Department of Environmental Sciences
SEMESTER -I

ENS-101 **FUNDAMENTALS OF ECOLOGY** **M.M. 70**

Unit -I   Introduction to ecology and environmental sciences: Definition, Objectives, subdivisions and scope. Basic ecological tools and techniques. Relation between ecology and environmental sciences. General concepts of level of organization, Biosphere, Autecology and Synecology.

Unit- II   Environment and abiotic components of ecosystem: Atmosphere, lithosphere and hydrosphere. Abiotic environmental factors (temperature, light, water etc.), Different environmental laws and limiting factors (Liebig's law of minimum, Shelford's law of Tolerance, Combined concept of limiting Factors).

Unit -III   Biotic components of ecosystem: Biotic community (General characteristics of a community, Interdependence in a community and community metabolism) and ecological niche (concept, definition and types of niche, Gause's Principle), ecological succession and community evolution. Population ecology: Population characteristics and regulation of population size. Inter and intra specific interaction (Positive and negative interaction). Ecological genetics, Quantitative analysis of plant community, Quadrates, Frequency, Density, Important value Index (IV l).

Unit -IV   Dynamics of Ecosystems: Bio-geochemical cycle. Food chain and energy flow in ecosystems. Concepts of productivity and standing crops, ecological indicators, Ecological efficiencies, edge effect.

Unit -V   Diversity of Ecosystems: Bio geography and different ecosystems of the world (Lake, Pond, marine, estuarine and terrestrial ecosystems)

ENS-102   NATURAL RESOURCE CONSERVATION AND MANAGEMENT   M.M 70

Unit -I   Natural resources: Concept and classification and natural resources, Management of water resources — Concept and classification (Globale water balance, Ice sheets and fluctuation of sea levels, Human use of surface and ground water, Ground water pollution). Integrated water resources management. Watershed management; National lake and river conservation programme.

Unit -II   Mineral resources and Environment: Resources and reserves. Resource cycle. Mineral and population, Ocean as new area for exploration of mineral resources. Ocean ore and recycling of resources. Mineral Resources of Antarctica: metallic and non metallic deposits.

Unit- III   Soil management: soil loss & soil erosion. Conservation and management strategies. Role of organic matter and its maintenance, diagnosis of nutrient deficiencies. Remedial measures and management techniques.

Unit- IV   Energy resources: solar radiation and its spectral characteristics, Fossil fuels classification, composition, physico-chemical characteristics and energy content of coal, petroleum and natural gas. Principles of generation of hydroelectric power, tidal, ocean thermal energy conversion, wind, geothermal energy, solar collectors, photovoltaic, solar ponds, nuclear energy- fusion and fission: magneto hydrodynamic power, bioenergy-energy from biomass and biogas, anaerobic digestion, energy use pattern in different parts of world.

Unit -V   Forest management: Forest- land use changes in India- future demands of forest lands. Captive plantation, community forest management, forest rehabilitation, urban forestry, Protected area management and conservation. Integrated development programme in forest area,

Department of Environmental Sciences
<u>SEMESTER -I</u>

ENS-103   **FOREST AND WILDLIFE ECOLOGY**   **M.M. 70**

Unit- I   Forest types, organization and productivity: Major types and composition of forests of India, structural organization of forest ecosystems, Primary production in different ecosystems and methods of measurement of primary production, Social forestry: Objectives, scope and necessity, agro forestry, Extension forestry, Eucalyptus dilemma, People's participation, Role of NGO's.

Unit- II   Silvicultural practices: Silvicultural principles, different silivicultural practices, impact of deforestation and shifting cultivation on forest ecosystems. Forest management: Objectives and principles, techniques, sustainable yield relation, biodiversity and Forest.

Unit- III   Values of wild life. Wildlife census methods (waterhole survey, point count and line transect methods, pug marks count method, King's census method), Components of wildlife habitat (Cover, Food, Water and Space), Common flora and fauna of India.

