Foster, Springer Verlag, Germany.

Disaster Management-S.K. Singh, S.C. Kundu and S. Singh, Mittal Publications, New Delhi.

Disaster Management- I. Prakash, RastraPrahriPrakashan, Ghaziabad.

Indian Disaster Report:Towards a Policy Initiative- S. Parasuram and P.V. Unnikrishnan, Oxford University Press, New Delhi.

Natural Disaster Reduction- G.K. Mishra and G.C. Mathur, Reliance Pub. House, New Delhi.

ENSE 658 OCCUPATIONAL HEALTH HAZARDS (Credits 04)

OBJECTIVE

To impart knowledge on occupational health and hygiene and preventive and control measures to be taken at work place to promote efficiency of human resource

SYLLABUS

Occupational Health and Hygiene: Definition; Categories; Exposure pathways; Effects on humans; Occupational health and workers; Reduction strategies for workplace stresses

UNIT SCHEDULE

BLOCK 1: INTRODUCTION TO OCCUPATIONAL HEALTH

Unit 1: The Occupational Health: Introduction; Scope; Factors causing health hazards

Unit 2: The Occupational Environment: Definition; Criteria; Occupational exposure limits (Thresold limits of factors/ pollutants)

BLOCK 2: WORKPLACE ENVIRONMENTAL FACTORS AND HEALTH

Unit 3: The Categories of Health Hazards: Physical, chemical and biological

Unit 4: Physical Environmental Factors and Occupational Disorders: The physical factors- Temperature, humidity, ionization, UV-radiation and acidity of air; Disorder (s) caused , mechanism of disorder (s)and prevention and control of disorder (s) with reference to human skin, lung, throat, nose, eye and nervous system

Unit 5: Air-borne Bio-allergents: Definition; Types; Distribution; Factors governing their availability; Modes of dispersal; Disorders caused in humans; Diseases intensity; Prevention and control of disorders

Unit 6: Climate Change and Human Disorders: The climate change phenomenon; Disorders caused to humans in tropical, temperate and high- elevational regions; control of disorders

Unit 7: Chemical-induced Human Disorders: The chemicals as environmental factors; Disorder(s) caused; Mechanism of disorder(s); Prevention and control of disorder(s) (caused by mercury, lead, chromium, cadmium, nickel, arsenic and nitrates)

Unit 8: The Drug-induced Human Disorders: The drug as disorder factor; Drug reaction; Control of drug reaction

Unit 9: Water-induced Human Disorders: The disorders- causes, effects and mechanisms; Prevention and control of disorders

Unit 10: The Psychological Stresses: Workplace-specific psychological stresses, mechanism and control

BLOCK 3: INDUSTRY-SPECIFIC OCCUPATIONAL HEALTH DISORDERS

Unit 11: Occupational Health and Workers: Measures for health; Health education; Medical first-aid; Management of medical emergencies; Epidemiological approaches

Unit 12: Occupational Health Disorders in Practice I: Case study of industries, viz., Pulp and Paper; Textile; Distillery

Unit 13: Occupational Health Disorders in Practice II: Construction; Steel

Unit 14: Occupational Health Disorders in Practice III: Food processing; Dairying and Pharmaceuticals

SUGGESTED READINGS

Occupationa Safety and Health for Technologists: Engineers and Managers- D.L. Goetsch, Prantice-Hall India P.Ltd., New Delhi.

Environmental and Industrial Safety- A.H. Hommadi, I.B. Publishers, New Delhi.

Safety and Environmental Management- D.E. Della and P. Giustina, Van Nostrand Ronald International Thomson Publishing Inc., New Delhi.

Handbook of Environmental Strategies- R.V. Kolluru, McGraw Hill Inc., New Delhi.

EVSE 659 HAZRDOUS WASTES AND THEIR MANAGEMENT (Credits 04)

OBJECTIVE

To recognize hazardous wastes, their handling, transportation and management for enabling environment and sustainable industrial growth

SYLLABUS

Hazardous Wastes: Definition, types, sources, classification and composition; Sampling and handling of hazardous wastes; Effects on life and environment; Transportation and storage

Hazardous Wastes Management: Strategy; Hazardous Wastes Management and Handling Rules, 1989; Hazardous wastes management strategy and treatment practices

UNIT SCHEDULE

BLOCK 1: INTRODUCTION TO HAZARDOUS WASTES

Unit 1: The Hazardous Wastes: Definition; Types; Sources; Composition; Characteristics; Hazardous products co-mingled with municipal solid wastes

Unit 2: Hazardous Wastes Classification: ISIC System

Unit 3: Hazardous Wastes and Environment: Effects of hazardous wastes on physical (air, water and soil) and biological environment.

