

- (b) Describe elastic and storage modulus. What will be the expected value of $\tan \delta$ for solid and liquid like behaviour of polymer? 5
- (c) Derive the relation for dynamic modulus and dynamic viscosity for viscoelastic fluid behaviours. 5
6. (a) What is die swell? Explain the different parameters which affect the die swell for polymer melts. 5
- (b) Discuss melt fracture with suitable schematic diagram. 5
- (c) If you are being asked to select L/D (length-diameter ratio) for a virgin polymer which of the following, would you select and why? L/D = 20, L/D = 30. Also mention the shortcoming of the machine chosen. 5
7. Write short note on any **five** of the following : 5×3=15
- Wall slip velocity
 - Necking phenomenon
 - Turbulent mixing
 - Planar extensional flow
 - Compression ratio in extrusion
 - Boltzmann superposition principle

[This question paper contains 4 printed pages]

Your Roll No. :
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Sl. No. of Q. Paper : **5807** **I**

Unique Paper Code : 6092011202

Name of the Course : **B.Sc. (Hons.) Polymer Science (UGCF)**

Name of the Paper : Polymer Rheology

Semester : II

Time : 3 Hours **Maximum Marks : 90**

Instructions for Candidates:

- Write your Roll No. on the top immediately on receipt of this question paper.
- All** questions carry equal marks. Attempt **six** questions in **all**.
- Question NO. **1** is compulsory and scientific calculator is allowed.
- Draw neat and labeled diagram wherever necessary
- Attempt all parts together.

1. (a) What is the 'shear rate' approximately required for polymer melts during processing? 3
- (b) What is the relevance of Hook's law and Newton's law in rheology of polymers? 3
- (c) Explain shear stress strain rate curves for Bingham plastic. 3
- (d) Explain the factors affecting the polymer viscosity. 3
- (e) A cone and plate rheometer (cone angle 1.5°) operates at a rotational speed of 100 min^{-1} . What should be the speed to generate the same shear rate if the cone angle is doubled? 3
2. (a) Derive the expression for the torque for a power law fluid for a cone and plate viscometer. 5
- (b) How does Ellis model help in finding out the rheological behaviour of polymer and rubber melts? 5
- (c) Explain the Bagley's correction factor. How it can be used to correct the apparent shear stress to give true value of shear stress? 5

3. (a) Discuss the importance of polymer rheology towards polymer processing. 5
- (b) Discuss the hysteresis curves for thixotropic and rheopectic fluids. 5
- (c) Differentiate between Pseudoplastic and Dilatant fluids by suitable curves. Also explain the cause of such behaviour for these Time - Independent fluids. 5
4. (a) Distinguish between distributive and dispersive or intensive mixing. 5
- (b) Describe the factors influencing melt flow index. 5
- (c) Arrange the following in increasing order of relaxation time : 5
 - (i) Linear polymer
 - (ii) Elastomeric
 - (iii) Branched polymer
 Justify your answer.
5. (a) Derive the stress relaxation of the Maxwell model and explain it with suitable curve. 5