(4)

M Tech

4) ENVIRONMENTAL ENGINEERING

G.S- EV

Syllabus & Model Question Paper

Syllabus

Environmental Chemistry, Biology and Ecology: Chemistry: Basic concepts of physical chemistry – Osmosis, Dialysis, Adsorption, Pollution Parameters – pH, COD, BOD, DO, TOC, Nitrogen, Fluoride, Sanitary Significance of Sulphate, Nitrates and Phosphates.

Microbiology: Plant kingdom, Animal kingdom, Morphology and Growth of Bacteria, Air, Water and Soil, Microbiology, Virology, Microbial Metabolism of Pesticides ad Heavy Metals.

Ecology: Ecosystem concepts, Food Chain and Food Web. Energy Flow in Ecosystem – Lotic and Lentic Systems, Eutrophication of Lakes. Population Growth Forms, Carrying Capacity, quantitative Ecology, Concept of Ecosystem.

Environmental Fluid Mechanics And Water Resources Engineering: Fluid properties and classifications, Newton's Law of Viscosity, Fluid Pressure and its measurements; Hydrostatics, Kinematics of Fluids, Bernoulli's equation, Momentum equation; Flow through Pipes – Darcy's equation, Friction factors, Pipes in Series, Parallel and equivalent pipe, minor losses; Flow measurements – Orifices, Mouthpieces, Notches, and Weirs; Flow in Open Channels – Uniform Flow, most economical sections, specific energy, critical flow, hydraulic jump; Water Hammer in pipes, impact of Jet on Vanes, Turbines – types; Pumps – Types, working and problems; Quantitative and Qualitative Hydrologic Cycle, Precipitation and Runoff Estimation. Unit Hydrographs, Stream Flow Analysis – time series, return period, mass diagrams for computing storage capacity, stream flow measurement; Groundwater – Definitions, type of Aquifers; Well Hydraulics – Steady state, Basic equation of groundwater flow. Open and Tube wells – type. Yield estimation, drilling maintenance of borewells; Artificial recharge, water conservation and Reuse, Soil conservation, Economic aspects of water resource planning.

Water Supply and Treatment: Drinking and Industrial Water Quality Standards; Water Quantity based on various demands; Types of intakes, raising main economics, Pumps in series and parallel. Hazen William Equations, Types of reservoirs, Preventive maintenance, regional water supply system; Physico-chemical and Bacteriological characterization of water – surface and sub-surface; Aeration, coagulation and Flocculation, Sedimentation, Filtration - slow rapid and pressure; Hardness and colour removal; Disinfection process – Mode, rate and factors; Corrosion and corrosion control; Operation and Maintenance of water treatment system.

Wastewater and Treatment: Quantity of Domestic Wastewater, characteristic wastewater, Disposal of Sullage water in rural areas; Classification of Watewater Treatment Techniques – Unit operations and process; Screening, Grit Chamber, primary, sedimentation; Biological units: Suspended and fixed growth system, Aerobic and Anaerobic systems, activated sludge process, Trickling filters, RBC, Biofilter, Secondary sedimentation tank, Stabilization ponds – aerobic, facultative and Anaerobic Lagoons, Septic tanks, digesters, sludge drying beds; Industrial Wastewater Survey; Variation in

Quantity and Quality of Industrial wastewater; Guidelines for discharge of Industrial Effluent on land into Muncipal Sewers and Natural water; Joint treatment, volume reduction, strength reduction, equalization neutralization and proportioning; Estimation of process kinetic parameters; Origin, characteristics and treatment of cane sugar industry, diary, distilleries and pharmaceuticals; Wastewater reuse and waste recovery from different industries.

