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**SARDAR PATEL UNIVERSITY**  
**M.Sc. (Polymer Science & Technology) Semester-IV Examination-2017**

**Tuesday, 11<sup>th</sup> April-2017**

**02:00 P.M. to 05:00 P.M.**

**PS04CPST08: POLYMER RHEOLOGY**

**Total Marks: 70**

- Note:** (1) Attempt all questions.  
(2) Figures to the right indicate marks.

- Q.1** Answer the following multiple choice questions. **08**
- (1) \_\_\_\_\_ is closely related with pressure and temperature.  
(i)  $T_g$  (ii)  $T_m$  (iii)  $T_p$  (iv)  $T_c$ .
  - (2) Flexible polymer chains adopt the shape of random coil in absence of \_\_\_\_\_.  
(i) strain (ii) stress (iii) both i & ii (iv) none of above.
  - (3) The applied stress is proportional to the strain is known as \_\_\_\_\_.  
(i) Pascall's law (ii) Metzner rule (iii) Hooke's law (iv) Poiseuille rule.
  - (4) \_\_\_\_\_ have a lower apparent viscosity at higher shear rate.  
(i) Dialantant fluid (ii) Newtonian fluid (iii) Bingham Plastics  
(iv) Pseudoplastic fluid.
  - (5) \_\_\_\_\_ is highly flexible.  
(i) LDPE (ii) HDPE (iii) PP (iv) All.
  - (6) \_\_\_\_\_ is the retardation of a chemical system reaching equilibrium.  
(i) Thixotropy (ii) Hysteresis (iii) Anti thixotropy (iv) Frozen in orientation.
  - (7) Melt fracture \_\_\_\_\_ by giving proper tapering at die entry.  
(i) increases (ii) averages (iii) decreases (iv) none of above.
  - (8) Swelling ratio = \_\_\_\_\_.  
(i) Die / Extrudate (ii) Diameter of die / Diameter of extrudate (iii) Extrudate / Die  
(iv) Diameter of extrudate / Diameter of die.
- Q.2** Attempt any seven of the following. **14**
- (1) Explain various parameters on which rheology of polymer depends.
  - (2) Give the reasons and assumption for deriving relationships about flow of object through channel of simple cross-section.
  - (3) Define: (1) Modulus of Elasticity (2) Creep.
  - (4) Explain important aspects of rheology.
  - (5) Derive Metzner equation for shear rate.
  - (6) Derive Poiseuille equation.
  - (7) How Weissenberg effect is observed? Explain.
  - (8) Explain jetting and fountain effect.
  - (9) Explain effects of pressure on flow properties.

- Q. 3** (a) Derive the relation used for the shear stress at the wall during flow through capillary and flow between parallel plates. 06  
 (b) Write a note on time dependent fluid. 06  
**OR**  
 (b) Discuss following. 06  
 1. Chain stiffness and conformation.  
 2. Molecular weight distribution.
- Q. 4** (a) Discuss the effects of temperature on viscous flow of polymer melts. 06  
 (b) Derive  $F = \frac{3\eta V^2}{8\pi H^4}$  for compression moulding process. 06  
**OR**  
 (b) Solve the following. 06  
 1. A blow moulded die has an outside diameter of 30mm and inner diameter of 27mm. The parison is inflated with pressure of 0.4 MN/m<sup>2</sup> to produce a plastic bottle of diameter 50mm. If the parison thickness swelling ratio 2, estimate the wall thickness of the bottle.  
 2. Blow moulding die has outside diameter diameter 40mm and inner diameter is 36 mm is used to produce a plastic bottle with diameter of 70 mm. If the swelling diameter of melt in thickness direction is 1.8 mm. Estimate the parison dimension. Also calculate the inflation pressure if the melt fracture stress is 10MPa.
- Q. 5** (a) How strain enhancement under constant stress of viscoelastic materials can be understood using Kelvin-Voight model? 06  
 (b) Discuss in detail about working of cone – plate rheometer. 06  
**OR**  
 (b) Write a note on Die Swell effect in polymer melt flow. 06
- Q. 6** (a) Write a note on Dispersion, Distribution & Homogeneity during mixing of polymer melt. 06  
 (b) Discuss the flow properties of following polymers: 06  
 (i) Polyethylene (ii) Polypropylene (iii) Poly (vinylchloride).  
**OR**  
 (b) Answer the following. 06  
 1. Explain the effects of chain branching on flow properties of thermoplastic polymer.  
 2. What do you mean by sharkskin effect? Explain.

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**SARDAR PATEL UNIVERSITY**

**M.Sc. Polymer Science & Technology Semester-IV Examination – 2017**

**Thursday, 13<sup>th</sup> April 2017**

**2:00 p.m. to 5:00 p.m.**

**PS04CPST09: Specialty Polymer**

**Note:** (1) Attempt all questions.

(2) Figures to the right indicate full marks.

