Annexure – 'B'

Syllabus for Research Assistant

Qualification Prescribed: *Master's Degree in Environmental Science / Chemistry / Microbiology / Biochemistry with at least 60 % marks in aggregate from a recognized University*

A. Environmental Science:-

- Principles of Environmental Sciences.
- Geographical classification and zones.
- Structure and composition of atmosphere, hydrosphere, lithosphere and biosphere. Mass and Energy transfer across the various interfaces, material balance. Laws of thermodynamics, heat transfer processes. Scale of Meteorology, pressure, temperature, precipitation, humidity, radiation and wind. Atmospheric stability, inversions and mixing heights.
- Natural resources conservation and sustainable development, Sustainable Development Goals (SDGs).

B. Fundamentals of Environmental Chemistry :-

- Stochiometry, Gibb's energy, Chemical potential, Chemical equilibria, acid base reactions, solubility product, solubility of gases in water, the carbonate system, unsaturated and saturated hydrocarbons.
- Chemical composition of Air.
- Water Chemistry.
- Soil Chemistry.
- Toxic Chemicals in the environment.
- Industrial pollutants.
- **Principles of Analytical Methods**: Colourimetry, Spectrophotometry, Chromatography, Gas Chromatography, Atomic Absorption Spectrophotometry, GLC, HPLC, Electrophoresis. X-ray fluorescence, X-ray diffraction, Flame photometry etc.

C. Ecology :-

- Principles and scope of Ecology.
- Aquatic, Terrestrial, Human ecology and Human settlement, Evolution, Origin of life and speciation.
- Ecosystems, pathways in Ecosystems. Physico-chemical and Biological factors in the Environment.
- Common flora and fauna of India: Aquatic, Phytoplankton, Zooplankton and Macrophytes.
- Endangered and Threatened Species, Eco-sensitive zones, Protected Areas, Biosphere Reserves, MBP.
- Biodiversity and its conservation: Definition, Hotspots of Biodiversity, Strategies for Biodiversity conservation, National Parks and Sanctuaries, Gene pool, Peoples Biodiversity Registers (PBRs).

D. Environmental Biotechnology:-

- Bioremediation, Biotransformation, Biodegradation, Phytoremediation, tissue culture techniques.

E. Environmental Geosciences and Energy:-

- The Earth systems and Biosphere, Earth's thermal environment and seasons, Earth's processes and geological hazards, Mineral/Water Resources and Environment, water cycle , carbon cycle.
- Principles of Remote sensing and its application in Environmental Sciences. Application of GIS in Environmental Management.

F. Environmental Pollution:-

- ***Air:*** Natural and anthropogenic sources of pollution. Primary and Secondary pollutants. (various Industrial effluents such as being generated from Pulp and Paper Mills, Pesticides, Pharmaceuticals, Iron & Steel Industries). Transport and diffusion of pollutants. Gas laws governing the behaviour of pollutants in the atmosphere. Air Sampling techniques. Identification of aeroallergens. Air-borne diseases and allergies.
- Methods of monitoring and control of air pollution SOx, NOx, CO, National Ambient Air Quality parameters, AQI, Non-attainment cities under National Clean Air Progreamme (NCAP)
- Suspended Particulate Matter (SPM). Effects of pollutants on human beings, plants, animals, materials and on climate. Acid Rain.
- ***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. STPs, ETPs and Technologies used.
- ***Soil:*** Physico-chemical analysis, bacteriological sampling as well 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:*** 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. Silence zones, noise limiters, white noise, pink noise. black noise.
- ***Marine:*** Sources of marine pollution and control. Criteria employed for disposal of pollutants in marine system-coastal management. Radioactive and Thermal Pollution.

G. Environment Impact Assessment:-

- Introduction to Environmental Impact Assessment, EIA notification 2006.
- Environmental impact Statement and Environmental Management Plan. EIA guidelines and notifications by Government of India, Public Hearing,
- Impact Assessment Methodologies.
- Procedure for reviewing Environmental impact analysis and statement. Guidelines for Environmental Audit.
- Environmental priorities in India and sustainable development.
- Environmental Monitoring : Methods of assessment of Environmental quality, short term studies/surveys, Rapid Assessment, Continuous Short and Long term Monitoring, Remote Sensing and its application i.e. Environmental Monitoring.

H. Waste Management:-

- Sources and generation of Solid Wastes, Hospital Waste, COVID BM Waste, Hazardous Waste, Plastic Waste, E-Waste. Different methods of disposal and their management; Recycling of waste material. Waste minimization technologies, laws/ rules for waste management under Environment (Protection) Act, 1986.
- Environment protection-issues and problems, International and National efforts for Environment Protection, Provisions in Constitution of India regarding Environment Protection.
- Environmental Policy Resolution, Legislation, Public Policy Strategies in Pollution Control, Wildlife Protection Act, 1972, Air (Prevention and Control of Pollution) Act, 1981 as amended, Motor Vehicle Act, 1988, The Water (Prevention and Control of Pollution) Act, 1974 as amended, The Environment (Protection) Act, 1986 and Rules 1986.
- Scheme of labelling of environmentally friendly products (Ecomark), Public Liability Insurance Act, 1991 and Rules 1991.

I. Bio Statistics:-

- Fundamentals of Biostatistics
- Sample survey
- Sampling distribution and Test of Significance
- Standard Deviation and its applicability.

J. Miscellaneous:-

- **Environmental Education and Awareness**. Environmental Ethics and Global imperatives.
- **Global Environmental problems** - Ozone depletion, global warming and climatic change. Current Environmental issue in India.
- Environmental Movements for protection of Forest, Environment etc in India.
- Judicial activism for environmental protection by Hon'ble Supreme Court of India and Hon'ble National Green Tribunal.
- International Environment Treaties and Conventions.

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K. Microbiology:-

- Introduction to Microbiology and Bacterial Technology
- Environmental Microbiology
- Bio Instrumentation
- Microbial Genetics and Molecular Biology Immunology
- Microbial Physiology and Metabolism
- Medical Microbiology

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