

DEPARTMENT OF ENVIROMENT SCIENCE

PROGRAMME: B. SC.

Semester I

Paper I

Fundamentals of Environmental Science

Students shall be able to:

- Explain the basics of Environmental Science and importance of Environmental Education.
- Understand and explain the fundamentals of atmospheric science including formation, depletion and effects of ozone layer on environment.
- Explain the fundamentals of climatology and basic concept of clouds.
- Understand the basics of meteorology and analyze meteorological parameters (Humidity, pressure, wind speed and wind direction).

Paper II

Environmental Ecology

Students shall be able to:

- Explain basic concepts of Ecology and environmental factors: Abiotic, Biotic
- Understand and explain the concept of ecological relationships and ecological adaptations.
- Study the changes in Population by understanding the concept of Population ecology, and explain the concept of Marine ecology.
- Explain community ecology and ecological succession.

Practical

Students shall be able to:

- Determine Relative Humidity of air using Psychrometer consisting of wet and dry bulb thermometers.
- Determine wind speed and wind direction with cup and propeller type of Anemometer.
- Measure light intensity by lux meter.
- Measure solar constant.
- Study characteristics of plant communities (Density, Frequency and abundance) by quadrat method.
- Measure primary productivity in a water body by light and dark bottle method.
- Study food chain in an aquatic ecosystem.

Semester II

Paper III

Introduction to Water and Soil Chemistry

Students shall be able to:

- Explain characteristics of Surface, ground and sea Water and its degradation due to natural and man-made activities.
- Analyze physico-chemical characteristics of water.
- Understand and explain formation of soil and analyze soil for its physical and chemical properties.
- Discern types of soil erosion and apply methods of soil conservation.

Paper IV

Introduction to Ecosystem and Biodiversity

Students shall be able to:

- Explain basic concepts of Ecosystem and understand and discern Biochemical cycles.
- Understand and explain basic concepts of Production ecology; measure productivity of an ecosystem and discern biogeochemical cycles.
- Explain types of forests in India and understand and explain concepts of Deforestation, Afforestation, Joint Forest management and Social forestry.
- Understand and explain the concept of Biodiversity and apply the methods of biodiversity conservation.

Practical

Students shall be able to:

- Sample ground and surface water and store them.
- Analyze physico-chemical parameters (Colour, temperature, turbidity) for characterization and evaluation of water quality.
- Determine hydrogen ion concentration (pH) of water and wastewater.
- Estimate Total solids, Total dissolved solids and total suspended solids from water and wastewater by gravimetric method.
- Estimate conductivity, chlorides, alkalinity, acidity and total hardness of water and wastewater.
- Sample soil by quartering method.
- Analyze soil for bulk density, moisture content, water holding capacity and soil texture.

Semester III

Paper V

Environmental Chemistry and Instrumentation

Students shall be able to:

- Explain characteristics of Water; chemistry and structure of Surface and Ocean Water.
- Explain the Fundamentals of Atmospheric Chemistry and explain the sources and effects of Green House Gases and Global Warming.
- Discern basic instrumental methods and analyze pH and Conductivity.
- Understand advanced instrumental methods of Chromatography, Colorimetry and Flame photometry along with their principle and applications.

Paper VI

Environmental Microbiology and Water Treatment

Students shall be able to:

- Understand basics of Environmental Microbiology and discern Air, Soil and Water micro flora.
- Explain the Water supply and distribution system, spread awareness about water borne diseases and explain importance of Environmental Sanitation.
- Discern the unit operations, processes, mechanisms and significance involved in water treatment: Aeration, Coagulation, Flocculation, Sedimentation, Filtration and Disinfection.
- Understand the basic concepts and application of Modern water treatment techniques:

Water Softening (Lime Soda process, Zeolite Process, Demineralization Process), Defluoridation, and Reverse Osmosis.

***Practical
Section A***

Students shall be able to:

- Analyze water for its potability.
- Determine residual chlorine, demand and dose for provided water sample.
- Separate copper by Solvent extraction method (Cu-DDC).
- Separate Nickel by Solvent extraction method (Ni-DMG).
- Demonstrate principle, working, standardization and application of pH meter.
- Demonstrate principle, working, standardization and application of Turbidity meter.
- Demonstrate principle, working, standardization and application of Conductivity meter.
- Detect Ni_2^+ , Co_2^+ and Cu_2^+ from a provided mixture by paper chromatography.
- Determine alkali metals (Sodium and Potassium) from various samples by Flame Photometry.
- Demonstrate principle, working, standardization and application of Gas Chromatography.
- Determine Alum dose for Defluoridation by Nalgonda Technique.

Section B

Students shall be able to:

- Enumerate bacteria from air, water and soil.
- Demonstrate bacteria from air, water and soil.
- Observe motility of organisms by Hanging drop technique.
- Apply differential gram staining.
- Determine total coliforms of water by MPN technique.
- Study microorganisms by standard plate count (SPC) method.
- Determine optimum coagulant dose, pH and time by Jar Test Apparatus.

Semester IV

Paper VII

Soil Pollution and Waste Management

Students shall be able to:

- Explain the basic concepts of Soil Pollution, soil pollutants, pesticide pollution and land protection.
- Understand the basic concept of Municipal solid waste and collect, handle, treat and dispose Municipal Solid Waste (MSW).
- Discern the solid waste management methods and explain the processing of solid waste.
- Explain the basic concepts and apply various methods of Hazardous and Biomedical Waste management.

Paper VIII

Natural Resources and GIS

Students shall be able to:

- Explain the concept of Natural Resources: Renewable, Non-Renewable.

