

**Tamil Nadu Public Service Commission**  
**Syllabus**  
**Environmental and Chemical Engineering**  
**(PG Degree Standard)**

**Code: 393**

**Unit I: Environmental Policy, Environmental Legislations and Environmental Impact Assessment (25 Questions)**

National Environment Policy - International Conventions and Obligations, International treaties of Environment-Water (P&C) Act, 1974 as amended - Air (P&C) Act, 1981 as amended - Environmental Protection Act, 1986 with amendments and Rules and Notifications made under Environmental (Protection) Act, 1986 for the management of hazardous waste, solid waste, e-waste, bio-medical waste, plastic waste, C & D wastes, battery waste etc., EIA - Notification, Methodology, models, Environmental Monitoring and Management Plan, Public consultations as per EIA Notification.

**Unit II: Environmental Chemistry and Environmental Microbiology (15 Questions)**

Chemical mass balance – Emission calculations – Green Chemistry principles –Aquatic Chemistry - Atmospheric Chemistry and Soil chemistry – Representative sample collection techniques- Field and lab analysis - Wet and Instrumentation Methods - Chemical speciation, Classification and Characteristics of microorganisms - Microorganisms in wastewater and air - Applications of microorganisms in wastewater treatment and soil remediation.

**Unit III: Principles & Design of Physico-Chemical treatment of Wastewater (20 Questions)**

Water Quality criteria and indices - Wastewater characteristics - Unit operations - Principles and design of screens, grit chamber, skimming tanks - Flow equalisation and neutralisation - Aeration and gas transfer mechanisms – Sedimentation -Types of settling – analysis and Design of Sedimentation tanks - Process and design of filtration systems - Adsorption, ion exchange, electro-coagulation, Electrodialysis, reverse osmosis – RO reject Management - Disinfection.

**Unit IV: Principles and Design of Biological Treatment of Waste water (25 Questions)**

Types of Reactors - Mass Balance Analysis - Reaction and Reaction rates - Suspended growth process - Role of microorganism - Growth kinetics, oxidation, modelling, mCRT, F/M Ratio, Bio kinetic coefficients - Design of activated sludge process, Plug flow Reactor, Aerated lagoon - Oxygen Requirement, transfer of oxygen, Equipments- Secondary clarifier, Sludge Volume Index, Sludge production, Operation and maintenance, Attached growth process - Trickling filter - process, substrate removal, classification, design, NRC, Rankine's and Eccenfelder equation - Rotating Biological contactors - UASB - Sludge digestion - sludge management – Advanced Biological Treatment – SBR, MBR, ANSBR.

### **Unit V: Air and Noise pollution Control (15 Questions)**

Sources and Effects– Classification-Photochemical reactions, Atmospheric Stability-Lapse Rates, Inversions, Plume Behaviour -Pollutant Dispersion, Emission Standards and Air Quality Standards, Air Quality Index, Methods of Pollutant Sampling and Measurement, Continuous emission and Air Quality monitoring. Control Methods for Particulate Emissions, Black carbon and Gaseous Pollutants; Indoor Air Pollution, Automobile Pollution-Emission Norms and Control Techniques, Source apportionment studies, Noise Pollution – Source – Effects – Standards - Measurement and Control Measures - Industrial Noise Measurement and control.

### **Unit VI: Solid and Hazardous Waste Management (25 Questions)**

Sources, generation rate, classification and characteristics - source segregation and storage - methods of collection - transportation - route optimisation – treatment –Incineration, Pyrolysis, Composting, MBT and Landfilling, Bioremediation ,Bioaccumulations - disposal – Coprocess - Centralised and de-centralised processing - Landfill design and operation - Dumpsite rehabilitation, Management of hazardous waste, biomedical waste, plastic waste, construction and demolition wastes and E waste - Resource recovery, recycle, reuse and product development from waste.

### **Unit VII: Statistical Approach and Modelling of Environmental Systems (15 Questions)**

Principles of Environmental modelling, Statistical approach, model building, environmental models, Data Sampling – Distributions – Inference - Estimation – Hypothesis Testing, Calibration, Validation, and Sensitivity Analysis. Types of air quality models-dispersion and emission models, chemical and ecological models, Pollutant and nutrient dynamics. Operational control of wastewater treatment processes, microbial dynamics calculations, Surface and ground water Modeling.

### **Unit VIII: Industrial Pollution Prevention and Cleaner Production Technologies (25 Questions)**

Industrial Manufacturing process description, Wastewater Characteristics, Source reduction, Treatment and disposal, key issues emerging contamination and pollution control measures for highly polluting industries such as Paper and Pulp, Sugar, Distillery, Chemical plants - Metal finishing, Iron and Steel, fertilizer, Meat packing, Poultry plant - Automobile - Thermal power plants, Cement Plants, Textile dyeing, Tanneries, Pharmaceutical, pesticides, petroleum refinery and petrochemicals - Integrated Waste Management for zero discharge, Cleaner production process including process modification, raw material substitution - Recycle and reuse of waste.

### **Unit IX: Environmental Safety and Risk Assessment (15 Questions)**

Health and Safety systems in work places. Hierarchy of control measures for occupational health risks. Accident, causes, mechanical and electrical hazards and preventive steps. Role of personal protective equipment and the selection criteria. Significance of human factors in the establishment emergency preparedness. Qualitative and quantitative risk assessment- Hazard identification and control, Hazard assessment, Overall risk contours for different failure scenarios – disaster management plan – Safety measures design in process operations. Ergonomics effects on humans. Inspections and audits, safety policies, EHS issues.

**Unit X: Sustainable Development, Environmental Management and Economics and Global, Regional and Local Environmental Issues (20 Questions)**

Sustainable Development Principles - International Conventions and treaties-Sustainable Development Goals and Indicators, Environmental Management Systems – ISO 14001, 19000 - Environmental Auditing – Ecolabelling- Life cycle Assessment-Design for Environment, Economics of pollution prevention - Cost Benefit Analysis - Circular economy - Economic instruments for environmental protection - Pollutant tax and emission trading - Natural resource economics, Green building concepts.

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