



KUVEMPU UNIVERSITY

Department of PG Studies & Research in Environmental Science
Jnana Sahyadri, Shankaraghatta – 577451, Shimoga Dist. Karnataka

Syllabus for Ph.D Entrance test in Environmental Science 2022-23

UNIT-1: Fundamentals of Environmental Science

Introduction to Environmental Science: General perspectives, Scope; Anatomy of Earth atmosphere and energy transfer in atmosphere; Structure of the earth's crust, rock cycle and soil profile; Biosphere: biomes and Components of biosphere; Natural disaster; Monitoring and management of natural disaster and applications of GIS. Natural disaster mitigation measures; Human ecology and environment: Disciplines Associated with Human Ecology, Environmental Ethics. Development and socio-environmental issues: Perception of risk, perspectives on our relationship with the environment; Real and potential responses to present and future challenges.

UNIT-2: Earth and Environment: Earth systems and its interaction; Earth's Materials – Distribution and abundance of elements and Geochemical features and classification of rocks. Geological features of India and Karnataka; Soil-characteristics and formation of soil, role of soil organisms in soil formation, soil erosion, types, soil conservation. Soil and ground water remediation, remediation technology- excavation, pump and treat, enhanced flushing, soil vapor extraction, air spraying, thermal methods, electro kinetic methods, bioremediations; Earths processes- Endogenic and exogenic processes. Exogenic - geological agents- River, Wind, Glaciers, oceans and seas. Endogenic – Earthquake process and volcanic activities. Land use Planning- Environmental aspects of terrain evaluation. Methods of site selection and evaluation of land in environmental planning.

UNIT-3: Environmental Chemistry and Toxicology: Atmospheric chemistry, Chemical composition of Air: Classification of elements, chemical speciation. Thermochemical and photochemical reactions in the atmosphere. CFC's, Oxygen and Ozone chemistry, chemistry of air pollutants, photochemical smog; Water pollutants- types sources- heavy metals- metalloids- organic, biological and radioactive- types of reactions in various water bodies including marine environment. Chemistry of oil based and water based paints. Ecotoxicology, Scope and basic division of toxicology. Toxicant and toxicity, Classification of toxic plants and animals, nature and chemistry of toxins. Factors influencing the toxicity: Duration. Dose and dosage, dose response relationships, statistical concept of toxicity; margin of safety, toxicity curves. Biological magnification of toxic materials: Bio-concentration, Bioaccumulations and biotransformation. Methods employed to measure bioaccumulation. Biochemical and developmental toxicity. Evaluation of reproductive toxicity and teratogenicity, mutagenicity and genotoxicity.

UNIT-4: Environmental Biology: Ecology, its relation to other sciences. Relation between Man and Environment; Factors affecting the environment; Ecosystems- Fundamental concepts and principles, Structure and function, Food chain disruption and consequences, modern concept of ecosystem; Major biomes –Temperate forests, Tropical rain forests, Tropical savannah and Deserts. Population ecology; Primary and secondary productivity - measurement of biomass and productivity in terrestrial and aquatic communities. Productivity of forest and grassland ecosystems; Basic laws of energy flow; Energy flow models, Energetic relations in Ecosystems. Biodiversity and Forest Ecosystem: biodiversity hot spots of world & India and strategies for its conservation. CBD and Agenda 21, National parks and sanctuaries, biosphere reserves. Ecological indicators. Endemic and RET species, Concept of keystone & flagship species. Forest ecosystem: Forest influence on Climate regulation, flood & soil erosion control and wildlife habitat protection; Green belt and its influence in urban environment. Carbon sequestration and Kyoto convention. Effect of fire on forest ecosystem.

UNIT-5: Environmental Engineering and Solid Waste Management:

Water and wastewater treatment and analysis; sedimentation, filtration, disinfections, removal of iron and manganese. Softening of water; Advanced technologies for wastewater treatment - ozonation, fluoridation, reverse osmosis, electro dialysis, desalination and ion exchange methods. Industrial wastewater treatment. Sources, hazards, Monitoring and control techniques- of air, water and soil pollutions; Environmental Engineering and biotechnology: detoxification of phenols and biodegradation of pesticides.