BLOCK 2: HAZARDOUS WASTES SAMPLING AND TRANSPORTATION

Unit 4: Hazardous Wastes Sampling:Introduction; Sampling- the safety concerns; Surface contamination sampling; Determination of the amount of hazardous wastes

Unit 5: Transportation of Hazardous Wastes: Requirements for handling and shipping of hazardous wastes samples; Packaging; Labeling; Other needs

BLOCK 3: STORAGE DISPOSAL AND HANDLING OF HAZARDOUS WASTES

Unit 6: Storage of Hazardous Wastes:Rules for storage; Storage practices and patterns

Unit 7: Disposal of Hazardous Wastes: Disposal methods; Disposal of household hazardous wastes; First aid procedures related to hazardous wastes

Unit 8: Handling of Hazardous Wastes: Handling Rule, 1989; Definitions; Applications

BLOCK 4: HAZARDOUS WASTES MANAGEMENT

Unit 9: Hazardous Wastes Management: Introduction; Basel Convention; Hazardous waste management plan-India

Unit10: Hazardous Wastes Management Strategy: The strategy; Components; Categories of hazardous wastes; Waste avoidance and minimization at source; Resuse; Recovery and recycling of hazardous wastes (including e-wastes); Safe disposal; Common treatment, storage and disposal facilities; Interstate transportation; Hazardous wastes incineration; Remediation of illegal dumping sites; Disposal of date-expired drugs and agro-chemicals; Handling and management of hazardous wastes during ship dismantling; Strengthening of infrastructure of regulatory bodies

Unit 11: Hazardous Wastes Treatment Practices I: Physical- Adsorption; Sedimentation; Electro-dialysis; Reverse osmosis; Solvent extraction; Distillation; Evaporation; Filteration; Floculation

Unit 12: Hazardous Wastes Treatment Practices II: Chemical-Oxidation and Reducation; Ozonolysis; Neutralization; Precipitation; Hydrolysis; Ion-exchange; Photolysis

Unit 13: Hazardous Wastes Treatment Practices III: Biological – Land treatment (Incineration, Landfill, Ocean dumping, Alternate technologies)

SUGGESTED READINGS

Hazardous Waste Mangement II - M.D. La Grega, McGraw Hill International, New York.

Hazardous Waste Mangement II - M.D. La Grega, P.L. Buckinghum and J.C. Evans (eds.), McGraw Hill International, New York.

Hazardous Wastes and Solid Wastes –D.H.F.Lill and B.G. Liptak, Lewis Publishers, New York.

Handbook on Hazardous Materials Management- Tom Carson, Institute of Hazardous Materials Management, New York, USA.

ENSE 660 ENVIRONMENTAL QUALITY MANAGEMENT: PRACTICES AND STANDARDS (Credits 04)

OBJECTIVE

To distinguish the role of politics and governance for environmental issues, and the significance summits of conventions, institutions and standards in environmental quality management

SYLLABUS

Environmental Politics and Governance:	Developing vs. developed world; Green politics and policies; Critiques of modern development; Eco-feminism; Environmental movements; Green clearance; Eco-marks and Eco-labelling; Green practices-Green belt, Eco-parks and bio-parks
Environmental Regulations:	Standards for air, drinking water, waste water, noise level, automobiles, hazardous waste, hospital waste and food quality

UNIT SCHEDULE

BLOCK 1: ENVIRONMENTAL POLITICS

Unit 1: Politicizing Environment: The concept; Developing vs. Developed world; Green politics and green policies

Unit 2: The Political Ecology of Modern Development: The concept; Critiques of modern development; Development alternatives in the contemporary world; Eco-feminism

Unit 3: Environmental Movements: Nature and ideologies; Cases from the Developed world and Developing countries

BLOCK 2: GOVERNANCE, INSTITUTIONS, GLOBAL SUMMITS AND CONVENTIONS ON ENVIRONMENT

Unit 4: Environmental Governance:The concept; The good governance-Global, national and local level; State control and central governance in India; Decentralization and nature of local participation in governance

Unit 5: Environmental Governance Institutions-I: India: Ministry of Environment, Forests and Climate Change; Regional Centres; Environmental Laboratories, CPCB; Centre-State interface

Unit 6: Environmental Governance Institutions-II: Global: The United Nations Organizations (UN), UNEP, FAO, WMO, WHO, IWC, WCU (IUCN), WWF, IPCC, UNFCCC, World Heritage Committee, CIFOR, UNESCO, Biodiversity International

