9) Polymer Science and Technology
Syllabus & Model Question Paper

Eligibility:
B.E. / B.Tech. in Polymer tech., Rubber Tech./ Plastics Tech. / Chemical Engg. / Mechanical Engg. / I&P. / Textile. / Fiber technology or AMIE (Chemical Engineering)

Subjects / Topics from which questions are to be set

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 bouondary 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 for cyclic process, P-V-T behaviour 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, Calendering.

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) Power loss in a orifice meter is
    a) Less than that in a venturimeter
    b) Same as that in a venturimeter
    c)More than that in a venturimeter
    d) Data insufficient can not be predicted.

2) The point at which all three (solid,liquid,gas) phases co-exist is know as
    a) Freezing point   b) Triple point
    c) Boiling point   d) None of these

3) For heat flow through a thick walled cylinder, use

    a) Arithmetic mean radius
    b) Log mean radius
    c) Geometric mean radius
    d) None of these

4) Polyurethanes are produced by

    a) Reaction between ethyl alcohol and di-isocyantes
    b) Reaction between methylalcohol and di-isocyantes
    c) Reaction between glycols and di-isocyantes
    d)None of these

5) The majority of the resins used to produce biaxially oriented blown films are

    a) amorphous
    b) Crystalline or semi -crystalline
    c) Can be (a) or (b)
    d)data is insufficient, can not be predicted

PART – II

Each question carries two Marks   **25 x 2 = 50 Marks**

1) 24 lb of gas consisting of 30% CO_2, 40% N_2 and 30% O_2 are placed in a cylinder 200 ft^3 in volume. What is the average molecular weight of the gas?
   a) 32
   b) 34
   c) 44
   d) 40

2) The frozen - in-stresses in molded products leads to

   a) Better strength
   b) High crystallinity
   c) Increased T g
   d) Anisotropic conditions

3) Monomer concentration decreases steadily thronghout reaction in

   a) step polymerization
   b) addition polymerization
   c) cross linking
   d) None of these

4) Which of the following is used as light stabilizer in polyamides

   a) Carbon black
   b) Mercapto benzimidazole
   c) Copper salts
   d) Zinc borate

5) How many g moles of water are present in 1 kg of water?
   a) 18.00
   b) 55.55
   c) 21.68
   d) 42.89