

UNIVERSITY OF MUMBAI

Syllabus for PET Examination

Name of Subject: Environmental Science, Faculty of Interdisciplinary Science, Subject Code:

UNIT - I: Fundamentals of Pollution

Basic Concepts of Air Pollution: Definition, Sources (Natural and Anthropogenic), Chemistry of Air Pollutants, Classification-Primary Air Pollutants, Secondary Air Pollutants & their Adverse Effects of Air Pollutants, Air quality standards and Index, Environmental Segments and Structure of the Atmosphere. Global Problems Associated with Air Pollution: Ozone Layer Depletion, Green House Effect, Global Warming and Climatic Changes, EL-Nino and LA-Nino, Acid Rain, Photochemical Smog, Indoor Air Pollution and Vehicular air pollution, Air Pollution Episode

Air Pollution Control Technology: Methods of Control of Air pollution, Air Pollution Control Equipment (Gravity Settling Chamber, Electrostatic Precipitator, Cyclone Collector, and Wet Scrubbers)

Basic Concepts of Noise Pollution: Sources of Noise Pollution, Properties of Sound, Sound Pressure and Intensity Levels, Measurement of Noise, Measurement and Analysis of Sound, Equipment Used for Noise Measurements, Effects of Noise Pollution, Approaches for Noise Control

Basic Concepts of Water Pollution: Sources and Effects of Water Pollution, Types of Water Pollutions, Marine pollution, Self-Purification of rivers, Oxygen Sag Curve, Zones of Pollution.

Water Pollutants: Water Sampling, Objectives, Selection of Sampling Site, Types of Water Samples, Sampling Equipment, Classification of Water Quality Parameters (Organic, Inorganic, Nutrient & Heavy metals), Basic Concept, Significance and Measurement of DO, BOD, COD, Phenol, Polynuclear Aromatic hydrocarbon (PAH) in Water and Wastewater, Bacteriological and Biological examination of water, Approaches to Prevent & Control of Water Pollution, Legislative Measures, Rain Water Harvesting methods for water conservation.

Thermal Pollution: Definition, Sources, Effects of Thermal Pollution, Control Measures and Methods

Unit - II: Fundamentals of Soil Sciences

Soil Chemistry: Introduction to Soil Chemistry, Composition, Soil Profile, Formation of Soil, Physico-Chemical Properties of Soil, Soil Reactions (Cation & Anion Exchange Phenomenon), Classification of Soils and their Characteristics, Major Nutrients of Soil, Nitrogen Pathways and

NPK in Soils, Bio-fertilizer and their Types, Humus Formation, Nature and Properties of Humus, Clay-Humus Complex, Significance of C: N Ratio.

Soil Pollution: Sources, Consequences, and Control Measures. Land Use Planning, Soil Surveys in Relation to Land Use Planning, Methods of Site Selection and Evaluation, Bioremediation and Restoration of Contaminated Soil.

UNIT - III: Environmental Chemistry

Introduction to Environmental Chemistry: Basic Principles Involved in the Analysis Various Constituents Present in the Environment, Water Structure and Anomalous Behavior of Water, Acid base reactions, solubility product, solubility of gases in water, the carbonate system, unsaturated and saturated hydrocarbons, Green Chemistry for Sustainable Future: Principles and Application of Green Chemistry.

General Chemistry: Classification of Elements, Theory of Valence, Gas Laws, Chemical Bonds, Measurement of Mass, Temperature, Volume, Length, Pressure, Density, Viscosity & their Uses. Basic Concepts from Quantitative Chemistry: Buffers & pH, Colorimeter, Lambert's Law, Beer's Law, Principles of Colloidal Chemistry, Emulsions. Physical Chemistry: Gibb's Energy, Chemical Potential, Chemical Equilibrium, Chemical Reactions, Solubility Product, Solubility of Gases in Water, Stoichiometry, Principles of Oxidation and Reduction, Adsorption & Absorption.

UNIT - IV: Solid and Hazardous Waste Management

Introduction, Classification, Origin, Characteristic of Solid Waste, Methods of Solid Waste Treatment and Disposal, Pyrolysis, Recycling and Reuse of Solid Waste and Management, Solid Waste Handling Methods, Segregation and Salvage, Status of Municipal Solid Waste. Solid Waste Management: Introduction, Vermiculture, Composting, Biogas from MSW, Land Fill (Site Selection, Site Investigation and Site Characterization), Landfill Planning and Designing, Construction & Operational Practices, Landfill Quality and Control, Municipal Solid Waste (Management and Handling Rules 2000), Biomedical waste and its management, Categories, recycling techniques.

Hazardous Waste: Classification, Identification, Sources and Characteristics of Hazardous Waste, Collection, Storage, Transportation, Hazardous Waste Testing in Terms of Toxicity, Corrosively, Ignitability and Reactivity, Priority Pollutants, Acute and Chronic Toxicity, Bioaccumulation, Mutagen city, Teratogenicity, Carcinogenicity and Genotoxicity.