Unit 7: Global Summits and Conventions: The Antarctica Treaty; UNCHE, WCS, , UNCED, Rio++, WCED, MAB, IGBP, DIVERSITAS, NAFA, SCOPE, MARPOL 73/78, Ramsar Convention, CMS, CITES

BLOCK 3: ENVIRONMENTAL CLEARANCE AND ECO-LABELLING

Unit 8: Environmental Clearance: The concept; Advantages; Case studies for establishing industry, thermal power plant, brick kiln and mining for sand and coal

Unit 9: Eco-marks and Eco-labelling:The concept; Scope and applications; Examples from selected developed and developing economies

Unit10: Green Claims: Green belt practice; Eco-parks and bio-parks; Bio-air conditioning and bio-purifiers; Pollution tolerance index of selected plant species; Case studies

BLOCK 4: REGULATING ENVIRONMENTAL QUALITY

Unit 11: Environmental Regulations: Introduction; Evolution; Significance; Limitations of practice

Unit 12: Standards for quality environments I: Air; Noise level; Drinking water; Waste water quality; Soil

Unit 13: Standards for Quality Environment II: Discharge of industrial effluents- Pulp and paper, Textile; Dairy, Thermal, Distillery, Tannery, and Chemical industry

Unit 14: Standards for quality environment III: Hazardous wastes; Hospital wastes; Food quality, Automobiles

SUGGESTED READINGS

Chronology of Twentieth Century History: Ecology and Environment, Vols.1 & 2- F.N. Magill (ed.), Fitzroy Dearborn Publishers, London.

Encyclopedia of Global Change, Vols 1 & 2- A.S. Goulie and D.J. Cuff (eds.), Oxford University Press, Oxford.

Environmental Movements in Asia- G. Person and A. Kalland, Curzon Press, London.

Global Environmental Politics:India and the North South Politics of Global Environmental Issues- R. Mukund, Oxford University Press, New Delhi.

Green Politics, Poles Apart, Global Warming in a Unequal World (Global Environmental Governance Series)- Centre for Science and Environment, New Delhi.

Global Warming and Global Politics- M. Patterson, Routledge, London.

Liberation Ecologies: Environment, Development and Social Movements- R. Peets and M. Watts, Routledge, London.

Pastoral Politics:Shephards, Bureaucrats and Conservation in Western Himalayas- V. Sabarwal, Oxford University Press, New York.

EVSE 661 WASTE TREATMENT DESIGNS AND WASTE UTILIZATION (Credits 04)

OBJECTIVE

To update learners about the concept, categories and characteristics of wastes, waste treatment and techniques for managing waste problem and utilization of wastes for human welfare

SYLLABUS

Waste:	Definition, classification and sources; Properties and physico-chemical composition; Degradation of wastes
Agro-wastes:	Nature and composition; Treatment and utilization technologies
Biodegradation and Bioremediation:	Concept, techniques and utilization
Waste treatment and recycling:	Concept; Primary, secondary and tertiary methods, treatment of waste water, solid wastes, sludge and slurries

UNIT SCHEDULE

BLOCK 1: WASTES: AN INTRODUCTION

Unit 1: Wastes: Definition; Classification; Sources; Composition and properties
Unit 2: Natural Compounds in Wastes: Lignocelluloses; Chitin; Pectin; Sugars, etc.

BLOCK 2: BIODEGRADATION AND BIOREMEDIATION

Unit 3: Biodegradation of Wastes: Concept and its potentiality; Degradation of cellulose, hemi-cellulose and lignin; Environmental influences
Unit 4: Agro-wastes Degradation and Utilization I: Silage production from agro-wastes- basic principles and role of sacoharolytic and proteolytic organisms; Enzymology of silage production
Unit 5: Agro-wastes Degradation and Utilization II: Composting and vermicomposting; Use of agro-wastes in mushroom cultivation; Emerging technologies; Cost consideration and advantages
Unit 6: Genetic Engineering in Biodegradation: Concept and practices; Cell immobilization; Product recovery
Unit 7: Bioremediation: Concept and Application; The concept; Utilization and biodegradation of hydrocarbons, chlorinated-nitrogen- containing compounds, polyaromatics (petroleum products and plastics); Concept of bioplastic