Unit- IV   Indian wildlife (Introduction, distribution of wildlife in ecological subdivision of India), IUCN Categories, National Parks, Wildlife Sanctuaries, Biosphere Reserves and Zoos in India, Gene pool. Habit, Habitat and breeding biology of few mammals (viz. Elephant, Tiger) and birds (viz. Weaver bird, Oriental Magpie Robin). Wildlife protection: wild life and range management, management of Forest Fire, Role of NGO's in wildlife and forest conservation, Agenda-21.

Unit- V   Reasons for wildlife depletion (Habitat destruction, Commercial wildlife exploitation, Overgrazing etc.), Eco-tourism management, Measurement for wildlife conservation (Ecological basis, Policies and programmes of wild life conservation and management), Special projects for endangered species (Project tiger, Gir lion Sanctuary Project, Sea turtle, Crocodile breeding project, Project Hangul), International trade of wildlife, Animal cruelty: causes and prevention.

UNIT -I   Evolution, Origin of life and Speciation, Human ecology and human settlement, Environmental Education and Awareness, Environmental Management: meaning and need.

UNIT -II   Convention on Conservation of Antarctic marine living resources (1980), Treaty on principles governing the activities of state in the exploration and use of outer space (1967). The citizens convention on biodiversity/biological (1992), International convention on the high seas, fishing and living resources (1958), Intervention of oil pollution casualties (1969).

UNIT -III Environment issues in India viz. Narmada dam, Tehri dam, Chipko movement, Beej Bachao Andolan, Green revolution, Silent valley movement, Urja gram, CNG implementation in Delhi. Formation and reclamation of wastelands: User, Alkaline and Saline soil. Epidemiological issues: Goiter, Fluoriasis and Arsenic poisoning.

UNIT -IV   Environmental priorities in India, Sustainable development: concept, objectives and principles. Challenges for sustainable development: Social, Political and Economic considerations, Role of individual and community in Sustainable development. Urban and rural planning, power generation, fly ash: utilization of fly ash, disposal & Recycling Resettlement and rehabilitation process.

UNIT -V   Wetlands conservation, Water crisis and rainwater harvesting, Water conservation, Coastal management: Concept scope uses and strategies. Desertification and its control. Coral reef conservation.

