

ANDHRA PRADESH
RECRUITMENT OF ASSISTANT PROFESSORS IN THE
UNIVERSITY SYLLABUS FOR THE SCREENING TEST

ENVIRONMENTAL SCIENCES

SUBJECT CODE - 20

Unit – I:

- Definition, principles and scope of Environmental Science.
- Earth, Man and Environment. Ecosystems, Pathways in Ecosystems.
- Physico-chemical and Biological factors in the Environment.
- Geographical classification and zones.
- Structure and composition of atmosphere, hydrosphere, lithosphere and biosphere. Mass and Energy transfer across the various interfaces, material balance. First and Second law of thermodynamics, heat transfer processes. Scale of Meteorology, pressure, temperature, precipitation, humidity, radiation and wind. Atmospheric stability, inversions and mixing heights, wind roses.
- Natural resources, conservation and sustainable development.
- Natural Disasters in India, Disaster management, mitigation plans.

Unit – II:

- A. **Fundamentals of Environmental Chemistry:** Stoichiometry, Gibb's energy, Chemical potential, Chemical equilibrium, acid base reactions, solubility product, solubility of gases in water, the carbonate system, unsaturated and saturated hydrocarbons, radionuclide's.
- B. **Chemical composition of Air:** Classification of elements, chemical speciation. Particles, ions and radicals in the atmosphere. Chemical processes for formation of inorganic and organic particulate matter. Thermo chemical and photochemical reactions in the atmosphere. Oxygen and ozone chemistry, Chemistry of air pollutants, Photochemical smog.
- C. **Water Chemistry:** Chemistry of water, concept of DO, BOD, COD, sedimentation, coagulation, filtration, Redox potential.
- D. **Soil Chemistry:** Inorganic and organic components of soil, Nitrogen pathways and NPK in soils.
- E. **Toxic Chemicals in the environment** – Air, Water: Pesticides in water.

Biochemical aspects of Arsenic, Cadmium, Lead, Mercury, Carbon Monoxide, Os and PAN Pesticides, Insecticides, MIC, carcinogens in the air.

- F. **Principles of Analytical Methods:** Titrimetry, Gravimetry, Calorimetry, Spectrophotometry, Chromatography, Gas Chromatography, Atomic Absorption Spectrophotometry, GLC, HPLC, Electrophoresis. X – Ray fluorescence, X – ray diffraction, Flame photometry.

Unit – III:

Definition, Principles and scope of ecology, Human ecology and Human settlement, Evolution, Origin of life and speciation.

- A. **Ecosystems:** Structure and functions, Abiotic and Biotic components, energy flows, Food chains, Food web, Ecological pyramids, types and diversity. Ecological Succession, Population, Community ecology and Parasitism, Prey – predator relationships.

B. **Common flora and fauna in India:**

- I. **Aquatic:** Phytoplankton, Zooplankton and Macro-phytes.
- II. **Terrestrial:** Forests

C. **Endangered and Threatened Species:**

- I. **Biodiversity and its conservation:** Definition, ‘Hotspot’s of Biodiversity, Strategies for Biodiversity conservation. National Parks and Sanctuaries. Gene pool. MAB Programmes. Biodiversity act. Biosafety and Bio piracy.
- II. **Micro flora of Atmosphere:** Air Sampling techniques. Identification of aeroallergens. Air – borne diseases and allergies.
- III. **Environmental Biotechnology:** Fermentation Technology, Vermiculture technology, Bio fertilizer technology. Bio-leaching.

D. **Environmental Movements:**

Bishnoi movement, Chipko movement, Appiko movement, Silent valley movement, Narmada Bachao Andolan etc.,

Unit – IV: Environmental Geosciences and Climate:

The earth systems and Biosphere: Conservation of matter in various geospheres – lithosphere,

hydrosphere, atmosphere and biosphere. Energy budget of the earth. Earth's thermal environment and seasons. Ecosystems flow of energy and matter. Coexistence in communities-food webs. Earths 'major ecosystems terrestrial and aquatic. General relationship between landscape, biomes and climate. Climates of India, Indian Monsoon, El Nino, Droughts. Tropical cyclones and Western Disturbances.