BLOCK 3: WASTE TREATMENT AND RECYCLING

Unit 8: Waste Treatment and Recycling: The concept; Objectives; Need of waste treatment and recycling
Unit 9: Physical Methods: Primary methods of effluent treatment, such as, screening, grit (removal), sedimentation and floatation
Unit10: Secondary Methods: Biological methods of effluent treatment- Basic concepts, aerobic and anaerobic treatment and energetic; Designs and principles in biological treatment
Unit 11: Advanced Biological Effluent Treatment: Basic concepts; Design and operation parameters for conventional, activated sludge process and trickling fillers; Advantages and disadvantages of various biological treatment methods
Unit 12: Anaerobic Wastewater Treatment:Basic Concepts; Process and kinetics; Advantages; Conventional and aerobic processes, such as, septic tanks, stirred tank reaction and floe-based digesters, viz., anaerobic filters
Unit 13: Tertiary Wastewater Treatment: Concept and process; Design criteria for removal of N, P, K from waste water
Unit14: Treatment of Solid Waste, Sludge, Slurries and Landfill Process: Concept; Approaches; Usefulness; Limitations

SUGGESTED READINGS

Environmental Engineering- P.A. Veailinol, J.J. Pierce and R.F. Weiner, Butterworth- Heinemann Publishing Co., London.
Environmental Engineering- A.H. Sincero and G.A. Sincero, Prentice-Hall of India (P.) Ltd., New Delhi.
Waste Water Treatment – M.R. Reo and A.K. Dutts, Oxford and IBH Publishing Co. (P.) Ltd., New Delhi.
Biological Waste Treatment- N.W. Eckenfelder and D.J.O. Corner, Pergamon Press, London.
Handbook of Organic Waste Conservation- N.R.N. Pewick, VenLosterandReinhol, Publising Co., London.
Biotechnological Methods of Pollution Control- S.A. Abbasi and E .Ramasemi, University Press, India, New Delhi.

ENSE 662 URBAN ECOSYSTEMS AND ENVIRONMENT (Credits 04)

OBJECTIVE

To recognize the dynamics of range of urban ecosystems and their importance as the loci of environmental conflict and governance for building sustainable urban societies

SYLLABUS

The Urban Clusters: Urbanisation and town planning; Consumerism and nature in urban clusters; Occupational environment; The urban decay; Sustainability and urban future

UNIT SCHEDULE

BLOCK 1: THE URBAN CLUSTERS AND URBANIZATION

Unit 1: The Urban Clusters: Metros, cities and towns; Importance in modernity; Regional context- drawing up resources and transferring wastes

Unit 2: The Urbanization: Concept; Process; Progress

Unit 3: Urban Planning: Historical and contemporary development; Urbanization policy and town planning acts- their environmental aspects; **Case studies**: Across a range of Indian cities, towns and metros

Unit 4: The Urban Human Settlements: Housing scenario across large-medium- and small-cities; The slums-environmental issues in urban context

BLOCK 2: RESOURCES AND URBAN CLUSTERS

Unit 5: Nature in Urban Clusters: Parks; Gardens; Public places

Unit 6: Resources Utilization: Consumption and consumerism in urban clusters (materials, symbolic and aesthetic)

Unit 7: Energy Use in Urban Context: Energy resources; Generation; Transportation; Usage and alternatives; Environmental impacts

Unit 8: Occupational Environment: Environmental aspects of informal and formal work spaces; Historical and contemporary developments across various urban sites; Spatial dimensions of waste circulation

BLOCK 3: URBAN DECAY AND SUSTAINABLE URBAN SOCIETIES

Unit 9: The Urban Collapse: Population; Pollution; Solid wastes; Community mobilization; Technology and social crimes

Unit 10: Sustainability of Urban Clusters: The governance issue; Role of agency (State), municipality, corporate and producer-consumers

Unit 11: Ecological Urban Societies: Eco-cycle orientation; Non-wasteful understanding

Unit 12: Environment – friendly Urban Amenities: Case studies – Green products; Green markets

Unit 13: Eco-cycle Urbans: The case of Developed and Developing Countries; Globalization and urban sectors

SUGGESTED READINGS

Industry vs Environment: Temples or Tombs, Three Controversies-D'Monte Darryl, CSE, New Delhi.

Slumming India – Gita Dewan Verma, Penguin Books, New Delhi.

The Making of Colonial Lucknow –T. Veena, Princeton University, Press, Princeton, Oldenburg.

