

**M.Sc. PART II**

**PAPER V**

**Environmental Toxicology and Hygiene**

**[a] Environmental Toxicology :**

1. **General Principles :** Introduction to toxicology, definition of toxicity and related terminologies, classification of toxicants, criteria for selection of chemical for testing, dose, dose-response relation, additive-synergistic and antagonistic effects, factors affecting toxic responses, route of administration, absorption, distribution, excretion, metabolism, toxicity testing acutes, sub-acute, and chronic toxicity.
2. **Toxic Agents :** Pesticides (2) Metals (3) Solvents and Vapours (4) Radiation and Radioactive Materials (5) Chemical Carcinogens (6) Food additives and contaminants (7) Air pollutants (8) Water and soil pollutants.
3. **Principles of Systematic Toxicology :**
  - (a) Neurobehavioural toxicology
  - (b) Cardio-vascular toxicology
  - (c) Respiratory and Inhalation toxicology
  - (d) Biochemical Toxicology
  - (e) Reproductive toxicology
  - (f) Genetic toxicology
4. **Application of Environmental Toxicology :**
  - (a) Regulatory toxicology
  - (b) Toxicology and law
  - (c) Occupational toxicology
  - (d) Eco-toxicology.
5. **Environmental and Medical Ethics.**

**[b] Environmental Hygiene :**

1. Introduction, definition, basic concept of environmental hygiene, function and extension.

2. **Type of chemical hazards : hazards due to organic gases / vapour; solvents, particulate matter.**
3. **Physical hazards : heat, noise radiation, vibration, illumination, micro waves, radio waves, high voltage electricity and magnetism.**
4. **Impact of Industrial pollutants with reference to human system, chemical nature of pollutant, its entry in human body.**
5. **Industrial hygiene surveys and record monitoring system.**
6. **Work-place environmental monitoring, biological monitoring etc.**
7. **Criteria for safe working TLV, MAC, STEL, ceiling values etc.**
8. **Type of occupational diseases with reference to industries.**
9. **Factory Act and legislation.**
10. **Industrial safety, accidents and work practice, workers education, engineering control technology and intervents on programme etc.**
11. **Ergonomics.**
12. **Industrial sanitation.**

## M.Sc. PART II

### PAPER VI

#### Waste Utilisation Management

1. General : Wastes as consequences of life, impacts of waste generation, standard, of life and waste quantities, public attitudes to waste utilisation and recycling, historical developments, challenges and opportunities, problems created by solid wastes due to throw away society and sustainable society.
2. Solid Wastes : Sources, types, composition, generation rates, onsite storage, collection, analysis, processing, transfer and transport, volume reduction, component separation, wealth from wastes, dewatering and drying, recovery of chemical and biological conversion products, material recovery system, flow sheets, disposal sites, leaching and its movement, landfilling, ocean disposal, incineration pyrolysis.
3. Industrial and Hazardous Wastes : Sources of generation, identification, classification, collection, transfer and transfer locations at disposal sites, compatibility of waste components w.r.t. Flammables, explosives, oxidising agents, reducing agents, reactives, mists, etc. case studies. Radio active wastes from nuclear reactors and other related industrial and their disposal problems.
4. Liquid Wastes : Recycling nutrients and trace inorganics, hydroponics, case studies of applications to maize products, pharmaceuticals, inorganic chemicals, textiles, pulp and paper, agro Industries, electroplating, petrochemicals, refineries, chloralkalies, etc. biomanagement for waste utilisation, recycling of phosphorus, lime, alum and chemicals, solar energy applications to zero effluent flow systems, pisciculture and engineered aquaponic systems, recycling of nutrients of nightsoil.
5. Gaseous Wastes : Scrubbers, crystallisers, economics of recovery of by-products or process modifications in air pollution control technology, case studies.
6. Linear Programming : Linear programming applications in collection, transportation and transfer of waste, transport problem.

## M.Sc. PART II

### PAPER VII

#### Environmental Management Systems - Specification & Legislations.

1. Scope , Terminology - Continual Improvement, Environment, Environmental Impact, Environmental Impact Evaluation, Environmental Impact Register, Environmental Management, Environmental Management Audit, Environmental Management Manual, Environmental Management Programme, Environmental Management Review, Environmental Management System, Environmental objectives, policy and target, Interested Parties, organization and varification activities.
2. Environmental Management System Requirements.  
Environmental Management System, Policy, organizational and Personnel-Responsibility Authority and Resources, management representative, Personnel, communication and Training , contractions.
3. Environmental Impacts - Register of Legislative , Regulatory and other policy requirements, Environmental effects evaluation and Register, Environmental Management Programme, Environmental Management Manual and documentation, operational control, Environmental Management Records , Environmental Management Audits.
4. A. Legislation : Common Law, historical law, role of legislation in pollution control, constitutional guarantees to environmental protection water laws, river laws, riparian rights.  
B. Pollution Control Acts : Familiarisation with important section and clauses of water, cass and air (Prevention and Control of Pollution) Acts, of 1974 , 1977 and 1981, with lacunae therein, appreciation of environmental projection Act, 1986 as improvement over previous acts, limitations.
5. A. Other Related Acts : Factory Act, 1948; Atomic Energy Act,1962' Insecticides and Pesticides Act., 1960 with their limitations.  
B. General : Role of courts and appellate authorities, need for special environmental protection courts, importance of consent, NOC and NA (Non - Agricultural) application proforma, role of voluntary agencies as campaigners and crusaders.

## **M.Sc. PART II**

### **PAPER VIII**

#### **Environmental Modern Analytical Techniques & Instrumentation.**

1. A. **Statistical Analysis :**  
Standard deviation , Errors, Limits of detection and determination, calibration graph and Regression analysis, Accuracy and Precision, Sensitivity , Selectivity.
- B. **Sampling :**  
Heterogeneity, the time factor, Errors arising during sampling, storage and preparation of samples.  
Standard methods for air , water , waste water and solid analysis.  
Identification of cations and anions formed in the environment  
integrated approach to analysis of unknown samples.
2. **Separation Techniques :**  
Solvent Extraction and Chromatographic methods of analysis.  
Principle Instrumentation and application of GC, GLC, HPLC, GC-MS, Ion Exchange, Ion Chromatography for environmental analysis.
3. **Spectroscopic Methods :**  
Principle and applications of UV, Visible, IR, FT-IR, NMR, <sup>13</sup>CNMR, Fluorimetry , X- ray, Atomic Absorption and Plasma Emission spectroscopy
4. A. **Electroanalytical Methods :**  
Polarography, Ion selective Electrode, Enzyme Electrode, Biosensors and stripping voltametry.
- B. **Radiochemical Methods :**  
Principles and Applications of Activation Analysis and Tracer Techniques in environmental analysis, Isotopic dilution and Radio immuno assay.
5. A. **Other Techniques :**  
Complexometric methods, Nephelometry, Turbidimetry, Flame-Photometry and Automation Analysis.
- B. Principles and Instrumentation of monitoring equipments - D.O. analyser, ion probe, SO<sub>2</sub> analyser and NOX analyser.