PRACTICAL-I
Semester- I

ENS-105: LAB COURSE - 1
Time: 6-8 HOURS   **M.M. 70**

A.   To determine the following parameters of grassland vegetation   15

   1. Minimum size and number of quadrate

   2. Frequency of plant species and its comparison with Raunkiaer's standard diagram.

   3. Density of plant species

   4. Important Value Index (IVI)

   5. Index of dominance and Diversity

B.   1. To determine the following productivity by chlorophyll content method.   15

   2. To determine the primary productivity by light and dark bottle method.

   3. To study the morphological and anatomical adaptation of the given hydrophytes.

   4. To study the morphological and anatomical adaptation of the given xenophile.

   5. To study the morphological and anatomical adaptation of the given mesophyte.

C.   1. To analyse the given soil sample for the presence of heavy metals by rapid field test. 10

   2. To analyse the given water sample for the presence of heavy metals by rapid field test.

D.   Comments   10

   1. Ecological Pyramid   2. Biosphere reserves   3. Biome

   4. Ecological Models   5. Principle of Gause   6. Ecological Efficiency

   7. Edge Effect   8. Standing Crops   9. Commensalisms

   10. Inter & Intra Specific Interactions.

E.   Viva Voce   10

F.   Practical record/Chart/Model   10

ENS-106: LAB COURSE -II
TIME: 6-8 HOURS   **M.M. 70**

A.   To analyse the following water quality parameters of given water sample.   15

    1. Dissolved oxygen (D.O.)

    2. Biological oxygen demand (B.O.D.)

    3. Chemical oxygen demand (C.O.D.)

    4. Hardness

    5. Total Dissolved solid (T.D.S.)

B.   To analyse soil for the following parameters.   15

    1.   Soil texture, temperature, pH analysis.

    2.   Organic matter analysis.

    3.   Water holding capacity.

    4.   Bulk density.

C.   1. To analyse the composition of solid waste.   10

    2. To analyse moisture content of given solid waste.

    3. To determine compostable organic matter in given solid waste.

D.   Comments   10

    1. Important value index   2. Productivity   3. Food Chain

    4. Autecology and Synecology   5. Liebig's law of minimum

    6. Shelford's law of tolerance   7. Law of Thermodynamics

    8. Ecological niche   9. Material Balance

    10. Energy flow

E.   Viva Voce   10

F.   Practical record/Chart/Model   10

Unit- I   Fundamentals of Environmental Chemistry: Stiochiometry, Gibb's energy, chemical potential, chemical equilibria, acid base reactions, solubility product, solubility of gases in water. Radioactive and Thermal pollution.

Unit- II   Air chemical speciation. Particles, ions and radicals in the atmosphere. Natural and anthropogenic sources of pollution. Primary and Secondary pollutants. Transport and diffusion of pollutants. Gas laws governing the behaviour of pollutants in the atmosphere. Oxygen and ozone chemistry. Chemistry of air pollutants, Photochemical smog. Methods of monitoring and control of air pollution SO_2, NOx, CO, SPM. Effects of pollutants on human beings, plants, animals, materials and on climate. Acid rain, Green house effect, Air quality standards.

Unit -III   Water: Chemistry of water, Types, sources and consequences of water pollution, Physicochemical and bacteriological sampling and analysis of water quality. Sewage and waste water treatment and recycling. Water quality standards. Concept of DO, BOD, COD, sedimentation, coagulation, filtration, Redox potential. Marine: Sources of marine pollution and control. Criteria employed for disposal of pollutants in marine system-coastal management.

Unit- IV   Soil: Soil Chemistry: Inorganic and organic components of soil. Nitrogen pathways and NPK in soils. Physico-chemical and bacteriological sampling and analysis of soil quality. Soil pollution and control. Noise: Sources of Noise pollution, measurement of noise and indices, effect of meteorological parameters on noise propagation. Noise exposure levels and standards. Noise control and abatement measures. Impact of Noise on human health. Sources and generation of solid wastes, their characterization, chemical composition and classification. Different methods of disposal and management of solid wastes (Hospital waste and Hazardous waste), Recycling of waste material, waste minimization technologies.

Unit- V   Bio-chemical toxicology: Nature of toxicity (Acute and chronic) Dose and time response relationship. Teratogenecity, carcinogenicity and Mutagenecity. Toxic Chemicals in the environment. Biotransformation of Xenobiotics: Uptake, Distribution, Metabolism, Accumulation and excretion of xenobiotics

Department of Environmental Sciences
Semester- II
ENS-202   **ENVIRONMENTAL METEOROLOGY AND REMOTE SENSING**   **M.M 70**

Unit I   Earths as a planet- Motion of the earth, earth's thermal environment and seasons, climate in India, Indian Mansoon and western disturbances, solar constant, Albedo. General Circulation.

Unit II   Dry adiabatic and saturated adiabatic lapse rates. Stability of the atmosphere, Inversions. Local winds. Clouds- Their formation and classification. Artificial modification of Clouds.

Unit III   Climatology - Climatic control. Elements and factors of climate and their interaction. Oceanic and Continental influence, Influence on environment. Climatic Change.

Unit IV   Basic Concepts of Remote Sensing, Physics of Remote Sensing; electromagnetic spectrum, terminologies, Principles of Radiation: radiation Transfer, interaction of EMR with earth surface and atmosphere, Spectral reflectance of vegetation, soil and water. Interpretation principles and techniques.

Unit V   Thermal and microwave sensing: basic concepts, Profiles: SAR, SLAR- operation, Characteristics of RADAR signals, earth surface characteristics influencing RADAR returns. Interpretation of microwave Data. Application of remote sensing, G.P.S. and G.I.S.