**Total marks: 70**

**Que. 1 Answer the following**

**08**

- (1) Udel type polymer is an example of \_\_\_\_\_  
(a) polyimide (b) polysulfide (c) polysulphone (d) polyketone
- (2) Guar gum is a mixture of \_\_\_\_\_  
(a) Galactose and mannose (b) amylose and amylopectin (c) glucose and fructose (d) none of these
- (3) Casein consist of a high number of \_\_\_\_\_  
(a) amylose (b) proline peptide (c) galactose (d) none of these
- (4) Which product is formed when sodium salt of cellulose reacted with methyl chloride  
(a) methyl cellulose (b) sodium carboxy methyl cellulose (c) hydroxy propyl cellulose (d) none of these
- (5) The energy difference between valance band and conduction band is known as \_\_\_\_\_  
(a) Carrier mobility (b) forbidden gap (c) semiconductor (d) none of these
- (6) \_\_\_\_\_ Polymer is used in analytical separation technique in gel electrophoresis  
(a) polyvinyl pyrrolidone (b) Polyvinyl alcohol (c) Polyacryl amide (d) none of these
- (7) \_\_\_\_\_ is obtained from brown seaweeds  
(a) Acacia gum (b) guar gum (c) alginate (d) none of these
- (8) In ionic polymer, If bound ion is sulphonate group then polymer is known as \_\_\_\_\_ exchange polymer  
(a) cation (b) anion (c) Zwitter ionic (d) none of these

**Que. 2 Answer the following (any seven)**

**14**

- (1) Explain the significance of high temperature resistance polymer
- (2) Discuss Polyphenylene sulfide
- (3) Write a note on casein
- (4) How to improve low performance polymers for high temperature use?
- (5) Discuss the application of hydrophilic polymer
- (6) Write a note on Polyvinyl alcohol

- (7) Define LOI and Smoke  
 (8) How gelatin is produced? Write properties and application of gelatin  
 (9) Explain the different steps for burning processes of a polymer
- Que. 3** (a) Write a synthesis scheme, property and application of polysulphone 06
- (b) **Discuss the following** 06  
 1. Polyetherether ketone  
 2. Polytetrafluoroethylene
- OR**
- (b) **Explain the following** 06  
 1. Polyphenylene oxide  
 2. Nomex
- Que. 4** (a) Write a note on hydrogel polymer. 06
- (b) **Write a note on following** 06  
 1. Guar Gum  
 2. Carbohydrate
- OR**
- (b) **Discuss the following** 06  
 1. Semi synthetic polymer  
 2. Write a note on alginate
- Que. 5** (a) Explain the synthesis of ionic polymer by post functionalization of a standard and special pre-formed polymer 06
- (b) Write a note on polyelectrolyte for Ion exchange 06
- OR**
- (b) Explain the hydrophilicity in Ionic polymer 06
- Que. 6** (a) Explain conduction mechanism of conducting polymer and discuss polyacetylene 06
- (b) Explain Ionic crosslinking 06
- OR**
- (b) **Answer the following** 06  
 1. Explain the classification of Ionic polymer  
 2. Discuss piezoelectricity and pyroelectricity

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## SARDAR PATEL UNIVERSITY

M.Sc. Polymer Science & Technology Semester-IV Examination – 2017

Monday, 17<sup>th</sup> April 2017

2:00 p.m. to 5:00 p.m.

### PS04CPST12: Polymer Blends, Adhesives and Pigments

Note: (1) Attempt all questions.

Total marks: 70

(2) Figures to the right indicate full marks.

**Que. 1 Answer the following**

08

- (1) Polystyrene – Poly(methyl methacrylate) is a example of \_\_\_\_\_ blend  
(a) Miscible blend (b) Partially miscible blend (c) Immiscible blend (d) None of these
- (2) \_\_\_\_\_ can reduce the interfacial energy between two phase separated domains in polymer blends.  
(a) Addition of block copolymer (b) Chemical modification of polymer (c) Polarity (d) Molecular weight of polymer
- (3) In a blend, when  $\alpha_1 = \alpha_2$ ,  $\gamma_1 = \gamma_2$ ,  $Q_{12}$  and  $\chi_{12}$  approach zero the polymer will become \_\_\_\_\_  
(a) Miscible (b) Partially miscible (c) Immiscible blend (d) None of these
- (4) \_\_\_\_\_ is example of weather proof & boil proof type adhesive  
(a) UF resin (b) MF resin (c) PF resin (d) None of these
- (5) \_\_\_\_\_ technique is used for wood surface preparation  
(a) Abrasion (b) degreasing (c) both a & b (d) None of these
- (6) \_\_\_\_\_ is used as degreasing solvent for metals  
(a) Acetone (b) Methanol (c) Ethanol (d) Trichloro ethylene
- (7) \_\_\_\_\_ method is used for preparation of polymer blend  
(a) solution mixing (b) melt mixing (c) Interpenetrating network (d) all of these
- (8) Polystyrene – Poly(vinyl methyl ether) is a example of \_\_\_\_\_ blend  
(a) Miscible blend (b) Partially miscible blend (c) Immiscible blend (d) None of these

