

Syllabus for Post TA 16

Fundamentals of Environmental Chemistry & Separation Principle: Basic concept of atoms, mole, ideal gas law, Raoult's law, deviation from ideal behaviors, Stoichiometry, zeroth, first, second & third law of Thermodynamics, Gibbs' energy, property of solid, liquid & gases, phase behavior, critical Temp, Pressure and volume, chemical potential, chemical kinetics, thermal, mechanical & Chemical equilibria. Refrigeration cycles and system, Humidification & de-humidification. solubility of gases in water. Classification of solvents, polar & non-polar solvent. Basic concept of adsorption in separation, unsaturated and saturated hydrocarbons and their role in pollution.

Composition of air, Particles, ions and radicals in the atmosphere. Chemical separation. Unit operation & unit process for separation, filtration, crystallization, absorption, PSA, VSA, extraction, gas-liquid separation, Fluidized Bed Separation, drying operation. Basic refrigeration cycle, Basic Concept of Acute and chronic health hazards, threshold limit value, margin of safety, Major water borne diseases and air borne microbes and prevention methods.

Basic operations of Air Blowers, air compressors, vacuum pumps and mechanical separation devices.

Basic principles of analytical equipment's i.e. spectrophotometry, TLC, GC & HPLC etc. Spectrophotometry (UV-VIS, AAS, ICP-AES, ICP-MS), Electrophoresis, XRF, XRD, NMR, FTIR, GC-MS, SEM, TEM and relevance of data generated from analyses.

Basic Heat Transfer Fundamentals: Heat Conduction, Convection, Radiation Heat Exchangers – classification, overall and individual film coefficients, mean temperature difference, LMTD correction factor for multiple pass exchanger, Evaporation, single and multiple effect operation, material and Energy balance in evaporators, boiling point elevation.

Properties of fluid: Density, Specific gravity, Specific Volume, Dynamic Viscosity, Kinematic Viscosity, Vapour Pressure, Compressibility. Fluid pressure, Pressure head,

Pressure intensity, Concept of vacuum and gauge pressures, atmospheric pressure, absolute pressure, Simple and differential manometers, Bourdon pressure gauge, Concept of Total pressure on immersed bodies, center of pressure, Simple problems on Manometers. Fluid Flow: Types of fluid flows, Path line and Stream line, Continuity equation, Bernoulli's theorem, Principle of operation of Venturimeter, Orifice meter and Pitot tube, Derivations for discharge, coefficient of discharge and numerical problems. Flow Through Pipes: Laminar and turbulent flows; Darcy's equation and Chezy's equation for frictional losses, Minor losses in pipes, Hydraulic gradient and total gradient line. Various types of Pumps, turbines, blower and hydrodynamics of fluid.

Instrumentation & Engineering Drawing:

P & ID symbols – Line numbering – line scheduling – Typical P & ID diagrams, symbols of different types of valves and their application, Pumps, Gland & Stuffing box, drawing of vessels & supports such as bracket, saddle, skirt. Storage Tanks, Cyclone separators centrifuges, thickeners and filtration equipment's. Crystallizers, agitated vessel, jacketed and coil heated vessels. Double Pipe & Shell & Tube Heat Exchangers, Tray Columns & Packed bed column. Classification in Pipes, tubes and Piping design, series & parallel connecting pipes to process equipment, layout, Support for piping insulation, plant constructions, start-up and commissioning.

Process Dynamics & Control: Dynamic behavior of systems - derivation of transfer functions for first and second order systems, liquid level, temperature, pressure, flow and concentration control processes, linearization of nonlinear systems, interacting and non-interacting systems.

Properties of material:

Mechanical, Electrical and magnetic properties of materials, Deformation of materials, different types of welding and joints in pipe & tubes, Heat Treatment techniques, corrosion, theories of corrosion - control and prevention of corrosion, Engineering materials, Advanced materials (Biomaterials, nanomaterials and composites) with special reference to the applications in Pharmaceuticals & Drug development Industries. Laws of thermodynamics.

Air Pollution: Sources and types of Pollutants - primary and secondary pollutants, Criteria air pollutants. Principles and instruments for measurements of (i) ambient air pollutants concentration and (ii) stack emissions. Impact of air pollutants on human health, plants and materials. Acid rain. Control devices for particulate matter, Principle and working of settling chamber, centrifugal collectors, wet collectors, fabric filters and electrostatic precipitator. Indoor air pollution, Vehicular emissions and Urban air.

Heat, mass & energy balance of Fuel fired, Electric fired incineration, Emission standard guidelines etc. Basic concept of carbon & carbon sequestration and application in pollution mitigation.

Water Pollution: Types and sources of water pollution. Impact on humans, plants and animals. Measurement of water quality parameters: sampling and analysis for pH, EC, turbidity, TDS, hardness, chlorides, salinity, DO, BOD, COD, nitrates, phosphates, sulphates, heavy metals and organic contaminants, Microbiological analysis – MPN.

Noise Pollution: Noise dose and Noise Pollution standards. Noise control and abatement measures: Active and Passive methods. Vibrations and their measurements

(*Question from syllabus will be based upon basic fundamental & Numerical calculation)