Solid Waste Management: Waste – Introduction, sources, characteristics, composition, classification; waste generated per capita- Global and Indian scenario. Solid Waste – collection, Storage, segregation- transportation and disposal methods-sanitary landfills and types of composting, aerobic and anaerobic digestion, types of incineration, pyrolysis. Biomedical wastes: types, collection and biomedical waste treatment; Hazardous waste- characteristics, resource conservation and Classification of hazardous waste and handling of hazardous solid wastes. Radio active wastes- sources, pollution, types of radioactive waste and its control and management. Waste management – waste minimization program, typical material recovery facility operation (TMRF), Reuse and recycling of paper, glass, rubber. Plastic waste status in India, effect of plastic wastes on environment, management of plastic waste.

UNIT-6: Environmental Pollution: Definition, Sources, types of pollutants, effects and control measures of Air pollution - Gas laws governing the behavior of pollutants in the atmosphere. Meteorological parameters, scale of meteorology, Effect of pressure temperature, precipitation, humidity, radiation and wind. Heat transferring processes, atmospheric stability, inversions and mixing heights, Wind roses, Plume behavior and Stack dispersion theories & models of monitoring & control of exhaust emissions. Ambient air quality standards and air pollution indices. Air sampling and monitoring techniques. Noise Pollution: Definition, Sources, types and Measurement of noise; Noise control and abatement measures. Aquatic Pollution: Definition; Sources and classification of aquatic pollutants. Consequences of pollution on surface, subsurface and marine water sources. Coastal water intrusion. Oil leakage and industrial

effluents. Water quality indices. Thermal pollution: Sources, causes and effects. Preventive and Control measures. Soil Pollution: Definition, sources and classification of soil pollutants and their impacts on biosphere; Industrial waste effluents and heavy metals, their interactions with soil components, Soil microorganisms and Interaction of fertilizer (NPK) with different components of soil. Soil pollution control Measures. Radioactive Pollution: Definition, Radioactivity, Radionuclide; Radioactive pollution impacts on ecosystem. Pollution control measures. Biological dosimetry.

UNIT-7: Environmental Laws, Planning, Policy, audit and Impact assessment:

Legal control of Environmental pollution in India with special reference to :

- i. The Wildlife protection Act – 1972.
- ii. The Water prevention and control of pollution Act, 1974, amended 1988: CESS Act 1977, amended in 1991.
- iii. The Forest Conservation Act, 1980, amended in 1988.
- iv. The Air prevention and control of pollution Act, 1981, amended in 1990.
- v. The Environment protection Act. 1986.
- vi. The Motor Vehicle Act, amended in 1988.
- vii. The National Environment Tribunal Bill 1992, Stockholm conference- 1972, UNEP-1982
- viii. Hazardous waste management rules-1989 & amendment rules.
- ix. Municipal waste management rules 2000.

(i) Planning: Importance of planning, local, regional, state and national planning. Site and location with reference to Environmental Pollution, Zoning-Physical planning.

(ii) Economics of pollution control, cost-benefit ratios. Reliability and Risk analysis.

National policy, sectorial – integration, state level policy and implementation. Environmental protection in India – Organizational structure at state and central governmental levels.

Environmental Impact Assessment and Audit: Origin and development of EIA, simple methods of identification of impacts, matrices network, checklists. Assessment and Prediction of impact on Air water, noise and biological environment. Methods of impact analysis, and Risk Assessment, mitigation measures. Environmental Audit: Introduction, General approach Environmental Auditing, Programme Planning, Environmental Audit methods, benefits of environmental auditing. On-site Audit, Post – Audit activities, statutory Environmental statements. Requirements of rule 14 for Environmental Audit under Environmental protection Act 1986.

UNIT-8: Remote Sensing Applications: Basics of remote sensing: Definition, components and energy interactions. Electromagnetic spectrum, Principles of radiation; radiation transfer; Physics of Remote Sensing; Active and Passive remote sensing; Ideal and Real remote Sensing characteristics. Fundamentals of aerial photographic systems; Terminologies: Types of aerial cameras, aerial photos; ground coverage; radiometric characteristics, Interpretation principles and techniques, Applications of aerial photos.