- A. **Earth's Processes and Geological Hazards:** Earths processes; concept of residence, time and rates of natural cycles. Catastrophic geological hazards. Study of floods, landslides, earthquakes, volcanism and avalanche. Prediction and perception of the hazards and adjustments to hazardous activities.
- B. **Mineral Resources and Environment:** Resources and Reserves, Minerals. And Population. Oceans as new areas for exploration of mineral resources. Ocean ore and recycling of resources. Environmental impact of exploitation, processing and smelting of minerals.
- C. **Water Resources and Environment:** Global Water Balance. Ice sheets and fluctuations of sea levels. Origin and composition of seawater. Hydrological cycle. Factors influencing the surface water. Types of water. Resources of oceans. Ocean pollution by toxic wastes. Human use of surface and ground waters. Groundwater pollution.
- D. **Land use Planning:** The land use plan. Soil surveys in relation to land use planning. Methods of site selection and evaluation.
- E. **Environmental Geochemistry:** Concept of major, trace and REE. Classification of trace elements, Mobility of trace elements, Geochemical cycles. Biogeochemical factors in environmental health. Human use, trace elements and health. Possible effects of imbalance of some trace elements. Diseases induced by human use of land.
- F. **Climatology:** Introduction of climatology, fundamental principles of climatology, the climate system, controls on climate, Global Climate classification, major climatic regions of the world based on latitude and distribution of vegetation, earth-sun relation, coastal effect on climate, orographic effect on climate, different climate zone, trends of climate and its variability, climate modification. Inter annual variability of climate and its effect on biosphere, different climate methods, Regional distribution and seasonal variation of cloud, precipitations and fog etc
- G. **Climate of India:** Weather, Climate, Physiographic and geological homogeneity of India, Geo-economic significance, Classification of climates, Criteria for

classification, Thornthwaites and Koppens classification, Climates of India, Indian monsoon, Jet streams general circulation, The seasons mechanism of monsoon, Forecast of monsoon various seasons, Distribution of rainfall, Drought prone areas, Flood prone areas, Climate change, Causes and consequences of global warming, Ozone hole , Sea level rise in climate, Climatic considerations in industrial locations, (El-Nino, droughts, tropical cyclones and western disturbances, IPCC, UNFCCC, Kyoto protocol)

Unit – V:

Sun as source of energy; 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, photovoltaics, solar ponds; nuclear energy – fission and fusion; magneto hydrodynamic power, bio-energy-energy from biomass and biogas, anaerobic digestion; energy use pattern in different parts of the world.

Environmental implication of energy use; CO₂ emissions, Impacts of global warming and Climate change; air and thermal pollution; radioactive waste and radioactivity from nuclear reactors; impacts of large- scale exploitation of Solar, Wind, Hydro and Ocean energy.

Unit – VI:

- **Air Pollution:** Natural and anthropogenic sources of pollution. Primary and Secondary pollutants. Transport and diffusion of pollutants, Effects of pollutants on human beings, plants, animals, materials and on climate. Acid Rains. Air Quality Standards. Air pollution monitoring and control techniques, sampling and monitoring of gaseous and particulate air pollutants, ambient and stack emission monitoring, major bioreactors for waste gas purification, bio filters, bio trickling filters, and bioscrubers, prevention of indoor air pollution. Air pollution control methods for industries- application of different air pollution control technique in cement industry. Thermal power plant, Mining industry, stone crushing, asbestos industries etc. Urban Air pollution control Techniques.
- **Soil Pollution:** Physico – chemical as bacteriological sampling as analysis of soil quality. Soil Pollution Control. Industrial waste effluents and heavy metals, their

interactions with soil components. Soil micro – organisms and their functions, degradation of different insecticides, fungicides and weedicides in soil. Different kinds of synthetic fertilizers (N, P & K) and their interactions with different components of soil.

- **Noise pollution:** 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.
- **Marine Pollution:** Sources of marine pollution and control. Criteria employed for disposal of pollutants in marine system- coastal management. Radioactive and Thermal Pollution. Role of Coastal zone management authority.

Unit – VII:

- Introduction to environmental impact analysis.
- Environmental impact Statement and Environmental Management Plan.
- EIA guidelines 1994, Notification of Government of India.
- Impact Assessment Methodologies.
- Generalized approach to impact analysis.
- Procedure for reviewing Environmental impact analysis and statement. Guidelines for Environmental audit.
- Introduction to Environmental planning.
- Base line information and predictions (land, water, atmosphere, energy, etc.).
- Restoration and rehabilitation technologies.
- Land use policy for India.
- Urban planning for India.
- Rural planning and land use pattern.
- Concept and strategies of sustainable development.
- Cost-Benefit analysis.
- Environmental priorities in India and sustainable development.

Unit – VIII:

A. Sources and generation of solid wastes, their characterization, chemical composition and classification. Different methods of disposal and management of

solid wastes (Hospital Wastes and Hazardous Wastes) Recycling of waste material.
Waste minimization technologies.

- B. Hazardous Wastes Management and Handling Rules, 1989, Resource Management, Disaster Management and Risk analysis.
- C. Environment protection-issues and problems, International and National efforts for Environment Protection, Provision of Constitution of India regarding Environment (Article 48A and 58A).
- D. Environmental Policy Resolution, Legislation, Public Policy Strategies in Pollution Control, Wildlife Protection Act, 1972 amended 1991, Forest Conservation Act, 1980, Indian Forests Act (Revised) 1982, Air (Prevention and Control of Pollution) Act, 1981 as amended by Amendment Act, 1987 and Rule 1982, Motor Vehicle Act, 1988, The Water (Prevention and Control of Pollution) Act, 1974 as amended up to 1988 and Rules 1975, The Environment (Protection) Act, 1986 and Rules 1986.
- E. Scheme of labeling of environmentally friendly products (Eco mark), Public Liability Insurance Act, 1991 and Rules 1991.