Hazardous Waste Treatment & Management: Physico-Chemical, Biological and Thermal Destruction of Hazardous Wastes, Incineration, Pyrolysis, Wet Air Oxidation, Secured Landfill Bioremediation, Biodegradation of Recalcitrant, Xenobiotics Treatment, Guidelines for Identification of Landfill for Hazardous Waste Disposal Leachate Management. Waste

Minimization, Recycle and Reuse of Hazardous Waste, Recovery of Chemicals from Hazardous Wastes, Management and Handling Rules, India-1989, Categories of Biomedical Waste, Contaminated Site Remediation- Ex-Situ and InSitu Approach, Landmark Episodes.

UNIT - V: Water & Waste Water Treatment

Water Treatment: Portability of Water, Objectives, Treatment of Water for Drinking Purpose, Coagulation, Flocculation, Sedimentation, Filtration (Rapid & Slow Sand Filters), Pressure Filter, Disinfections.

Water Softening Methods: Temporary Permanent Hardness Removal, Lime Soda Process, Zeolite Process, Demineralization Process, Iron and Manganese Removal; Fluoridation; Defluoridation.

Wastewater Treatment: Sources of Wastewater, Objectives of Treatment, Preliminary Treatment, Selection and Applications of Screens (Bar Screens, Fine Screens, Self Cleaning and Cutting Screens), Grit Chambers (Aerated & Plain), Primary Treatment-Sedimentation (Septic Tank & Imhoff Tank), Primary Treatment: Plane Sedimentation with Coagulation, Filtration & Disinfection Methods, Secondary Treatment (Biological Methods): Activated Sludge Process, Oxidation Pond & Trickling Filter and Up-flow Anaerobic Sludge Blanket Reactor, Tertiary Treatment: Adsorption, Ion Exchange, Electrolysis, Reverse Osmosis & Treatment with Activated Carbon, Sludge Handling Treatment and Disposal, Composition & Characteristics of Sludge, Need for Disposal, Operation & Maintenance of Wastewater Treatment Plant

UNIT - VI: Energy Resources & Environmental Management

Natural Resources: Conservation and Management, Definition, Broad Classification, Renewable, Non Renewable and Mineral Resource Renewable (Non-Conventional Source of Energy): Solar Energy, Wind Energy, Geothermal Energy, Tidal Energy, Biomass energy (Bio Gas), Ocean Energy and Magneto- hydrodynamic Power (MHD), Impact on Environment and their applications, Energy Production & Consumption.

Non Renewable (Conventional Source of energy): Thermal Power, Hydro Energy Atomic Energy, Nuclear Energy (Fission and Fusion) and Fossil fuels (Coal, Petroleum Oil and natural Gas).

Environmental Management: Environmental Impact Assessment, Environmental Audit, Concept of ISO 9000 and ISO 14000 in Environmental System Management, Basic Concept of Sustainable Development, Constitutional and Statutory Laws in India, Salient Features of Coastal Zone Regulations (CZR) Notification, the Convention of Biodiversity. (Several Case Studies to be given as Assignment), Environmental laws in India

UNIT - VII: Instrumental Techniques in Environmental Analysis & Errors

Chromatography: Definition of the Term Chromatography-Theory of Chromatographic Separation, Stationary and Mobile Phases, Classification of Chromatographic Separations, Spectrophotometry Principle, working and applications of various like UV Visible Spectrophotometer, Infra red (IR) Spectrophotometer, Nuclear Magnetic Resonance (NMR), Atomic Absorption Spectrophotometer (AAS), Flame Photometer, Conductivity Meter, Nephelometer/Turbidity Meter, pH Meter.

UNIT - VIII: Ecology, Biodiversity and Wildlife Biology

Introduction of Ecology: Definition, Subdivision, Modern Branches of Ecology, Applications and Significance to Human Beings Ecosystems: Types of Ecosystem-Aquatic Ecosystem-Ocean and Pond Ecosystem, Terrestrial Ecosystem-Forest, Desert and Grassland Ecosystem. Structure and functions of Abiotic and Biotic components, Energy flow, Food chains, Food web, Ecological pyramids, Biogeochemical Cycles in environment (Gaseous & sedimentary type), Hydrological cycles.

Biodiversity and its conservation: Definition 'Hotspots' of Biodiversity Strategies for Biodiversity conservation National Parks and Sanctuaries, Common flora and fauna in India, Endangered and Threatened Species, Methods of Wildlife Conservation Project Tiger, Project Elephant and Project Crocodile, Ex-situ' Conservation (Zoos) 'In-situ' Conservation (National Parks and Sanctuaries) Wildlife Conservation: Importance of Conservation, Reason for extinction of wildlife, Classification of Scarce Wildlife, History of Wildlife Conservation, Wildlife Conservation in India, Endangered Species of India, Hot Spot Biodiversity in India.