- Understand and explain the Earth's Resources: Land, Mineral, Water.
- Discern the natural catastrophes, interpret risk assessment and apply disaster management methods.
- Understand and apply the concept of Remote sensing, Image processing and GIS.

***Practical
Section A***

Students shall be able to:

- Sample soil by quartering method.
- Sample soils from different polluted sites.
- Determine cation exchange capacity of provided soil sample.
- Determine sodium adsorption ratio.
- Determine nitrogen, phosphorous and potassium of soil.
- Determine total organic carbon and present organic matter from the given soil sample.
- Analyze soil sample for micronutrients (Fe, Zn, Mn).
- Determine solid waste index.
- Determine moisture content of a solid waste sample by gravimetric method.
- Determine calorific value of Municipal solid waste sample by bomb calorimetry.
- Determine volatile and non-volatile matter in a Municipal solid waste sample.

Section B

Students shall be able to:

- Demonstrate non-conventional energy resource system: Solar cooker, solar water heater.
- Determine solar intensity by Lux meter.
- Study biogas plant and analyze biogas slurry for acidity, alkalinity and solids (Total solids, total suspended solids).
- Analyze vermicompost for physico-chemical parameters with respect to total nitrogen and phosphate.
- Measure rainfall by Rain gauge.
- Analyze ground water quality for Total solids, Fluoride and Iron for its potability test.
- Study remote sensing techniques.
- Interpret techniques for aerial photographs and satellite imageries.
- Map vegetation by using Aerial Photographs.
- Map vegetation by using Satellite imageries.
- Demonstrate land use pattern of the region.

Semester V

Paper IX

Principles of Air and Noise Pollution

Students shall be able to:

- Explain the basic concepts of Air Pollution, air pollutants and meteorology.
- Understand the global problems, prevention and control measures of air pollution
- Interpret the legislative measures of Air pollution and genesis of vehicular pollution
- Understand and explain the basic concepts of noise pollution along with its prevention and control

Paper X

Environmental Management

Students shall be able to:

- Explain the basic concepts of Environmental impact Assessment (EIA) and Environmental impact Statement (EIS), Public Participation.
- Apply the impact assessment methodologies, its assessment and legislation of EIA
- Analyze and carry Environmental Audit (EA) for industries and interpret the significant Environmental Acts.
- Understand the concept of sustainable development and people's participation in Environmental protection and environmental issues.

Practical

Section A

Students shall be able to:

- Determine the suspended particulate matter (SPM) and (RSPM) in ambient air by using High Volume Sampler.
- Carry-out comparative analysis of air sampling from Residential, Commercial and Industrial zone using key parameters like SO_x and NO_x.
- Determine settleable particles in air using Dust fall jar apparatus.
- Prepare and interpret wind roses.
- Determine the concentration of carbon monoxide (CO) in a given auto exhaust air sample.
- Determine the concentration of acid rain in air sample.
- Measure and compare the noise pollution by noise meter in silent, industrial, residential, commercial zones with standards specified.
- Demonstrate electrostatic precipitators, scrubbers, cyclone collector, gravity settling chamber and its working.

Section B

Students shall be able to:

- Prepare Environmental Audit Report, model of EIA report.
- Carry out the study of natural environment of the area with respect to the air, noise, water, soil, and socio-economics.
- Carry out the study of EIA legislation for environmental protection.
- Concentration of hydrocarbons in a given auto exhaust air sample.
- Determine the sulphonation rate by lead peroxide method.
- Determine ammonia in atmosphere.
- Determine Air Pollution Index (API).
- Study the impact of air pollution on photo density flux of plant leaves.
- To estimate the effect of exhaust gases on chlorophyll content in different plants.

Semester VI

Paper XI

Water Pollution: Monitoring and Management

Students shall be able to:

- Explain the basic concepts of Water Pollution, water pollutants and water quality monitoring with its management.
- Understand the global problems associated with water pollution: Marine and Oil

Pollution, and the concept of eutrophication.

- Interpret the basic concepts, effects and mitigation measures of thermal pollution.
- Understand and explain the basic concepts, effects of radioactive pollution and discern the various disposal methods of radioactive waste.

Paper XII

Water Supply and Wastewater Treatment

Students shall be able to:

- Explain the water distribution system, methods of water supply, design consideration in distribution system and the concept of environmental sanitation.
- Understand the general aspect of wastewater treatment and discern the preliminary and primary treatment methods
- Discern the biological wastewater treatment: secondary and tertiary treatment methods, and interpret the sludge handling treatment and disposal methods.
- Understand the concept of industrialization and the types of industrial effluents, and explain the unit operations for industrial wastewater treatment.

Practical Section A

Students shall be able to:

- Determine Zn^{++} , Cd^{++} , Pb^{++} by complexometric titration.
- Determine sulphate and phosphate in given water sample.
- Estimate nitrate by PDA method and total Kjeldahl's nitrogen in given water sample.
- Estimate BOD_3 and determine COD in given sample.
- Demonstrate eutrophication of polluted lakes.

Section B

Students shall be able to:

- Determine Sludge Volume Index (SVI) of waste water sample.
- Estimate Phenol in given waste water sample.
- Estimate Sodium and potassium in sewage sample.
- Demonstrate UV-Visible spectrophotometer, AAS and Gas chromatography.
- Determine oxygen consumption in normal fish/snail at different temperature.
- Estimate the toxicity of heavy metals using fish/snail as test animal and determine LC_{50} value.
- Estimate chromium in a waste water sample.
- Demonstrate Poly aromatic hydrocarbon (PAH) in water and wastewater.