Sensors and Scanners- Profiles and geometry of scanners, different types of sensors, their characteristics; Multispectral and thermal scanning. Earth resource Satellites: ERS operating in the optical spectrum- History; Landsat satellite, SPOT, TRMM, EOS mission, ENVISAT, Megha Tropique, IRS programmes-an overview; meteorological and ocean monitoring satellites. Digital image processing: Basic concepts and principles; image enhancement; edge enhancement; band rationing classification-supervised and unsupervised classification. Smoothing and filtering techniques; post classification smoothing classification accuracy enhancement; data merging; scale effects. Global Positioning System (GPS): Concept, principles, procedures and scope. Applications of GPS. Applications of remote sensing: Mining and quarrying, land use, forest cover, water resource; coastal zone management; watershed; marine and ocean resource; wildlife ecology; agriculture and range land application; earthquakes and flood mapping assessment

UNIT-9: Water Quality Science and Technology and Environmental Microbiology:

Water quality-introduction: quality assessment and control; Structure and properties of water, Water resources, Hydrological cycle; Sources and uses of water: Ground water and surface water; Water quality parameters – physico chemical and BOD analysis; Drinking water standard, irrigation water standards, surface water standards,; Water pollution: Introduction, organic, pesticidal, heavy metal and oil & grease pollution. Water contaminations and water borne diseases Water treatment methods and purification of drinking water. Wastewater recycling. Advanced techniques for water quality maintenance.

Environmental Microbiology: Microbes in air, water, wastewater and soil; sampling techniques. Microbiological aspects in the drinking water and distribution. Indicator microorganisms - MPN and MF technique. Bio-fouling, bio-film and Bio-corrosion. Antibiotic resistant bacteria in drinking water, food and their implications. Food And Medical Microbiology: Microbial contamination in hospitals - microbial infections. Control strategies. Environmental Biotechnology - Role of microbes in mining, oils sleek degradation, Industrial water treatment, Implications of GMOs and transgenic plants on native biota and Environment. Introduction to Fermentation Technology.

UNIT-10: RESEARCH METHODOLOGY: Research – Definition, Importance and Meaning of research, Types of Research, Characteristics of research, Steps in research, Identification, Selection and formulation of research problem, Research questions, Research design, Formulation of Hypothesis, Review of Literature. Sampling: Sampling theory, techniques, types of sampling, sample size, sampling steps, Errors- sampling and non-sampling. Merits and limitations of sampling. Data in Research: Primary and secondary data, processing and presentation of data, Relevance, limitations, and cautions. Statistics in Research –Descriptive statistical tests, Measure of Central tendency, Dispersion, Skewness and Kurtosis. Hypothesis and Hypothesis testing, Standard Error, parametric and non-parametric tests. Applications of Chi-Square Test, ANOVAs, and “t” test. Graphical Presentation of data. General Methods of Sampling Components of air, water, soil, sediment, biomaterials for routine and specific analysis. Processing and storage of samples, handling of chemicals, waste and hazardous waste and toxic materials. Research Reports: types of reports, contents, style of reporting, steps in drafting reports, editing the draft, evaluating, and finalizing the report. Ethics of scientific research, IPR, Copyright and patent, plagiarism, and consequences. Presentation of Research

Work in conferences and seminars. Publication of res each work – Journals, online journals, bulletins, supplements, archives, newsletters, reports, and other forms of research publications. Citation Index and Journal Impact factors.

Principles of Analytical Methods: Titrimetry, Gravimetry, Colorimetry, Spectrophotometry, Chromatography, Gas Chromatography, Atomic Absorption Spectrophotometry (AAS), Inductively coupled plasma emission spectroscopy (ICPES), High performance (pressure) liquid chromatography (HPLC), Electrophoresis, X-ray fluorescence, X-ray diffraction, Flame photometry. Instrumental methods of analyses of soil and water samples. Microbiological analyses.

References:

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4. Soil and water conservation Engineering, Schwab. S.O, Frevert.R.K, Edimster. T.W. and Barns, K.K., John Wiley and Sons, 1975.
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