2

2) CHEMICAL ENGINEERING

1. **Process Calculations**: Units and Dimensions, material and energy balances, humidity, combustion.
2. **Momentum Transfer**: Basic equations of fluid flow, flow of incompressible fluids in conduits, transportation and metering of fluids, dimensional analysis.
3. **Mechanical Operations:**Particulate technology, Size reduction, flow of fluids past immersed bodies, sedimentation, filtration, agitation and mixing.
4. **Heat Transfer:** Conduction, convection and radiation, heat transfer with phase change, design of double pipe and shell-and-tube heat exchangers, evaporators.
5. **Thermodynamics:**First and second law of thermodynamics, PVT relations, Thermodynamic properties of pure fluids and solutions, phase and chemical reaction Equilibria.
6. **Material Science:** Crystal geometry and structure determination, atomic structure and chemical bonding, crystal imperfections, phase diagram, deformation of materials and fracture, heat treatment, corrosion and its prevention, polymers and polymerization.
7. **Chemical Reaction Engineering:** Kinetics of homogeneous reactions, design of ideal reactors, non-isothermal reactors, catalysis, gas liquid reactors.
8. **Process Control and Instrumentation:**First order systems, closed loop system- controllers, P, I, D and on-off modes, stability, Control system design, pressure measurement, temperature measurement, thermocouples and pyrometers.
9. **Industrial pollution control:** Sources, sampling and analysis of waste water, waste water treatment-preliminary, primary, secondary and tertiary treatment, air pollution control-sampling and estimation, control methods of gaseous pollutants and particulates, solid waste management-origin, classification and treatment, noise control-determination of noise levels, noise control characteristics, acoustic absorptive materials.
10. **Chemical Process Industries:**Industrial gases and acids, chlor-alkali and cement industries, inorganic fertilizers, paints, pigments, varnishes, enamel, oils, fats, waxes, soaps, detergents, sugar, starch and allied industries, petroleum industries and petrochemicals. Coal, pulp and paper industries.
11. **Mass Transfer Operations:** Diffusion- types, measurements, mass transfer coefficients, theories of mass transfer, concept of stages, cascades operation, NTU, HTU; humidification, drying, adsorption, crystallization, absorption, distillation, liquid-liquid extraction, leaching.
12. **Process modeling:**Models and model building, principles of model formulations, precautions in modelbuilding, Fundamental laws: Review of shell balance approach, continuity equation, energy equation, equation of motion, transport equation of state equilibrium and Kinetics, classification of mathematical models. Mathematical Modeling and Solutions to the Following:Basic tank model – Level V/s time.Batch Distillation – Vapor composition with CSTRs in series time.

MODEL QUESTIONS

CHEMICAL ENGINEERING

PART – I

Each question carries one mark **50 X 1= 50 Marks**

1. With increase in the temperature, viscosity of a liquid
   a. Increases
   b. Decreases
   c. Remains constant
   d. May increase or decrease, depends on the liquid

2. In SI units, thermal conductivity is expressed in
   a. Watt/m, °K
   b. Watt/m^3, °K
   c. Watt/m^2, °K
   d. Watt/m^4, °K

3. Rancidity of the fatty oil can be reduced by its
   a. Decoloration
   b. Hydrogenation
   c. Oxidation
   d. Purification

4. Vacuum filter is most suitable for the
   a. Removal of fines from liquid
   b. Liquids having high vapor pressure
   c. Liquids of very high viscosity
   d. None of these

5. Black smoke coming out of the chimney of a furnace is an indication of the use of …….. in the furnace.
   a. Low amount of excess combustion air
   b. Large quantity of excess combustion air
   c. Hydrocarbon fuel
   d. Pulverized coal as fuel

PART - II

Each question carries two marks **25 X 2 = 50 Marks**

1. Osmotic pressure exerted by a solution prepared by dissolving one gram mole of a solute in 22.4 liters of a solvent at 0°C will be ………. atmosphere
   a. 0.5
   b. 1
   c. 1.5
   d. 2

2. 1 m^3 of an ideal gas at 500 K and 1000 kPa expands reversibly to 5 times its initial volume in an insulated container. If the specific heat capacity (at constant pressure) of the gas is 21 J/mole. K, the final temperature will be
   a. 35 K
   b. 174 K
   c. 274 K
   d. 154 K

3. The rate of a chemical reaction is almost doubled for every 10 °C rise in temperature. The rate will increase .... times, if the temperature rises from 10 to 100 °C
   a. 256
   b. 512
   c. 112
   d. 612

4. If the specific heats of a gas and a vapor are 0.2 kJ/kg. K and 1.5 kJ/Kg. K respectively and the humidity is 0.01, the humid heat in kJ/kg is
   a. 0.31
   b. 0.107
   c. 0.017
   d. 0.215

5. The open loop transfer function of a process is $K \frac{(s+1)(s+4)}{(s+2)(s+3)}$. In the root locus diagram, the poles will be at
   a. -1, -4
   b. 1, 4
   c. -2, -3
   d. 2, 3