

**SYLLABUS**  
**FOR**  
**Ph.D Entrance Examination**  
**(PET)**  
**IN**  
**ENV. Sc. & Disaster Management**



**University Department of EDM**  
**BINOD BIHARI MAHATO KOYALANCHAL UNIVERSITY**  
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## **SYLLABUS FOR PH.D ENTRANCE TEST IN ENVIRONMENTAL SCIENCE AND DISASTER MANAGEMENT**

### **PART-A**

**Part –A shall consist of 50% objective type compulsory question of 1 mark each based on research methodology. It shall be of generic nature, intended to assess the research aptitude of the candidate. It will primarily be designed to test reasoning ability, data interpretation and quantitative aptitude of the candidate.**

### **PART –B**

**Part-B shall also consist of 50 objective type compulsory question of 1 mark each based on the syllabus of the subject at Masters level as per the broad headings below:**

- 1. Fundamental of Environmental Sciences.**
- 2. Environmental chemistry.**
- 3. Environmental Biology.**
- 4. Environmental Geosciences.**
- 5. Energy and environment**
- 6. Environmental pollution and control.**
- 7. Solid and Hazardous Waste Management.**
- 8. Environmental Assessment, Management and legislation.**
- 9. Statistical Approaches and Modelling in Environmental Science.**
- 10. Disaster Management and Contemporary environmental Issues.**

#### **1. Fundamental of Environmental Sciences**

Definition, Principles and Scope of Environmental Science. Structure and composition of atmosphere, hydrosphere, lithosphere and biosphere. Laws of thermodynamics. Meteorological parameters - pressure, temperature, precipitation, humidity, mixing ratio, saturation mixing ratio, radiation and wind velocity, adiabatic lapse rate, environmental lapse rate. Wind roses. Interaction between Earth, Man and Environment. Biogeographic

provinces of the world and agro-climatic zones of India. Concept of sustainable development. Natural resources and their assessment. Remote Sensing and GIS: Principles. Environmental education and awareness. Environmental ethics.

## **2. Environmental chemistry**

Fundamentals of Environmental Chemistry: solubility of gases in water, the carbonate system, unsaturated and saturated hydrocarbons.

Composition of air. Particles, ions and radicals in the atmosphere. Chemical speciation. Chemical processes in the formation of inorganic and organic particulate matters, and photochemical reactions in the atmosphere, Oxygen and Ozone chemistry. Photochemical smog.

Water as a universal solvent. Concept of DO, BOD and COD. Sedimentation, coagulation, flocculation, filtration, pH and Redox potential (Eh).

Inorganic and organic components of soils. Biogeochemical cycles – nitrogen, carbon, phosphorus and sulphur. Toxic chemicals: Pesticides and their classification and effects. Biochemical aspects of heavy metals (Hg, Cd, Pb, Cr) and metalloids (As, Se). CO, O<sub>3</sub>, PAN, VOC and POP. Carcinogens in the air. Principles of analytical methods: Titrimetry, Gravimetry, Calorimetry, Chromatography (Paper Chromatography, TLC, GC and HPLC), Flame photometry, Spectrophotometer (UV-VIS, AAS).

## **3. Environmental Biology.**

Ecology as an inter-disciplinary science. Origin of life and speciation. Human Ecology and Settlement. Ecosystem Structure and functions: Structures - Biotic and Abiotic components. Functions - Energy flow in ecosystems, energy flow models, food chains and food webs.

Biogeochemical cycles, Ecological succession. Species diversity, Concept of ecotone, edge effects, ecological habitats and niche. Ecosystem stability and factors affecting stability. Ecosystem services.

Basis of Ecosystem classification. Types of Ecosystem: Desert (hot and cold), forest, rangeland, wetlands, lotic, lentic, estuarine (mangrove), Oceanic.

Biomes: Concept, classification and distribution. Characteristics of different biomes: Tundra, Taiga, Grassland, Deciduous forest biome, Highland Icy Alpine Biome, Chapparal, Savanna, Tropical Rain forest.