Unit – IX:

Basic elements and tools of statistical analysis; Probability, sampling, measurement and distribution

of attributes; Distribution-Normal, t and χ^2 Poisson and Binomial; Arithmetic, Geometric and Harmonic means; moments; matrices, simultaneous linear equations; tests of hypothesis and significance.

Introduction to environmental system analysis; Approaches to development of models; linear simple and multiple regression models, validation and forecasting. Models of population growth and interactions – Lotka – Volterra model, Leslie's matrix model, point source stream pollution model, box model, Gaussian plume model.

Unit – X:

- Environmental Education and Awareness. Environmental Ethics and Global imperatives.
- Global Environmental problems-ozone depletion, global warming and climatic change.

- Current Environmental issue in India.
- Context: Narmada Dam, Tehri Dam, Almetti Dam, Soil Erosion, Formation and reclamation of Usar, Alkaline and Saline Soil.
- Waste lands and their reclamation.
- Desertification and its control.
- Vehicular pollution and urban air quality.
- Depletion of Nature resources.
- Biodiversity conservation and Agenda – 21.
- Waste disposal, recycling and power generation, Fly ash utilization. Water Crises-
- Conservation of water. Environmental Hazards.
- Eutrophication and restoration of Indian lakes. Rain water harvesting. Wet lands conservation.
- Epidemiological issues (e.g., Goitre, Fluorosis, Arsenic).

Unit XI: RS GIS Application in Environment.

- A. **Aerial Photography and Photogrammetry:** Sensory organ eye and camera, Working principle of camera, Camera types, cameras used in aerial photography, Aerial photography- history of aerial photography, Platforms used in aerial photography, Methods of aerial photography, Types of Aerial photographs (vertical & oblique photographs), Geometry of aerial photographs, Scale of aerial photographs; Stereoscopic vision , Stereoscopes, stereoscopic photographs, Parallax bar, Photogrammetry – Photo interpretation, mapping of objects from aerial photographs.
- B. **Satellite Remote Sensing:** Polar and geostationary satellites, Meteorological satellites and non-meteorological remote sensing satellites, Landsat, Spot, IRS, ERS, JERS, Quick bird; Sensors-Pushbroom and Whiskbroom types, Data reception, Archiving and distribution of data, Radar and LIDAR as Active Remote Sensing Systems, Working of Radar, Satellite images, Radar Images.
- C. **Geographic Information System (GIS):** Definition, Scope of Geographic Information System, Capabilities and advances of GIS, Use of GIS in spatial and temporal analysis, Components of GIS system , GIS software's ; Digital Image processing- Image structure, Raster and Vector data types, Image enhancement and

rectification, Band combination, Geo referencing the data, Image classification, image interpretation. Geographical Positioning System, Applications of GPS.

- D. **Application of RS and GIS:** Application of RS& GIS - in Environmental Systems , soil erosion study, flood mapping and flood damage study, Agricultural study, Natural resources study such as Water, soil, wildlife, Grassland, minerals & Metals etc.; Use of RS &GIS in Environmental Audit. Use of RS&GIS in Environmental Management study- in soil Conservation and Management, in Water Shade Management, in forest conservation & management, in wildlife conservation and management, in Urban Planning. Use of RS and GIS in Disaster management

Unit-XII: - Water and Wastewater Treatment Technologies:

Water and wastewater treatment and analysis, various steps in water treatment, Screening and types of screening , sedimentation, types and design of sedimentation tank, filtration, ultra filtration, Nano filtration, disinfection, removal of iron and manganese, softening of water, taste and odour removal, removal of oil and grease, skimming Tank, function of skimming tank, disposal of skimming.

- A. **Industrial Wastewater Treatment:** Industrial wastewater treatment, general characters of industrial wastewater, theories of treatment, Concept of Effluent Treatment Plant (ETP), design of ETP, Concept of Common Effluent Treatment Plant, design and functioning of CETP plant for public owned treatment plant, Effluent treatment methods for pharmaceutical and Automobile industry, iron and steel industry. Dairy industry, pulp & paper industry, sugar industry, distillery industry, leather industry.
- B. **Advanced Waste water Treatment Techniques:** Advanced technologies for wastewater treatment - Ozonation, Fluoridation. Reverse Osmosis, Electro Dialysis, Desalination method and Ion Exchange Methods, Advanced Oxidation Process, Thermal Evaporation, adsorption method. Membrane technology.
- C. **Industrial Hazardous Waste Treatment and Disposal Methods**
Hazardous waste treatment, sources and characteristics, Hazardous waste treatment methods: Hazardous waste disposal methods,
- D. **Environmental Engineering and biotechnology:** introduction, scope and application, detoxification of phenols and biodegradation of pesticides, primary and secondary sludge phenol and cyanide removal. Bioremediation for removal of industrial pollutants.