ENS 663 GENDER RESOURCES AND ENVIRONMENT (Credits 04)

OBJECTIVE

To recognize gender difference in human relationships with resources and environment, and different impacts of environmental change on men and women

SYLLABUS

Gender Hierarchies: Historical construction of gender; Evolution of gender hierarchies and inequalities; Traditional knowledge and gender

Gender and Environment: Conceptual and theoretical perspectives; Role and responsibilities for resources and environment; Consequences of resources and environmental degradation; Feminization of resources and environment; Women' groups, institutions and movements

Global Change and Gender-specific Opportunities: Resource management; Energy utilization; Rehabilitation of degraded ecosystems; Enterprises

UNIT SCHEDULE

BLOCK 1: GENDER HIERARCHIES

Unit 1: **The Gender:** Introduction; Historical construction; Gender-specific division of labour; Cultural, social and economic perspectives; Is women really marginalized?

Unit 2: **Gender Differences:** Evolution of gender hierarchies in materialistic perspective; Gender in inequalities; Gender and knowledge vacuum

BLOCK 2: KNOWEDGLE AND GENDER

Unit 3: **Gender-specific Knowledge Systems and Communication Systems:** Gender-specific traditional knowledge and technologies – Knowledge of specific crops and flora, Knowledge arising from specific tasks

Unit 4: **Women Education:** Feminizing education- the concept; Initiatives and progress; National perspective plan for women

BLOCK 3: GENDER, RESOURCES AND ENVIRONMENT

Unit 5: **Gender Role and Responsibilities:** Ecosystem management; Environmental conservation; Energy resource management; Agriculture and rural development

Unit 6: **Feminization of Resources and Environment:** Conceptual and theoretical perspectives of ecofeminism and feminist environmentalism; Women' rights to environmental assets; Gender and environment- critical issues and options

Unit 7: **Resources and Environment Degradation:** Consequences on women- economic, social and cultural dimensions

Unit 8: **Promoting Women for Sustainability:** Adaptation to climate change; Women and emerging scientific technologies for improving economic efficiency and removing drudgery; Promoting women' role in sustainable development

Unit 9: **Women-driven Resources and Environment Conservation:** Women' groups (SHG, MMD); Women' institutions (GASAT, TWAWS), Women' movements (Chipko); Women role models (MeghaPatkar, Gaura Devi, Vandana Shiva, Ila Bhat)

BLOCK 4: GLOBAL CHANGE AND GENDER-SPECIFIC OPPURTUNITIES

Unit 10: **Resource Management**: Case studies related to women-centric common property resource management; Mountain development; Rehabilitation of degraded lands; Water resource management

Unit 11: **Women-centric Resource Utilization:** Energy Utilization: Tree management, Integrated pest management; Biodiversity conservation- case studies

Unit 12: **Women-centric Natural Resources Based-Enterprises:** Case studies on Apiculture, Sericulture, Mushroom cultivation, Medicinal and aromatic plants cultivation

Unit 13: **Women-centric Environment-oriented Enterprises:** Case studies on REDD, Solid waste management

SUGGESTED READINGS

The Gender and Environment Debate: Lessons from India- Feminist Studies- Bina Agarwal, The World Bank, Washington, D.C.

Gender, Environment and Poverty Interlinks:Regional Variations and Temporal Shifts in Rural India- Bina Agarwal- The World bank, Washington, DC.

Livelihood and Gender- S. Krishna, Sage Publications, New Delhi.

Staying Alive-Vandana Shiva, Zed Books, UK,

Feminist Political Ecology:Global Issues and Local Experiences- D. Rochelequ et al., Routledge, New York.

Women, Environment and Sustainable Development: Towards a Theoretical Synthesis- R. Braidotti et al., Zed Books, UK.

Cold Hearths and Barren Slopes: The Fuelwood Crisis in the Third World- Bina Agarwal, Zed Books, UK.

ENSE 664 SOCIAL ENVIRONMENT AND HUMAN ECOLOGY (Credits 04)

OBJECTIVE

To build a sustentative background of the learners on the fundamentals of human history in relation to nature and environment, human and social evolution, social systems and control, human social systems- nature ecosystem interactions, and human ecology as the basis of sustainable development

SYLLABUS

Bio-history: Biological evolution and patterns in nature; Human and social evolution; Cybernatics and society; Globalization and human society

Human Ecology: Environment and society; Ecosystems and social systems; Perceptions of nature; Human ecosystems as systems; Humans- ecosystems interactions; Sustainability

UNIT SCHEDULE

BLOCK 1: BIO-HISTORY

Unit 1: Human Society:Biological evolution and patterns in nature; Human and Social Evolution
Unit 2: Biosphere Interplay:Biosphere and human society

BLOCK 2: HUMAN SOCIAL SYSTEMS: ANALYSIS AND CYBERNATICS

Unit 3: Human: The decision maker; Biological impacts of human population
Unit 4: Analysis of Human Social Systems: Classification and theory; Dynamics and control
Unit 5: **Globalization and Human Society:** Concept of globalization; Role of Technology; Technology, family and quality of life

