9) Polymer Science and Technology

Syllabus and Model Question Paper

1. **Fluid Mechanics and Statics:** Types of fluids – shear stress and velocity gradient relation Newtonian and non-newtonian fluids, laminar and turbulent flow. Flow in boundary layers, Reynolds number, Bernoulli equations, variation of pressure with height – hydrostatic equilibrium, Barometric equation, Measurement of fluid pressure – monometers.

2. **Chemical Process Calculations:** Concept of mole, mole fraction, compositions of mixtures of solids, liquids and gases. Ideal gas law calculations, general material balance equation for steady state.

3. **Chemical Engineering Thermodynamics:** Basic concepts – system, surrounding and processes, closed and open systems, state and properties, intensive and extensive properties, state and path functions, general statement of first law of thermodynamics, first law of thermodynamics, first law for cyclic process, P-V-T behavior of pure fluids, equations of state and ideal gas law, processes involving ideal gas law, constant volume, constant pressure, constant temperature, van-der Waals equation.

4. **Heat and Mass Transfer** Modes of heat transfer, unilayer and multiplayer condition, forced and natural convection, introduction to molecular diffusion in gases and liquids, theories of mass transfer, principles and types of distillations.

5. **Polymer Science:** Classification of polymers, definition of polymerization, chain polymerization (free radical, ionic and co-ordination polymerizations), step (condensation) polymerization, copolymerization methods of polymerization (bulk, solution, suspension, emulsion).

6. **Polymerization Kinetics:** Definition of reaction rate, order, molecularity, different theories of reaction rate, activation energy, kinetic expressions for simple first order & second order chemical reactions, kinetics of linear step reaction polymerization, kinetics of addition polymerization initiated by free radical initiator: steady state assumption.

7. **Processing Technology:** Extrusion, injection moulding, blow moulding compression moulding, rotational moulding, thermoforming, calendaring.

8. **Polymer Manufacturing:** Industrial production methods of HDPE, LDPE, PP, PS, PVC, PMMA, Nylon 6 and Nylon 66.

Model Question Paper

Polymer Science and Engineering

PART-I

Each question carries One mark. 50 X 1 = 50 Marks

1. Bernoulli's equation cannot be applied when the flow is
   a) Rotational b) Turbulent
   c) Unsteady d) all of the above
2. Concept of material balance Is based on
   a) Conservation of mass b) Conservation of energy
   c) Conservation of momentum d) Conservation of volume
3. At absolute zero temperature, the _____ of the gas is zero
   a) Pressure b) Mass
   c) Volume d) Density
4. In direct extrusion process at higher temperature, which of the following is used to avoid friction?
   a) Oil b) Lubricants
   c) Molten glasses d) wax
5. Mechanical properties of nylons are improved by
   a) Plasticizers b) Nucleating agents
   c) Mould agents d) Impact modifiers

PART-II

Each question carries Two marks. 25 X 2 = 50 Marks

1. A strong acid catalyzed polyesterification reaction follows _____ order kinetics.

   a) 1 b) 2

   c) 3 d) 4

2. LMTD in case of counter flow heat exchanger as compared to parallel flow heat exchanger is

   e) Higher f) Lower

   g) Same h) Depends on temperature conditions

3. Degree of freedom of the system ice-water-vapor will be

   a) 0 b) 2

   c) 1 d) 3

4. On addition of solute in the solvent, the _____ of solution decreases.

   a) Boiling point b) Freezing point

   c) Vapor pressure d) Both vapor pressure and freezing point

5. Which of the following combinations undergoing polymerization give polysulphones?

   a) Olefins and sulphur dioxide b) cycloolefins and metal sulphate

   c) Olefins and sulphur trioxide d) Vinyl monomer and sulphur ring