

M.Tech

2) CHEMICAL ENGINEERING GS-CH

Syllabus & Model Question Paper

Syllabus

1. **Process Calculations:** Units and Standards, material and energy balance, humidity and saturation and combustion.
2. **Fluid Mechanics:** Fluid statics, incompressible flow through conduits, flow meters, flow past immersed bodies, transportation of fluids.
3. **Mechanical Operations:** Size analysis, reduction and separation, filtration, agitation and material handling.
4. **Thermodynamics:** First and Second law of thermodynamics, PVT relations, thermodynamic relations, phase equilibria and reaction equilibria.
5. **Heat Transfer:** Conduction, convection, heat exchangers, steady and unsteady state heat transfer and radiation.
6. **Mass Transfer:** Diffusion, convective mass transfer, gas liquid contactors, distillation, absorption, adsorption, leaching, drying, evaporation, crystallization.
7. **Reaction Kinetics:** Theories of reaction rates; kinetics of homogeneous reactions, interpretation of kinetic data, single and multiple reactions in ideal reactors, non-ideal reactors; residence time; non-isothermal reactors; kinetics of heterogeneous catalytic reactions; diffusion effects in catalysis.
8. **Process Control:** Measurement of process variables; sensors, transducers and their dynamics, dynamics of simple systems, dynamics such as CSTRs, transfer functions and responses of simple systems, process reaction curve, controller modes (P, PI, and PID); control valves; analysis of closed loop systems including stability, frequency response (including Bode plots) and controller tuning, cascade, feed forward control.
9. **Pollution Control Engineering:** Waste Water Treatment, Air pollution treatment, Solid Waste Treatment, Noise Control.
10. **Process Industries:** Water, Industrial Gases: CO₂, H₂, O₂, N₂, Water Gas, and shift Gas, Sulfur: SO₂, SO₃, Acids: Sulfuric, Hydrochloric and Phosphoric Acids. Fertilizers: Ammonia, Urea, Ammonium Chloride, Ammonium Nitrate, Ammonium Phosphate, Ammonium Sulfate, DAP, Concept of Sustained and Solubilised Fertilizer and Formulation, Potash Fertilizers, Bio-Fertilizers. Coal tar distillation and Chemicals from coal. Oils, Fats, and Waxes, Soaps and Pulp and Paper, Sugar and Starch Industries, Fermentation Industries, Petroleum Industries – Constituents of crude petroleum, refining and processing, polymers and Rubber.

MODEL QUESTIONS

CHEMICAL ENGINEERING

PART – I

Each question carries One Mark 50 x 1 = 50 Marks

- 1) Reynolds number is the ratio of
 - a) Viscous forces to gravity forces
 - b) Inertial forces to viscous forces
 - c) Viscous forces to inertial forces
 - d) Inertial forces to gravity forces

- 2) Heat transfer co-efficient (h_i) for liquids increases with
 - a) Increasing temperature
 - b) Decreasing temperature
 - c) Decreasing Reynolds number
 - d) None of these

- 3) Black liquor is converted into the white liquor by
 - a) Evaporation and burning the concentrate followed by causticization of products
 - b) Multi effect evaporation only
 - c) Selective liquid extraction
 - d) Extractive distillation

- 4) In the equation, $A = U - TS$, A is defined as
 - a) Gibb's free energy
 - b) Helmholtz free energy
 - c) Both a and b
 - d) None of the above

- 5) Which of the following acts as a homogeneous system
 - a) Water + Steam
 - b) Ice + Steam
 - c) Water + Nitric acid
 - d) None of the above

PART – II

Each question carries two Marks 25 x 2 = 50 Marks

- 1) Substances A and B form an ideal solution. The Vapour pressures of A and B at a certain temperature are 1000 and 500 mm Hg respectively. The concentration of A in liquid and vapour phase in equilibrium at 750mm Hg total pressure are :
 - a) 0.67, 0.5
 - b) 0.5, 0.67
 - c) 0.67, 0.75
 - d) 0.75, 0.67

2) In an evaporator 2400 kg of water is evaporated so that the solution is concentrated from 10 to 25 % solids. What is the weight of original solution in kg?

- a) 4000 b) 4400 c) 3600 d) None of these

3) A reversible reaction $A+B=C+D$ is conducted in a vessel until equilibrium is reached using an equimolar mixture of A and B. The equilibrium constant is 1. The content of C in final product is

- a) 33.3% b) 25% c) 50% d) 75%

4) The Temperatures across an insulation layer of thickness 15mm are 40 and 80 °C respectively. The thermal conductivity of the material at these temperatures is 0.045 W/m-K. The cross sectional area of wall is 2 m². The heat flux across the layer in W/m² is

- a) 2.4 b) 12 c) 1.2 d) 24

5) The power in kW required to crush 100 tph of a solid, if 80% of feed passes through a 49 mm screen, 80% of product passes through a 4 mm screen and work index = 14 is

- a) 15.81 b) 31.62 c) 316.2 d) 158.1