**Institute of Environmental Studies**

**Kurukshetra University, Kurukshetra**

**Syllabus for Entrance Test of Ph. D (2020)**

**IES/2020/247**

**Date. 13/02/2020**

**Important Instructions for Entrance Test:**

**Entrance Test Paper will consists of 100 objective type questions of 200 marks. Time duration 2 hrs.**

**For each correct response the candidate will get 2 marks. There shall be no negative marks for incorrect response. No marks will be given for unanswered questions.**

**The questions for the Entrance exam will spread over the entire syllabus.**

**Statistics** –Measures of central tendency- Mean, median, mode, geometric mean and harmonic mean, measures of dispersion, moments, Standard error of estimate, standard deviation, variance, skewness and kurtosis, Basic laws of probability, definition of a random variable and concept of a probability density function; binominal, poison and normal distributions. Correlation and linear regression of one independent variable. Analysis of variance. Application of one-way and two-way ANOVA. Principles of experimental design-randomization; replication and local control, randomized block design; A basic idea of computer graphics, use of different software; information retrieval and data management.

**Methods** of vegetation analysis, Methods of estimating plant biomass and productivity. Methods of Analysis of soil microbial diversity, soil enzymes, soil carbon. Isolation and enumeration of microorganisms from soil by the serial dilution agar plating method. Methods for biochemical estimation of Protein, oil content, DNA and RNA.

**Techniques:** Chromatography – Principle, methodology and application of chromatographic techniques: (a) Paper (b) Thin layer (c) Column (d) Gel (e) Gas and (f) HPLC. Microscopy - optical, phase contrast. Spectrophotometry - principle, methodology and application, flame photometry.

**Ecology:** Population regulation, community organization, species interaction; Ecological Succession –concept, types, climax and changes in ecosystem properties during succession. Ecosystem structure, functions, processes, energy flow and productivity, ecological efficiencies; ecosystem stability and regulation. Biogeochemical cycles, gaseous and sedimentary cycles. Man’s impact on nutrient cycles. Principles and importance of conservation biology; genetic variations, natural selection, genetic drift and gene flow. Species, genetic and ecosystem diversity; Methods for study of biodiversity; diversity indices; dominance diversity curves. *In situ* biodiversity conservation strategies and approaches: Protected areas, biosphere reserves in India – Sanctuaries, natural parks. *Ex Situ* Biodiversity conservation: Species management plans, captive breeding, field gene banks, seed gene banks, *in vitro* active and base gene banks. IPR.; **Resources**: Land resources; Water resource; Energy resources; Mineral resource and Forest resources.

**Pollution:** Air and Noise Pollution: Sources, classification and properties of air pollutants. Water Pollution: Sources, consequences, ecological and biochemical aspects of water pollution, characteristics of domestic, industrial and agricultural wastes, their effects on water bodies; Thermal pollution. Soil Pollution: Soil pollution from use of fertilizers, pesticides, heavy metals, waste disposal, industrial effluentsand surfactants. Toxic effects of pollutants on organisms. Impacts of toxics on terrestrial and aquatic systems. Dose response relationships; Biomagnification, Bioaccumulation. Photochemical Smog, Acid Rain and Ozone layer depletion.

Global climate change: Greenhouse effect, greenhouse gases-sources, trends, radiative forcing, warming potential of gases. CO2 fertilization effect on plants; potential impacts of global warming – polar ice caps and melting of glaciers, sea level increase, weather extreme, ecosystems , human health, coral leaf bleaching , surface ocean chemistry, biogenic calcification in oceans. Tools to study global climate change- paleoclimate records, general circulation models, ice cores. Mitigation strategies for global warming; biological carbon sequestration, carbon sequestration in geological formations; role of forests in soil carbon storage. Kyoto protocol; carbon trading. Global environmental change programmes, IPCC; Indian initiative for mitigating global climate change.

**Environmental Biotechnology:** Significance of microorganisms. Microbes and environmental management, Extremophiles. Biodegradation of macromolecules; Biodegradation of xenobiotics; Bioremediation of metal contaminated soils, spilled oil and grease deposits and synthetic pesticides; Phytoremediation. Biosensors to detect environmental pollutants. Environmental applications of Bioreactors. Micropropagation and cloning of plants, applications in forestry and wasteland management. Genetically modified organisms and Biosafety guidelines.

**Application tools for Environmental Management:** Concepts and principles of Remote Sensing; Application of remote sensing in vegetation analysis, biomass and productivity, nutrient cycling and biodiversity analysis. Basic components and tools of GIS; Basic principles of global positioning system. Ecological restoration, Approaches of ecological restoration for wetland and forest ecosystems. Ecoinformatics: A general account. Scope and importance of Ecological Economics. Evaluation of ecosystem services; Environmental Sustainability. Ecological engineering. Approaches for environmental impact and risk assessment, EIA Process and Methodology, Environmental Management Plan and Environmental Audit.