



DAV UNIVERSITY, JALANDHAR

PhD Entrance Test Syllabus

DEPARTMENT OF ENVIRONMENTAL SCIENCE

Section A (50 questions)

Research Methodology

Descriptive statistics: Definition and relevance in biological research; Measures of Central Tendency: Arithmetic Mean, median, mode, quartiles and percentiles; Measures of Dispersion: Range, variance, standard deviation, coefficient of variation; Skewness and Kurtosis. Probability Theory.

Inferential statistics: Hypothesis testing, Errors in Hypothesis Testing- Null Hypothesis, Alternative Hypothesis, Type I and Type II errors, Confidence Limits. Setting up of level of significance. One tailed and Two- tailed tests.

Correlation and Regression: Correlation coefficient (r), properties, interpretation of r , partial and multiple correlations, linear regression: Fitting of lines of regression, regression coefficient, Bivariate and Multiple Regression.

Parametric and Non-Parametric Statistics: Definition, Advantages, Disadvantages, Assumptions; Parametric Tests: Student's t -test, One Way Analysis of Variance, Two Way Analysis of Variance; Non-Parametric Tests: Analysis of Variance, Chi square and Kendall Rank Correlation. Basic principles and significance of research design; Randomized Block Designs (RBD), completely randomized designs (CRD); Latin square design; Split plot design and Factorial design. Data collection, organization and interpretation. Research articles, research papers, popular research articles and reviews; difference between periodicals; journals; monographs, magazines; proceedings. Science citation index; H-index, i10 index, Impact factor calculation, Impact factor of a journal; Eigen factor, Major journal search engines. Copyright act; Academic frauds; Plagiarism; Software's to check plagiarism.

Section B (50 questions)

Environmental Science

Unit 1: Fundamentals of Environmental Science, Definition, principles and scope of Environmental Science., 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.

Unit – II: Ecology and Biodiversity, Definition, Principles and scope of ecology, Evolution, Origin of life and speciation, Ecosystems, Biodiversity, uses, threats and its conservation measures

Unit – III: Environmental Geosciences, Fundamental Concept of Environmental Geosciences, Energy budget of the earth. Earth's thermal environment and seasons. General relationship between landscape, biomes and climate. Climates of India, Indian Monsoon, El Nino, Droughts. Tropical cyclones and Western Disturbances, Earth's Processes and various Geological Hazards, Principles of Remote sensing and its application of Environmental Sciences, Application of GIS in Environmental Management.

Unit – IV: Energy Resources, Solar energy, Fossil fuels Hydroelectric power, Tidal, Ocean Thermal Energy Conversion, wind, geothermal energy; nuclear energy – fission and fusion; magneto hydrodynamic



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

Unit – V: Pollution Types, sources and consequences of Air and Water pollution, Methods of monitoring and control of air pollution SO₂, NO_x, CO, SPM., Acid Rain, Air Quality Standards, Physico – chemical and Bacteriological sampling and analysis of water quality. Standards, sewage and waste water treatment and recycling. Water quality standard; 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; 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 of marine pollution and control. Criteria employed for disposal of pollutants in marine system-coastal management. Radioactive and Thermal Pollution.

Unit – VI: Current Social issues 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. Landuse policy for India. Urban planning for India. Rural planning and landuse pattern. Concept and strategies of sustainable development. Cost-Benefit analysis. Environmental priorities in India and sustainable development. 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. 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 – VII: Solid Waste Management and Environmental Laws

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. Hazardous Wastes 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).



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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.

Scheme of labelling of environmentally friendly products (Eco mark), Public Liability Insurance Act, 1991 and Rules 1991.

Unit – VIII: Statistical Analysis

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.

Molecules and their interaction relevant to biology: Composition, structure and function of biomolecules (carbohydrates, lipids, proteins, nucleic acids and vitamins). Stabilizing interactions (Van der Waals, electrostatic, hydrogen bonding, hydrophobic interaction, etc.). Principles of biophysical chemistry (pH, buffer, reaction kinetics, thermodynamics, colligative properties). Bioenergetics, glycolysis, oxidative phosphorylation, coupled reaction, group transfer, biological energy transducers, Principles of catalysis, enzymes and enzyme kinetics, enzyme regulation, mechanism of enzyme catalysis, isozymes, Conformation of proteins (Ramachandran plot, secondary structure, domains, motif and folds), Conformation of nucleic acids (helix (A, B, Z), t-RNA, micro-RNA), Stability of proteins and nucleic acids, Metabolism of carbohydrates, lipids, amino acids nucleotides and vitamins. CELLULAR

Organization: Membrane structure and function: Structure of model membrane, lipid bilayer and membrane protein diffusion, osmosis, ion channels, active transport, membrane pumps, mechanism of sorting and regulation of intracellular transport, electrical properties of membranes.

Structural organization and function of intracellular organelles: Cell wall, nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles, chloroplast, structure & function of cytoskeleton and its role in motility.

Organization of genes and chromosomes: Operon, unique and repetitive DNA, interrupted genes, gene families, structure of chromatin and chromosomes, heterochromatin, euchromatin, transposons.

Cell division and cell cycle: Mitosis and meiosis, their regulation, steps in cell cycle, regulation and control of cell cycle.

Fundamental processes: DNA replication, repair and recombination: Unit of replication, enzymes involved, replication origin and replication fork, fidelity of replication, extrachromosomal replicons, DNA damage and repair mechanisms, homologous and site-specific recombination.

RNA synthesis and processing: transcription factors and machinery, formation of initiation complex, transcription activator and repressor, RNA polymerases, capping, elongation, and termination, RNA



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processing, RNA editing, splicing, and polyadenylation, structure and function of different types of RNA, RNA transport.

Protein synthesis and processing: Ribosome, formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination, genetic code, aminoacylation of tRNA, tRNA-identity, aminoacyl tRNA synthetase, and translational proof-reading, translational inhibitors, Post-translational modification of proteins.

Control of gene expression at transcription and translation level: regulating the expression of phages, viruses, prokaryotic and eukaryotic genes, role of chromatin in gene expression and gene silencing.

Cell communication and cell signaling

Host parasite interaction: Recognition and entry processes of different pathogens like bacteria, viruses into animal and plant host cells, alteration of host cell behavior by pathogens, virus-induced cell transformation, pathogen-induced diseases in animals and plants, cell-cell fusion in both normal and abnormal cells.

Cell signaling: Hormones and their receptors, cell surface receptor, signaling through G-protein coupled receptors, signal transduction pathways, second messengers, regulation of signaling pathways.