BLOCK 3: HUMAN ECOLOGY

Unit 6: **Introduction to Human Ecology:** Environment and human society; Energy and money in human-use-system
Unit 7: Human Ecosystems: Ecosystem and Social Systems: Perceptions of nature
Unit 8: Biological Systems: Exogenous and endogenous; Organization of animals by biological rhymes
Unit 9: Human population: The positive and negative feedback; Growth and regulation; carrying capacity; Sustainability and human society
Unit 10: Human-ecosystem Interactions I: Unsustainable interactions
Unit 11: Human-ecosystem Interactions II: Sustainable interactions
Unit 12: Human Values: The concept; Role in sustainable society

SUGGESTED READINGS

Biohistory: The Interplay Between Human Society and Biosphere- S. Boyden, The UNESCO, Paris and The Parthennon Publishing Group, Carnforth, UK.
Human Ecology- G.G. Marten, Earthscan, London.
Human Ecosystems – W.B. Clapham, Jr. McMillan Publishing Co.Inc., New York and Coller McMillan Publishers, London.
Cybernatics and Society – A.F.G. Hanken, Abacus Press, Kent.
Human Values and Professional Ethics – R.R. Gaur, R. Sangel and G.P. Bagaria, Excel Books, New Delhi.
Human Values – A.N. Tripathi, New Age International (P.) Ltd. Publishers, New Delhi.

ENSE 665 ENVIRONMENTAL HISTORY AND RESOURCE UTILIZATION (Credits 04)

OBJECTIVE

To examine use and abuse of natural resources and environment in a historical perspective for mass consciousness about the past roots of contemporary environmental dilemmas, conflicts and choices in favour of designing conservation with human face

SYLLABUS

BLOCK 4: SOCIAL IMPACT ASSESSMENT
UNIT: Rehabilitation and Resettlement
UNIT: Social impacts

Environmental History:	The Discipline; History and ecology; The European power and its consequences; Policy and legislations; Environmentalism in India
Natural Resources History:	Use and transformation of forests, grasslands and water resources; The contemporary environmental problems; The future

UNIT SCHEDULE

BLOCK 1: INTRODUCTION TO ENVIRONMENTAL HISTORY

Unit 1: History and Ecology: Introduction; Environmental history; The community and life; Community ecology and history; Ecological processes

Unit 2: The Primary Harmony: The Serengeti-kinship of humans and other forms of life

Unit 3: Environmental History- A discipline: Introduction; Development of ideology; Environmental history in developed and developing nations

Unit 4: The European Power: The rise; Consequences for people (Marginalisation), biodiversity and landscape; Threats of environmental decline; Destruction of ecology

Unit 5: State, Policy and Legislations: Role in degradation of natural resources and environmental degradation

Unit 6: Administrative Policy and Conflicting Claims: Case studies

1. Labour society in colonial Bengal
2. The Duars of West Bengal
3. Forest fire in Kumaun

Unit 7: The Environmentalism: Environmental movements- Deep Ecology, Social ecology, Earth first, Chipko, Apiko, Indigenous Rainforests Action Group, Tribal Movements,
Case study: Women and joint forest management in India

BLOCK 2: NATURAL RESOURCES AND ENVIRONMENT: THE HISTORIAL CHANGE

Unit 8: The Transformation of Biosphere: Population growth and explosive dispersion of Europeans; Exploitation of biosphere; Case study: The Western Ghats, India

Unit 9: Perceiving the Natural Forests: Early-to modern India- Pre-colonial, colonial and Post colonial independent India

Unit 10: Forest Governance- Historical Perspective: Empire forestry (Forest and colonial administration; Merchant capitalism and forests); Indian forestry (Production forestry in independent India)

Unit 11: Deforestation and Forest Degradation: Forest dwellers; Kingship states; Legislations and settlement patterns; Agrarian expansion

Unit 12: The Grasslands-Landscape under Conflict: Origin of grasslands; Flocks, Hero-stones and cult;Grassland management- Pre-colonial to modern India; Pastoralism in India- Historical perspective (the pastoralist - castes, ecological change, pastoral adaptation- long-range nomads, semi-nomads and settled herdsperson); Re-adaptation and crisis

Unit 13: History of Water Resources Utilization: The water resources; Use of water resources and fishery in colonial period and independent India