Population ecology: Characteristics of population, concept of carrying capacity, population growth and regulations. Population fluctuations, dispersion and metapopulation. Concept of 'r' and 'K' species. Keystone species.

Community ecology: Definition, community concept, types and interaction - predation, commensalism, and parasitism. Biological invasions.

Biodiversity and its conservation: Definition, types, importance of biodiversity and threats to biodiversity. Concept and basis of identification of 'Hotspots'; hotspots in India. Measures of biodiversity. Strategies for biodiversity conservation: in situ, ex situ and in vitro conservation. National parks, Sanctuaries, Protected areas and Sacred groves in India. Concepts of gene pool, biopiracy and bio-prospecting. Concept of restoration ecology. Extinct, Rare, Endangered and Threatened flora and fauna of India.

Environmental Biotechnology: Bioremediation – definition, types and role of plants and microbes for in situ and ex situ remediation. Bioindicators, Biofertilizers, Biofuels and Biosensors.

#### **4. Environmental Geosciences.**

Origin of earth. Primary geochemical differentiation and formation of core, mantle, crust, and hydrosphere.

Concept of minerals and rocks. Formation of igneous, sedimentary and metamorphic rocks.

Controls on formation of landforms - tectonic including plate tectonic and climatic.

Energy budget of the earth. Earth's thermal environment and seasons.

Coriolis force, pressure gradient force, frictional force, geo-strophic wind field, gradient wind. Indian monsoon, droughts, El Nino, La Nina.

Geophysical fields. Weathering including weathering reactions, erosion, transportation and deposition of sediments. Soil forming minerals and process of soil formation, Identification and characterization of clay minerals, Soil physical and chemical properties, soil types and climate control on soil formation

#### **5. Energy and environment**

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. Gross-calorific value and net-calorific value.

Principles of generation of hydro-power, tidal energy, ocean thermal energy conversion, wind power, geothermal energy, solar energy (solar collectors, photo-voltaic modules, solar ponds).

Nuclear energy - fission and fusion, Nuclear fuels, Nuclear reactor – principles and types.

Bioenergy: methods to produce energy from biomass.

Wind energy: harness process and principles.

#### **6. Environmental pollution and control.**

Air: Natural and anthropogenic sources of pollution. Primary and Secondary pollutants. Transport and diffusion of pollutants. Methods of monitoring and control of air pollution SO<sub>2</sub>, NO<sub>x</sub>, CO, SPM. Effects 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 standard.

Soil: 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 ( NP & K ) and their interactions with different components of soil.

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.

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

Radioactive and Thermal Pollution.

#### **7. Solid and Hazardous Waste Management.**

Solid Waste - types and sources. Solid waste characteristics, generation rates, solid waste components, proximate and ultimate analyses of solid wastes. Solid waste collection and



transportation: container systems - hauled and stationary, layout of collection routes, transfer stations and transportation. Solid waste processing and recovery – Recycling, recovery of materials for recycling and direct manufacture of solid waste products. Electrical energy generation from solid waste (Fuel pellets, Refuse derived fuels), composting and vermicomposting, biomethanation of solid waste. Disposal of solid wastes – sanitary land filling and its management, incineration of solid waste. Hazardous waste – Types, characteristics and health impacts. Hazardous waste management: Treatment Methods – neutralization, oxidation reduction, precipitation, solidification, stabilization, incineration and final.

e-waste: classification, methods of handling and disposal.

Fly ash: sources, composition and utilisation. Plastic waste: sources, consequences and management.

## **8.Environmental Assessment, Management and Legislation**

Aims and objectives of Environmental Impact Assessment (EIA). Environmental Impact Statement (EIS) and Environmental Management Plan (EMP). EIA Guidelines. Impact Assessment Methodologies. Procedure for reviewing EIA of developmental projects. Life-cycle analysis, costbenefit analysis. Guidelines for Environmental Audit. Environmental Planning as a part of EIA and Environmental Audit. Environmental Management System Standards (ISO14000 series). EIA Notification, 2006 and amendments from time to time. Eco-labeling schemes.