Semester- II

ENS-203   **ENVIRONMENTAL MANAGEMENT AND IMPACT ASSESSMENT   M.M 70**

Unit I   Environmental Management, Concept of Environmental management, Aspects & approaches to Environmental Management, Ecological Basis of Environmental Management, Agro-climatic Regional Planning, Risk Assessment : Basic components of a hazard control system, Techniques of risk assessment, Emergency control & disaster planning

Unit II   Environmental Impact Assessment: Introduction, concept and aims, impact statement, methods and processes, mitigation measures. Prediction and assessment of impacts on air, water and noise. EIA Guidelines 1994, notification of Govt. of India.

Unit Ill   Public participation in Environmental decision making. Environmental Economics, Economics of pollution control, Cost Benefit Analysis. Economics and Environment Economic growth, Gross National product and the quality of life: Sustainable-earth economy, Discount factor Environmental Ethics: Ethics and moral, Throw-away society ethics, Sustainable-Earth Society ethics, Ethical guidelines.

Unit IV   Prediction and assessment of impacts on the biological, cultural and socioeconomic environments, Introduction and basic concepts.. Environmental Impact Assessment of major developmental projects — industries, mining, thermal power plants, atomic power stations, transport (rail, road highway), tourism (including hotels, beach, resorts), River valley Project.

Unit V   Environmental Audit- introduction, concepts, steps, methodology. EIA of different xenobiotics (chemical, fertilizer, heavy metals)

Unit I Basic elements and tools of statistical analysis: Probability, Sampling, Measurement and distribution of attributes; Distribution — Normal, Poisson and Binomial; Arithmetic, Geometric and Harmonic Means; moments; tests of hypothesis and significance, t and χ^2 tests.

Unit II Models of population growth and interactions- Lotka-Volterra model, Leslie's matrix model, point source stream pollution model, box model, Gaussian plume model,

Unit III Principal of analytical methods: Titrimetry, Gravimetry, Colourimetry, Spectrophotometry (atomic absorption spectrophotometry, X-ray fluorescence, X-ray diffraction, flame photometry, NMR and ESR spectroscopy) Chromatography, Gas chromatography, , GLC, HPLC, Electrophoresis, Gel filtration.

Unit IV Bio-sensors: Radioactive techniques and scintillation counter, Microscopy (Compound, Phase contrast, fluorescent, electron microscope), pH meter, refractometer, Nephalometer, biochips, Smoke meter. Samplers- types, methods of sample preservation.

Unit V Introduction and history of Computer, Computer Basics, Communication technology and Information superhighway. IT tools, MS Windows and MS Office (MS word, MS Power point and MS Excel). Application of Computer in Environmental Modeling and forecasting.

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Department of Environmental Sciences
PRACTICAL-II
Semester- II

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ENS-206: LAB COURSE VI
TIME: 6-8 HOURS   **M.M.70**

A.   Statistical analysis :   15
1. To calculate the student "t" by record data.
2. To calculate heterogeneity of given population (x^2 test)
3. To test of into specific association.
4. To test for independence.
5. To calculate the mean value of observe data.

B.   Hypothetical EIA of following :   15
1. Urbanization
2. Dam construction
3. Hydroelectric power generation
4. Tourism
5. Sugar mills

C.   To record the following parameters by weather monitoring station: 10
1. Atmospheric Pressure
2. Rainfall
3. Outdoor, indoor temperature
4. Wind speed and direction
5. Wind chill and temperature
6. Humidity & draw point

D.   Comments on the following: 10

1. Teratogenicity   2. Redox Potential   3. Physics of Remote Sensing

4. GIS   5. Environmental Ethics 6. IT Tools

7. Electrophoresis   8.Biochips   9. COD   10. Albedo

E.   Viva voce   10

F.   Practical record/Chart/Model: 10