Solid and Hazardous Wastes Management: Sources, Composition and properties of Municipal Solid Wastes, Solid Waste Generation, storage and processing at source; Landfill – Classifications, types, control of gases and leachates, preliminary design of landfills; Separation, Transformation and recycling – size reduction, density separation; Thermal processing – combustion, pyrolysis, gasification, energy recovery; Composting – Aerobic and Anaerobic digestion and energy production; Incineration – Types, processes, heat recovery, incineration products; Definition, sources and classification of Hazardous waste; Characterization of Harardous Waste – Ignitability, Corrosivity, Reactivity, Toxicity, Quantification, Waste Minimization; Toxicology – Toxic effects, Carcinogens, Ecotoxicology, Toxicology Assessment; Physico-chemical and Biological treatment – Air stripping, Soil vapor extraction, carbon absorption, steam stripping, stabilization and solidification. Slurry phase and solid phase treatment. Thermal methods – combustion, liquid injection; Land disposal and site remediation, monitoring of disposal sites. **Atmospheric Pollution and Control:** Atmospheric structure and composition, Air pollution episodes; Sources and classification of air pollutants – Natural and anthropogenic, primary and secondary pollutants. Properties of major air pollutants along with sources and sinks – particulate and gases, photochemical air pollutants, air pollution due to automobiles; Air pollution effects on human health and welfare, vegetation, animals, materials and structure/ monuments, visibility problem, acid rain, green house effect, Ozone depletion and heat island effect; Measurement of air pollutants – Measurement of gaseous and particulate pollutants, sample train, air pollution indices and index; Air pollution Meterology – scales, factors like heat, solar radiation, temperature, lapse rate, wind, humidity, precipitation, mixing height, pressure atmospheric stability conditions, wind velocity by profile, windrose diagram; Atmospheric dispersion of stack effects – Plume rise, effective stack height, plume rise formulations, gaussian dispersion coefficients, ground level concentration; Air pollution control equipments – setting chambers, inertial separators, cyclones, fabric filters, scrubbers, ESP. Control of gaseous pollutants – adsorption, absorption, combustion and condensation. **Transport Processes and Water Quality Assessment:** Process Dynamics – Transport and Reaction Process, Material Balance, Kinetic Approach to Equilibrium; Mechanics of Mass Transport – Diffusive Mass Transport and convective Mass Transport in Molecular and Turbulent Flow Regimes; Chemical Thermodynamics – Free Energy, Entropy Formation, Effects of Ionic Strength on the value of equilibrium constant. Simultaneous reactions. Factors affecting equilibrium concentration and their temperature effects; Process Kinetics – First order reaction, parallel, reversible and enzyme reaction; Gas Absorption and Adsorption, Particle treatment, Ion exchange and electrodialysis; Groundwater Quality – Basic Differential Equation, 1-D and 2-D approaches; Ultimate Disposal of wastewater in water bodies and on land; Wastewater disposal in rivers – effects of Oxygen demanding outfall, pipe and diffuser outfall; Wastewater disposal in Lakes – Steady state 'DO' analysis for completely mixed and

stratified lake, nutrient loading; Wastewater disposal in estuaries – characteristics of Eastuarian flow regime; Wastewater disposal on land – application rate, leaching factor, SAR, Microbial effects on soils; Subsurface Water Quality Assessment – Impacts of point source, discharge and leachate from landfill sites. **Environmental Impact Assessment:** Introduction – Rapid and comprehensive EIA, Need of EIA studies. Baseline data. Hierarchy in EIA, Statutory requirements of EIA; Advantages and Limitation of EIA, Step-bystep Proceudre for conducting EIA; Objective and Scope of EIA; Environmental attributes, Public participation in EIA, Environmental and Dsiaster Management Plans; Project Activities – Attribute, Activity relationships, Matrices and BEES; Impact Quantifications – Hazardous Waste Dumpsites, Sanitary Landfilling; EIA of Infrastructural Projects – Highways, Airports, Water supply and Sanitation, Wastewater treatment; EIA of Construction projects – Effects and Mitigation; EIA of Water Shed Development Programme (Reservoirs, Dams, Irrigation and Agricultural Activity); EIA of Power projects – Hydro, Thermal and Nuclear; EIA of Industrial Developmental Process.

Model Question Paper

PART - I

Each question carries One Mark **50 x 1 = 50 Marks**

1) Sugar Industry effluent is generally referred as
   (a) High Strength Organic waste (b) Medium Strength organic waste
   (c) Low strength Organic waste (d) None

2) Sterilization of water kills
   (a) All microorganisms (b) Pathogens only
   (c) Beneficial microorganisms only (d) None

3) Water dispersed in air system is used in
   (a) Wastewater Treatment (b) Water Treatment
   (c) Solid Waste Treatment (d) Hazardous Waste Treatment

4) Wind: speed and direction are represented by

   (a) Gaussian Plume (b) Wind mill (c) Windrose Diagram (d) None

5) Instream standards refer to

   (a) Effluent Discharge Standards (b) Raw Wastewater Characteristics
   (c) Receiving Stream Standards (d) None

PART – II

Each Question carries Two Marks **25 x 2 = 50 Marks**

1) Adsorption process is a

a) physical phenomenon
b) physico-chemical phenomenon
c) biological phenomenon
d) chemical phenomenon .

2) Typical density of food wastes in solid wastes is

a) 300 kg / m^3
b) 130 kg / m^3
c) 195 kg / m^3
d) 290 kg / m^3

3) Settling velocity of a particle in a sedimentation tank is determined using

(a) Chezy's equation
(b) Hazen-William's equation
(c) Manning's equation
(d) Newton's equation

4) Ionization constants for solutions of weak acids and bases are expressed in interms of

a) pH b) p(x) c) pOH d) None

5) The relationship between Chlorine concentration and contact time is expressed by

a)C=tk b)t=Ck c)k=Ct d)C^n tp=k