Environmental Laws in India: Constitutional provisions in India (Article 48A and 51A). Wildlife Protection Act, 1972 amendments 1991, Forest Conservation Act, 1980, Indian Forest Act, Revised 1982, Biological Diversity Act, 2002, Water (Prevention and Control of Pollution) Act, 1974 amended 1988 and Rules 1975, Air (Prevention and Control of Pollution) Act, 1981 amended 1987 and Rules 1982, Environmental (Protection) Act, 1986 and Rules 1986, Motor Vehicle Act, 1988, The Hazardous and Other Waste (Management and Transboundary Movement) Rules, 2016, The Plastic Waste Management Rules, 2016, The Bio-Medical Waste Management Rules, 2016, The Solid Waste Management Rules, 2016, The e-waste (Management) Rules 2016, The Public Liability Insurance Act, 1991 and Rules 1991, Noise Pollution (Regulation 9 and Control) Rules, 2000, Coastal Regulation Zones (CRZ) 1991 amended from time to time. National Forest Policy, 1988, National Water Policy, 2002, National Environmental Policy, 2006.

Environmental Conventions and Agreements: Stockholm Conference on Human Environment 1972, Montreal Protocol, 1987, Conference of Parties (COPs), Basel Convention (1989, 1992), Ramsar Convention on Wetlands (1971), Earth Summit at Rio de Janeiro, 1992, Agenda-21, Convention on Biodiversity (1992), UNFCCC, Kyoto Protocol, 1997, Earth Summit at Johannesburg, 2002, RIO+20, UN Summit on Millennium Development Goals, 2000, Copenhagen Summit, 2009. IPCC, and UNEP.

## **9. Statistical Approaches and Modelling in Environmental Sciences**

Attributes and Variables: types of variables, scales of measurement, measurement of Central tendency and Dispersion, Standard error, Moments – measure of Skewness and Kurtosis, Basic concept of probability theory, Sampling theory, Distributions - Normal, log-normal, Binomial, Poisson, t, 2 and F-distribution. Correlation, Regression, tests of hypothesis (t-test, 2 - test ANOVA: one-way and two-way); significance and confidence limits. Approaches to development of environmental models; linear, simple and multiple regression models.

## **11. Contemporary environmental Issues and Disaster Management.**

Global Environmental Issues – Biodiversity loss, Climate change, Ozone layer depletion. Sea level rise. International efforts for environmental protection. National Action Plan on Climate Change (Eight National missions – National Solar Mission, National Mission for

Enhanced Energy Efficiency, National Mission on Sustainable Habitat, National Water Mission, National Mission for Sustaining the Himalayan Ecosystem, National Mission for a 10 'Green India', National Mission for Sustainable Agriculture, National Mission on Strategic Knowledge for Climate Change).

Environmental issues related to water resource projects - Narmada dam, Tehri dam, Almatti dam, Cauvery and Mahanadi, Hydro-power projects in Jammu & Kashmir, Himachal and North-Eastern States.

Chipko movement, Appiko movement, Silent Valley movement and Gandhamardhan movement. People Biodiversity register. Wild life conservation projects: Project tiger, Project Elephant, Crocodile Conservation, GOI-UNDP Sea Turtle project, Indo-Rhino vision. Carbon sequestration and carbon credits. Waste Management – Swachha Bharat Abhiyan. Sustainable Habitat: Green Building, GRIHA Rating Norms. Vehicular emission norms in India. Epidemiological Issues: Fluorosis, Arsenocosis,.

Environmental Disasters: Minnamata Disaster, Love Canal Disaster, Bhopal Gas Disaster, 1984, Chernobyl Disaster, 1986, Fukushima Daiichi nuclear Disaster 2011. landslide, flood, earthquake and etc.

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