

CHL 392 : Polymer Science and Engineering
Major Test (09-05-2007)

Time : 2 Hours

Total Marks : 66

PART I

Q.1. Answer **any four** of the following (brief and to the point):

- a) Discuss the steps involved in reaction injection moulding and list the advantages of the process for making large structural parts.
- b) List different moulding processes with examples. Compare injection blow moulding with extrusion blow moulding.
- c) Discuss different process parameters in injection moulding and state the best possible design of a multicavity mould for 10 products at a time.
- d) Discuss the features that are available for compounding in single screw and twin screw extruder. Draw the screw characteristic curves.
- e) State constituents and properties of polymeric composites. Describe atleast two conventional manufacturing techniques for polymeric composites

(16)

Q.2.a) Analyse the creep behaviour and complex modulus of the Maxwell model.

- b) A certain polymer sample can be represented by a Maxwell element. When a tensile stress of 10 Pa is applied for 10 sec, the maximum length attained by the sample is 1.15 times the original length. After removal of the stress at 10 sec, the length is only 1.10 times the original length. Determine the relaxation time.

(8)

Q.3. The characteristic curve for a single screw extruder is given by,

$$Q = \alpha N - \frac{\beta \Delta P}{\mu L}, \quad \alpha = \frac{\pi^2}{2} D^2 H (\sin \phi) (\cos \phi), \quad \beta = \frac{\pi}{12} D H^3 (\sin^2 \phi)$$

- a) Derive the expression for maximum output and maximum pressure drop attainable.
- b) What will be the changes in the screw characteristics curve when:
 - i) diameter is halved
 - ii) screw speed is doubled
 - iii) channel depth is decreased by 50%

(6)

Answer any one of the following:

(6)

Q.4. a) What is glass transition temperature? How can it be experimentally determined?

- b) List four mechanical properties that characterise a typical polymer. How are they related to end use application of polymeric materials?

Q.5. a) Polyamides are versatile polymers – justify by listing different applications.

- b) Compare polystyrene, high impact PS and ABS.
- c) Give the special features and related uses of PTFE.

P.T.O.

PART II

Q.1. Write chemical structure of following monomers (**any four**) and corresponding polymers along with the technique of preparation and two industrial applications.

- (i) Vinyl chloride
- (ii) Acrylic acid
- (iii) Polytetrafluoroethylene
- (iv) Polyethylene
- (v) Polyethylene terephthalate
- (vi) Silicon Rubber

(10)

Q.2. Distinguish between the followings:

- (i) Chain transfer agents and inhibitors
- (ii) Condensation and addition polymerization
- (iii) Suspension and emulsion polymerization technique
- (iv) Free radical and ionic polymerization
- (v) Non aqueous and aqueous redox polymerization
- (vi) Emulsion and reverse emulsion polymerization
- (vii) Block and graft copolymerisation

(7)

Q.3. How will you synthesize polymethyl methacrylate and Bisphenol A polycarbonate? Compare their four engineering properties and give two important applications of each polymer.

(6)

Q.4. Recommend ideal polymer for following applications

- (i) Soft drink bottle
- (ii) Television body
- (iii) Helmet
- (iv) Disposable syringes
- (v) Heat sealable multilayer films for food packagings
- (vi) Neon signs
- (vii) Disposable tea cups
- (viii) Plastic pipes for electric cables
- (ix) Garden water pipes
- (x) Plastic mugs
- (xi) Spectacle lenses
- (xii) Synthetic leather
- (xiii) Transparent roofing for railway platform
- (xiv) Electrical switches

(7)