**Que. 2 Answer the following (any seven)**

14

- (1) Discuss the advantages of blending
- (2) How the chemical modification of polymer enhancing the miscibility
- (3) Discuss the surface treatment of wood for adhesive application
- (4) Explain the different methods for preparation of polymer blend.
- (5) Write the advantage and disadvantage of adhesive bonding.
- (6) Write the different reason for insufficient bonding in adhesive bonding.
- (7) Discuss the surface treatment of plastic for adhesive application
- (8) Write the classification of adhesive based on durability
- (9) Explain the type of stresses that occur on the adhesive bonded joint

- Que. 3** (a) Explain the different parameters influencing the miscibility 06
- (b) **Answer the following** 06
1. Discuss the methods of studying miscibility or immiscibility.
  2. Explain the different factors in miscibility
- OR**
- (b) Write a note on equation of state theory 06
- Que. 4** (a) Write the a note on modification during polymerization in polymer modification for physical compatibilization 06
- (b) Discuss briefly on physical additive used in compatibilization 06
- OR**
- (b) **Answer the following** 06
1. Write a note on practical compatibilization in a polymer blend.
  2. Explain polymer modification for reactive compatibilization.
- Que. 5** (a) Explain the different methods of adhesive application 06
- (b) Explain the different methods of adhesive bonding 06
- OR**
- (b) **Answer the following** 06
1. Explain the factor affecting the adhesive selection.
  2. What are the different reasons for poor adhesion bonding?
- Que. 6** (a) Explain the different methods of adhesive bond curing 06
- (b) Discuss briefly on reactive compatibilization 06
- OR**
- (b) **Answer the following** 06
1. Explain the factor affecting the adhesive and solvent bonding
  2. What are the different additives used in adhesive formulation? Explain its role in adhesive

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## SARDAR PATEL UNIVERSITY

M.Sc. (Polymer Science & Technology) Semester-IV Examination-2017

Wednesday, 19<sup>th</sup> April-2017

02:00 P.M to 05:00 P.M

PS04EPST06: ANALYTICAL TECHNIQUES

Total Marks: 70

- Note:** (1) Attempt all questions.  
(2) Figures to the right indicate marks.

- Q. 1** Answer the following multiple choice questions. **08**
- (1) \_\_\_\_\_ error in analytical techniques biases a result in one direction.  
(a) Systematic (b) Random (c) Both of above (d) None of above.
  - (2) \_\_\_\_\_ is operationally identical to molality.  
(a) Normality (b) Molarity (c) Formality (d) None of above.
  - (3) \_\_\_\_\_ is used to extract one material from another in chromatography.  
(a) Eluate (b) Elution (c) Eluant (d) none of above
  - (4) Quantitative analysis in Paper chromatography can be done by \_\_\_\_\_.  
(a)  $R_F$  values (b)  $R_X$  values (c) both of above (d) none of above
  - (5) An atom is said to be NMR active when I is \_\_\_\_\_ zero.  
(a) equal to (b) greater than (c) less than (d) none of above.
  - (6) Wavelength of IR region is \_\_\_\_\_ nm.  
(a) 0.75-25 (b) 750-25000 (c) 0.00075-0.025 (d) 4000-400.
  - (7) \_\_\_\_\_ measures the linear dimension change of sample as a function of temperature or time.  
(a) DMA (b) GTA (c) TMA (d) DSC
  - (8) \_\_\_\_\_ and Ruska developed electron microscope which can magnify object up to 20000 times.  
(a) Borries (b) Knoll (c) Busch (d) de Broglie
- Q. 2** Attempt any seven of the following. **14**
- (1) Explain Normality.
  - (2) Write a brief note on the requirements of primary standards.
  - (3) Write down about the apparatus of column chromatography.
  - (4) Discuss in brief about the advantages of TLC over to paper chromatography.
  - (5) Write a brief note on Matrix Assisted Laser Desorption Ionization in mass spectra.
  - (6) Write a short note on the graphical explanation of the shielding, Deshielding and chemical shift.
  - (7) Differentiate between Light and Electron microscopy.
  - (8) Explain the factors affecting the position of IR band.
  - (9) Draw only the neat labelled diagram of heat flux DSC.

- Q. 3** (a) Explain Good laboratory practice in detail. **06**  
(b) Answer the following. **06**  
1. Accuracy in validation process.  
2. Selectivity and Linearity in validation process

**OR**

- (b) Discuss the following points of validation process. **06**  
1. Robustness.  
2. Precision.  
3. Quality assurance and control chart.
- Q. 4** (a) Give an account on the instrumentation of Gas chromatography with neat labelled diagram. **06**  
(b) Explain instrumentation of HPLC with neat labelled diagram. **06**

**OR**

- (b) Answer the following. **06**  
1. Two dimensional paper chromatography.  
2. Separation in GPC.
- Q. 5** (a) Write a detail note on finger print region in IR spectroscopy. **06**  
(b) Explain in detail about the types of ions produced in Mass spectra. **06**

**OR**

- (b) Explain following. **06**  
1. Advantages of TMS as internal standard in NMR.  
2. Coupling constant 'j'.
- Q. 6** (a) Give an account on Scanning Electron Microscope. **06**  
(b) Write a detail note on TGA thermo balance with neat labelled diagram. **06**

**OR**

- (b) Explain Dynamic mechanical analyser with neat labelled diagram. **06**

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