Integral University, Lucknow

Syllabus for Ph.D. Entrance Test Program

Subject: Environmental Science

Unit –I

Definition, Principles and Scope of Environmental Science.

Earth, Man and Environment. Ecosystems, Pathways in Ecosystems.

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.

Natural resources, conservation and sustainable development.

Unit –II

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.

Water chemistry: Chemistry of water, Concept of DO, BOD,COD, Sedimentation, coagulation filtration, Redox potential.

Toxic chemical in the environment-Air, water: Pesticides in water, Biochemical aspects of Arsenic, Cadmium, Lead, Mercury, Carbon monoxide, O_3 and PAN pesticides. MIC, carcinogens in the air.

Unit-III

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

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.

Endangered and threatened species.

Biodiversity and its conservation: Definition, 'Hotspots' of biodiversity, strategies for biodiversity conservation. National Parks and Sanctuaries. Gene pool.

Micro flora of atmosphere: Air sampling techniques. Identification of aeroallergens. Air borne diseases and allergies.

Unit-IV

Flow of energy and matter in ecosystems, coexistence in communities- food webs, Earth's major ecosystems-terrestrial and aquatic. General relationship between landscape, biomes and climate. Climates of India, Indian mansoon, El Nino, Droughts. Tropical Cyclones and Western Disturbances.

Mineral Resources and Environment: Resources and Reserves Minerals and Population. Ocean for the new areas for exploration of mineral resources. Ocean ore and recycling of resources. Environment impact of exploitation, processing and smelting of minerals.

Water Resources and Environment: Global Water balance. Ice sheets and fluctuations of sea levels. Origin and composition of sea water. 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. Ground water pollution.

Environmental Geochemistry: Concept of major, trace and REE. Classification of trace elements, Mobility and 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.

Unit-V

Sun as a 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, photovoltaic, 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; CO_2 emissions, global warming; 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: 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. Methods of monitoring and control of air pollution.SO_2, NO_x, CO, SPM. Affects of pollutants on human beings, plants ,animals, materials and on climate. Acid rain. Air quality standards.

Water: Types, sources and consequences of water pollution. Physico-chemical and bacteriological sampling and analysis of water quality.

Standards , sewage and waste water treatment and recycling. water quality standards

Soil: Physico -chemical and bacteriological sampling as analysis of soil quality. soil pollution control. Industrial waste effluents and heavy metal, their interactions with soil components. Soil microorganisms and their functions ,degradation of different insecticides, fungicides and weedicides in soil. Different kind of synthetic fertilizers(N P and K) and their interaction with different components of soil.

Noise: sources of noise pollution , measurement of noise and Indices, effects of meteorological parameters on noise propagation. Noise exposure levels and standards. Noise control and abatement measures .Impact of noise on human health.

Marine : Sources of marine pollution and control. Criteria employed for disposal of pollutants in marine system- coastal management.

Radioactive and thermal pollution.

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.

Concept and strategies of sustainable development.

Cost benefit analysis.

Environmental priorities in India and sustainable development.

Unit –VIII

Different methods of disposal and management of solid wastes (Hospital Wastes and hazardous Wastes) Recycling of waste material. Waste minimization technologies.

Hazardous Waste management and handling Rules, 1989, Resource Management , Disaster Management and Risk analysis.

Environment Protection- issues and problems, International and national efforts for Environment protection, Provision of constitution of India regarding Environment (Article 48A and 58A).

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.

Unit –IX

Bioremediation Technology transfer and future challenges.

Bioremediation of hydrocarbons by genetically engineered bacterial strain

Bioremediation of industrial waste and role of microorganism.

Bioremediation of heavy metals

Bioremediation of xenobiotics by microbial degradation.

Gene manipulation of pesticides degradation by microorganisms.

Unit –X

Environmental education and awareness.

Environmental Ethics and global imperatives

Global Environmental problems- Ozone depletion, global warming and climatic change.

Current Environmental issues in India.

Context: Narmada dam , Tehri Dam, Almetti dam, Soil erosion formation and reclamation of usar, alkaline and saline soil.

Waste land and their reclamation.

Desertification and its control

Vehicular pollution and urban air quality.

Depletion of natural resources.

Biodiversity conservation and agenda -21

Waste disposal, recycling and power generation, flyash utilization.

Water crises- Conservation of water.

Environmental hazards.

Eutrophication and restoration of Indian Lakes.

Rain water harvesting.

Wetland conservation.

Epidemiological issues(e.g., Goitre, fluorosis, Arsenic)