BLOCK 3: RETHINKING THE PAST AND REMAKING THE FUTURE

Unit 14: World Environmental Degradation: Accumulation; Urbanization; Diverse of nature and culture

Unit 15: The Modern Environmental Problems: Cases

1. Punjab: The green revolution
2. Bryansk: The aftermath of Chernobyl
3. Amazon: Threats of biodiversity
4. Global warming: An environmental history perspective

Unit 16: Re-thinking Conservation: Transforming indigenous beliefs and practices (Case study- Kurava grove of Kerala); Responsible consumerism (disregard practices like Use and through; Buy one and get one free, Packaging by non-decomposables, etc.); Forests and biodiversity beyond reserves; Redefining

forestry (Silvicultural practices, plantations, changing paradigm of regeneration and protection forests from fire, wildlife, and pests & diseases; Livelihood practices and dwellers' rights, wildlife to forest health)

Unit 17: The Global Future:Entrepreneuring the solutions promoting (i) Natural capitalism – (Renewable energy, Biosphere reserves, World heritage sites, Diverse (solid) waste utilization), and (ii) Pattern of change (Green food, green transport, green building and conservation- friendly water use)

SUGGESTED READINGS

Advances in Historial Ecology- B. William, Columbia University Press, New York.
Environment and History- B. William and P. Coates, Routledge, London.
Silent Spring- R. Carson, Houghton Miflin, Boston.
This Fissured Land: An Ecological History of India- M. Gadgil and R. Guha, Oxford University Press, New Delhi.
India's Wildlife History:An Introduction- M. Rangarajan, Permanent Black, New Delhi.
Environmental History:A Concise Introduction- I.G. Simmons, Blackwell Scientific Publications, Oxford.

ENSE 666 RESOURCE MANAGEMENT (Credits 04)

OBJECTIVE

To recognize and explain the concept of resource management and appreciate its significance for promoting sustainability of resources

SYLLABUS

Resource Management:	Concept; Evolution; Characteristics; Factors governing resource management; Approaches; Resource Conflicts; Community a resource management institution; International aids; Management of national and international resources; Endogenous management; Future perspective
Common Property Resources:	The concept of common property; Characteristics; Macroeconomic and environmental considerations; Common property resource use and diversification; Common property resource management

UNIT SCHEDULE

BLOCK 1: FIUNDAMENTAL VARIABLES IN RESOURCE MANAGEMENT

Unit 1: Ecological Variables and their Influences: Matter; Energy; Space; Time; Diversity; Environment; Natural resources (forests)

Unit 2: Socio-economic and Cultural Variables and their Influences: Introduction; Need of various energies; Grazing and browsing; Shifting cultivation; Forests and common land encroachments; Dependence of forest dwellers (tribals/ aboriginals); The timber demand

Unit 3: Poverty and its Implications: Poverty syndrome-Developing countries and India; Causes of Poverty; Relationship between poverty, economy and political instability; Indicators and effects of poverty; Remedial measures and responsibility centres against poverty; Poverty management in India

Unit 4: Control, Distribution and Utility of Resources: Legal aspects; Political forces; Economic factors

BLOCK 2: RESOURCES AND RESOURCE MANAGEMENT

Unit 5: Introduction to Resources and Resource Management: Resources-Definition from ecological, economic and social perspective; Resource management-concept, evolution as a discipline; Resource allocation, resource development and resource management

Unit 6: Resource Use:Resource conflicts; Resource extraction; Recreation and preservation; Farming and wildland (forestry) resources; The build environment; Access-centric to gender, social groups, space and economy

Unit 7: Approaches in Resource Management: Ecological approach; Economic approach; Technological; approach; Ethnological approach; Implications of approaches; The holistic (ecosystem) approach and integrated approach; Resource Management: Case studies

- Himalayan hill region
- Semi-arid and arid region
- Marine and coastal resources
- Urban resources in developing and developed countires

Unit 8: **Management of International Resources:** Climate; Biodiversity; Ozone; Ocean; International fisheries; Antarctica

Unit 9: **International Aids:** International development assistance; Bilateral development assistance; Multilateral development assistance; International assistance for environment and forestry- GEF TFAP, ITTA

Unit 10: **Community- A Resource Management Institution:** Why do people manage resources? Resource management and property rights; Building institutions for resource management

BLOCK 3: ENDOGENOUS RESOURCE MANAGEMENT

Unit 11: **Endogenous Knowledge and Technologies:** Definition; Genesis: Characteristics; Advantages and scope

Unit 12: **Traditional Resource Management Systems:** Introduction; Traditional ecosystem views; Restraints on resource use; Some rules of thumbs; Scientific prescriptions; Conclusion

