

**DEPARTMENT OF ENVIRONMENTAL SCIENCES,
UNIVERSITY OF KERALA**

M.Phil Syllabus

Paper I

Research Methodology

- Microscopy- Phase contrast, fluorescence, Electron microscope.
- Titrimetry- Principles and Methods- Buffers
- Gravimetry- Mass spectrometry
- Colorimetry- Spectrophotometry
- Flame photometry- Atomic Absorption Spectrophotometry.
- Chromatography- Gas chromatography, Gas-liquid chromatography, High Pressure-Liquid Chromatography
- Emission Spectrophotometry
- Electrophoresis
- X- ray diffraction, X- Ray fluorescence
- Sampling, preservation and storage of air, water and soil. Bio sampling, Bio-geochemical sampling.
- Methods of physical, chemical, biological and bacteriological analysis of air, water and soil- Air and water quality standards.
- Methodology in Environmental Impact Assessment- Environmental Audit.
- Statistical tools and analysis- Computer analysis- Environmental System Analysis, Development of Models.
- Literature collection, Manuscript preparation and publication.

Paper II
Advances in Environmental Sciences

- Impact of geological hazards on Environment- special reference to floods, landslides, earthquakes, volcanoes, avalanche.
- Climate and Monsoons of India and Kerala.
- Global impact of Elnino - Southern Oscillation.
- Applications of Remote Sensing and Geographical Information System in Environmental management.
- Disaster management.
- Ecology of Reservoirs of India.
- Causes and Management of Eutrophication.
- Management of polluted rivers – Ganga Action Plan.
- Techniques of rain water harvesting.
- Conservation of Wetlands.
- Energy conservation- role of bio-energy in energy management.
- Land use Policy and Planning
- Land and Soil conservation
- Sand, granite and ore mining issues.
- Biosphere reserves of India - role in conservation
- Ecology of Mangroves in India
- Coral Reef Ecosystems: Threats and Conservation.
- Biodiversity Conservation: Need and Conventions.
- Integrated Forest Management.
- Global warming – causes and remedies.
- Interlinking of rivers: Pros and Cons.
- High dam vs low dam controversies
- Diseases related to Environmental pollution and their control.

- Effect of Environmental pollutants on Physiology of animals and plants.
- Bio monitoring of water, air and soil pollution.
- Fermentation technology.
- Vermiculture.
- Methods of waste water treatment.
- Management of solid waste including hazardous wastes.
- Bioremediation: Its role in environmental cleanup.
- Ecofriendly technologies, Green chemistry.
- Role of Ecotourism and Ecoclubs in environmental preservation
- Environmental Laws and Legislations.
- Environmental Ethics.
- Cost-Benefit analysis of Environmental programmes.
- Concepts and Strategies of sustainable development.
- Environmental Education in India.
- Impact of GMOs and LMOs in natural ecosystems.
- Urban Planning in India.

PAPER III

(Dissertation Oriented paper)

1. Environmental Pollution and Control Technology

Air, soil, water pollution- sources, effects and control. Composition of air, gaseous and particulate pollutants- effects on plants, animals, materials and man. Noise pollution, control of pollutants at source.

Soil pollution- erosion, human and animal excreta, fertilizers, pesticides, industries, waste dumping- sanitation, control. Water pollution- indicators- waste water treatment- water contamination- standards for drinking, swimming etc.

2. Environmental Biology

Biota and environment- physico-chemical factors influencing plants and animals of terrestrial and aquatic habitats. Pollutants- soil, air and water- affecting organisms. Producers, consumers and decomposers- energy flow, ecosystem. Plant and animal behavior, morphology, physiology and development in relation to their environment.

3. Environmental Geology and Geochemistry

Distribution of elements in rocks and some geological associations- Weathering processes- physical, chemical and biological weathering of minerals and rocks- Formation of soils and soil profiles. Redistribution of elements by weathering in the surface environment- Metal pollution in soils and trace metals in soils- Collection and geochemical analysis of surface and sub-surface sediment samples from terrestrial environment- Collection and geochemical analysis of water samples and bottom sediment samples from aquatic environments (*i.e.*, river & lakes) - Regional geochemical mapping and its application to environmental sciences- Sources, occurrence and movement of ground water- Aquifer, aquitard and aquiclude- Contamination of surface water and ground water- Water quality standards for drinking and domestic purposes- Factors influencing water quality- clays, environmental influence, climate, geological effect, biological effect, microbiological effect, influence of man. Various remedial measures for improving the drinking water quality.

4. Environmental Microbiology

Microbiology of fresh water- isolation and purification of bacteria, fungi- bacterial growth curve- characterization of aerobic and anaerobic microbes.

Microbiology of soil – population - role in organic waste degradation- microbial conversion of solid waste composting- different methods of composting- microbial processes during composting- biogas- microbiology of methane production.

Microbiology of water and sediments - waste water- Role of microbiology in industrial processes- fermentation - single cell protein- bioleaching- energy production by microorganisms- GEMS - merits, demerits, bio-safety and regulations. Application in agriculture, industry and environment.

5. Environmental Chemistry

Environmental segments, natural cycles of the environment, water chemistry, physico-chemical characteristics of water, chemical analysis of water and waste water, water pollutants, water quality standards, soil chemistry, waste and pollutants in soil, soil sampling and analysis, atmosphere and atmospheric chemistry, air pollutants, sampling and analysis of air pollutants like SO₂, NO_x, H₂S and metals, ambient air quality standards.

6. Environmental Toxicology

Environmental toxicants, synergism, potentiation and antagonism; Dose-response relationships, LD₅₀, Animal toxicity tests, Biological and chemical factors that influence toxicity, bioaccumulation, biomagnifications, biostratification, biomonitoring, Global dispersion of toxic substances, xenobiotic and endogenous substances- toxic elements and organic compounds- chemical pollutants within the human environment hazards to human health- metals and toxicity- degradable and non-degradable toxic substances- biochemical effects of heavy metals- toxicology and biochemical effects of pesticides- carcinogens and mutagens.

7. Environmental Biotechnology

Biotechnology and pollution abatement: aerobic and anaerobic treatment processes- bioreactors- biofilms- biofilters- immobilized enzymes- bioactivators- biodecolorization and deodourisation- Solid waste - bioconversion of industrial sludge, garbage, biotechnology of vermicomposting- Bioremediation- biodegradation- xenobiotics- heavy metals- Biostimulation- Bioaugmentation- biosorption, role of bacteria, fungi, algae. Macrophytes- constructed wetlands, biological detoxification- Molecular methods of pathogen destruction- PCR- 16s rDNA sequencing, recombinant DNA technology. Biochips- Biosensors- microarray.

8. Environmental Conservation and Management

Resources- Living and nonliving of land and water. Soil, water, forest resources exploitation by man. Control measures, conservation techniques, laws and regulations.

9. Environmental Waste Management

Wastes – sources of origin- classification- qualitative and quantitative analysis- Municipal solid wastes- MSW management- collection, transportation and disposal- methods and procedures. Management of agricultural, commercial/ industrial and household wastes- vermin-composting, biogas production, recycling, 3R's principles of Waste water treatment - rules and regulations.