

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE - SEMESTER-IV (NEW) EXAMINATION – WINTER 2021****Subject Code:2142105****Date:03/01/2022****Subject Name:Heat and Mass Transfer in Metallurgy****Time:10:30 AM TO 01:00 PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

- Q.1** (a) Define viscosity and state Newton's law of viscosity. **03**  
 (b) What is kinematic viscosity? Derive unit for dynamic and kinematic viscosity. **04**  
 (c) Derive differential mass balance equation. **07**
- Q.2** (a) If fluid is passing with velocity of 2 m/sec through a pipe of 10 cm diameter, calculates its flow rate. **03**  
 (b) What are different types of fluids as per Newton's law of viscosity? **04**  
 (c) From differential momentum balance equation derive Bernoulli's equation. **07**
- OR**
- (c) Explain different types of fluid flows. **07**
- Q.3** (a) Calculate specific weight, density and specific gravity of one liter of liquid weighs 7N. **03**  
 (b) Explain Fourier's law of heat conduction and get unit for conductivity. **04**  
 (c) Derive differential momentum balance equation in rectangular system. **07**
- OR**
- Q.3** (a) For temperature difference of 250 °C over thickness of 25 cm refractory material having thermal conductivity 0.15 W/mK. Calculate heat flux. **03**  
 (b) Explain term: White body, gray body, black body and emissivity. **04**  
 (c) Derive general heat conduction equation for rectangular coordinate system. **07**
- Q.4** (a) What is Newton's law of cooling? Derive unit for co-efficient of convective heat transfer. **03**  
 (b) Explain different modes of convective heat transfer. Differentiate between them. **04**  
 (c) Derive Hagen-Posiseulle equation. **07**
- OR**
- Q.4** (a) Explain Stefan-Boltzmann law. **03**  
 (b) What is thermal resistance and derive its unit. **04**  
 (c) Explain any one flow rate measuring equipment. **07**
- Q.5** (a) What is mass transfer? Briefly explain different modes of mass transfer. **03**  
 (b) Explain kirkindall effect. **04**  
 (c) Explain plank's law and Wien's distribution law. **07**
- OR**
- Q.5** (a) Derive units of diffusivity. **03**  
 (b) Explain fick's law of diffusion. **04**  
 (c) Derive general mass diffusion equation in stationary media. **07**

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