Unit 13: **Indigenous Strategies and Technologies:** Case studies

- The highland paddy farmers of Arunachal Pradesh
- Farmers' tree cultivation strategies in Uttarakhand
- Soil management in hills of Nepal
- Soil and water conservation in semi-arid and arid regions

BLOCK 4: COMMON PROPERTY RESOURCES (CPR) AND MANAGEMENT

Unit14: **The Common Property Resources:** Introduction; Types; Characteristics; Role of CPRs; Complementaries between CPRs and PPRs; Factors governing CPRs-Social, cultural, economic, ecological and institutional; Tragedy of CPRs; CPRs' Use: Rights; Privileges; Concessions and *de facto* use

Unit 15: **Diversification of CPRs' Use:** Introduction; The Indian caste society; Prudent resource use; Takeover by state; Local resource (Forest) councils; Neo initiatives

Unit 16: **Common Property Resources Management:** Definition; Framework for analysis; Descision makers in CPRM; Technology choice; Management arrangements; Prioritizing CPRs- The necessity; institutional requisites, management approaches

Unit 17: **Contemporary CPR Management Systems:** Case studies- Himalayan hill region; Semi-arid and arid region; Forest region

Unit 18: **Conflict Analysis in Multiresource Management (examples:Natural forest):** The approach; Interest groups and resource uses; Implications for management

Unit 19: **Planning for Resource Management:** Approach; Decision- levels and appropriate information needs; Information Techniques and technologies; Data analysis; Project organization and management; Project risks; Resource management- Perspectives on the future

SUGGESTED READINGS

Indigenous Soil and Water Conservation in India's Semi-arid Tropics- J. Kerr and N.K. Sanghi, Gatekeeper Series No., 34, International Institute of Environment and Development, London.

Communities as Resource Mangement Institutions- M.W. Murphree, Gatekeeper Series No. 36, International Institute of Environment and Development, London.

Living in a Fragile Ecosystem: Indigenous Soil Mangement in the Hills of Nepal- D. Tamang, Gatekeeper Series No. 41, International Institute of Environment and Development, London.

Resource Management in Developing Countries- P.H. Omara-Ojungu, Longman Scientific and Technical Publs. U.K.

ENSE 667 ENVIRONMETNAL COMMUNICATION (Credits 04)

OBJECTIVE

To understand the concept, methods and practices of communication for environmental issues

SYLLABUS

Communication and Environment: The concept, types, process and theories; Role of mass media; Pragmatic aspect and context of environmental communication; Ethics in environmental reporting; Scenario of environmental communication; Production and advertising channels; Print, Broadcast, Telecast and Electronic media

Mode of Journalism: Feature, interview, review, Travelogue, and memoir; Photojournalism

UNIT SCHEDULE

BLOCK 1: FUNDAMENTALS OF COMMUNICATION

Unit 1: The Environmental Literacy: Need; Consumers' behaviour and environment
Unit 2: Basics of Environmental Communication: Public nature of environment; Role of communication in environmental science and studies
Unit 3: Environmental Communication: Types; Process; Theories
Unit 4: Mass Communication: Introduction; Role of mass media

BLOCK 2: ENVIRONMENTAL COMMUNICATION: PRAGMATIC ASPECT AND CONTEXT

Unit 5: Strategies for Communication: Use of analogies, Metaphor and Simile; Anecdotes and personalizing
Unit 6: Human Interest: Cultural and survival needs; Sources of information and ethics in reporting
Unit 7: Fundamentals of Media Laws
Unit 8: Editing, Printing and Production
Unit 9: Advertising and Property Rights
Unit 10: Environmental Communication Today: Global, National and Local Scenario

BLOCK 3: CHANNELS AND JOURNALISM

Unit 11: The Media I:Print media; Broadcast media; Telecast media; Little media; Group media; Electronic media and web journalism
Unit 12: Modes of Journalism:Feature, analysis, interview, review, travelogue and memoir, photojournalism

SUGGESTED READINGS

Nature in the Global South: *Environmental Projects in South and South-East Asia* - P.Greenough et al., Orient Longmann, New Delhi.
Environment, Information and Consumer Behaviour- S. Krarup and C.S. Russell (eds.), Edward Elgar, U.K.
Earth in Mind: On Education, Environment and Human Prospect- D.Orr, Island Press, Washington, DC.
People, Park and Wildlife: Towards Co-existance- V. Saberwal et al., Orient Longman, New Delhi.
Geology, Environment and Society- K.S. Valdiya, University Press, New Delhi.