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SEAT NO: _____

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SARDAR PATEL UNIVERSITY

M.Sc.Semester-III: (Physical Chemistry) Examination (CBCS)-2019

Wednesday, 27th March, 2019

02:00 p.m. to 05:00 p.m.

PS03EPHC22, Advanced Characterization Techniques

- N.B.:*
- i. Attempt all questions.
 - ii. Figures to right indicate full marks.
 - iii. Unless otherwise mentioned, symbols and notations have their usual standard meanings.
 - iv. Neat sketches are to be drawn to illustrate answers, wherever required.
 - v. Assume suitable data, if necessary and indicate the same clearly.

Q.1 The question i) to viii) contain a Multiple Choice Questions (MCQs). Each [08]

question has four alternative responses marked (a), (b), (c) and (d) out of which *only one* is the correct response. Please mark correct response i e (a) / (b) / (c) / (d).

- i) Which of the following is an addition polymer?
(a) Nylon-6 (b) Nylon-6,6
(c) High density polythene (d) Dacron
- ii) Degree of crystallinity
(a) Decreases Tg value (b) Stabilizes Tg value
(c) Increases Tg value (d) Does not affect Tg value
- iii) _____ When the cyclic loading is applied, there is a phase lag between the applied stress and resulting strain and a corresponding dissipation of mechanical energy
(a) Hysteresis (b) Elasticity (c) Stiffness (d) Viscosity
- iv) A series connection between a Hookean spring and a Newtonian dashpot results into _____ model.
(a) Maxwell (b) Kelvin-Voigt (c) Standard linear solid model (d) Prony series
- v) Thermal analysis techniques measure a parameter as a function of time and temperature. TGA measures sample weight, DSC measures heat flow ...
What does a Sievert's instrument measure?
(a) The radiations emitted by a sample (b) The sievertness of the sample
(c) The volume of a sample (d) The pressure drop linked to gas sorption on a sample
- vi) In TGA Experiment, the choice of material of furnace working in the temperature range 1100-1500° C is
(a) Kanthal or Nichrome wire or ribbon (b) Platinum or any alloy
(c) Tungsten or molybdenum (d) Platinum -Rhodium alloy
- vii) **Statement 1:** In $\mu_a = \tau/\gamma = K\gamma^{(n-1)}$, n = consistency index and K is the flow behaviour index.
Statement 2: $n = 1$ for Newtonian fluids, $n < 1$ for dilatant fluids and $n > 1$ for pseudo plastic fluids.
(a) True, False (b) True, True (c) False, False (d) False, True

(1)

(P.T.O)

- viii) For non-Newtonian fluids, apparent viscosity is a function of :
 (a) shear rate (b) flow rate (c) viscous rate (d) specific rate

- Q.2** Answer the following questions as directed (**ANY SEVEN**). [14]
- i) How rotational isomerism in polymer decides physical properties?
 - ii) Explain Finite Strain Elasticity.
 - iii) Define with schematic diagram: Loose loop and Loose end.
 - iv) Elucidate: Stress relaxation modulus.
 - v) Discuss sample size and sample shape factors affecting DSC Curve.
 - vi) Draw with schematic diagram - Instrumentation of Thermomechanical Analysis (TMA).
 - vii) Explain continuum mechanics as a keystone in rheology.
 - viii) Brief on Quicksand as a non-Newtonian fluid.
 - ix) Explain: Pitch drop experiment.
- Q.3** a) Discuss how liquid crystalline polymers at the molecular and supermolecular level is valuable to recognize mechanical properties of polymer. [06]
- b) Give brief account on Strain Energy Function. [06]
- OR**
- b) (i) Discuss Generalized Hooke's Law. [03]
 (ii) Explain: Poisson's ratio (ν) and Shear modulus (G). [03]
- Q.4** a) What is spectrum of relaxation time? If an infinite number of Maxwell units in Multi Element model gives an infinite number of relaxation time. Derive the relationship creep under constant stress σ . [06]
- b) Describe Maxwell model and derive the expression: [06]
 $\sigma = \sigma_0 \exp(-\frac{t}{\tau})$ where τ is the relaxation time.
- OR**
- b) (i) Explain the creep for single step loading of a stress σ_0 at time $\tau = 0$ by using Boltzmann superposition principle. [03]
 (ii) Discuss viz-a-viz: Elastic solid and Viscous liquid. [03]
- Q.5** a) How furnace atmosphere affect thermogravimetric curves? Give reply with suitable examples? [06]
- b) i) Compare: Basic principle involved in Differential Thermal Analysis (DTA) and Differential Scanning Calorimetry (DSC). [03]
 ii) Explain following basic units of a Thermobalance: [03]
 (I) The Balance (II) The Sample holders (III) The Furnace
- OR**
- b) Write a note on following factors affecting the DTA curve: [06]
 (a) Environmental factors (b) Instrumental factors and (c) Sample factors.

- Q.6 a) What is Ideal liquid? Give time- and rate-dependent viscous behavior for Ideal liquid. [06]
- b) Discuss Strain vs Time graph for (I) Purely Elastic Response (II) Purely Viscous Response and (III) Viscoelastic response. [06]

OR

- b)
- (i) Define following terms in connection with viscoelastic measurements: [03]
(I) Storage modulus (II) Loss tangent (III) Phase angle (δ)
- (ii) Explain the following fluids with time-dependent viscosities: [03]
(I) Thixotropic fluids (II) Rheopectic fluids

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