

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE - SEMESTER-IV(NEW) – EXAMINATION – SUMMER 2019****Subject Code:2142105****Date:15/05/2019****Subject Name: Heat and Mass Transfer in Metallurgy****Time:02:30 PM TO 05:00 PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1**
- (a) Briefly explain laminar and turbulent flow. **03**
  - (b) Explain Steady-Unsteady and Uniform-Non uniform flow. **04**
  - (c) Explain Newton's law of viscosity and get unit for proportionality constant. Also classify and explain different fluids. **07**
- Q.2**
- (a) Define discharge and derive its units. **03**
  - (b) Explain briefly pilot tube for flow rate measuring equipment. **04**
  - (c) Derive differential mass balance equation. **07**
- OR**
- Q.3**
- (c) Derive Bernoulli's equation by integration of Navier - Stokes equation. **07**
  - (a) Calculate discharge through pipe of 25 mm diameter through which water of 1000 kg/m<sup>3</sup> is flowing with velocity of 2 m/sec. **03**
  - (b) Explain briefly venturimeter for flow rate measuring equipment. **04**
  - (c) Derive differential equation of motion in rectangular coordinate system. **07**
- OR**
- Q.3**
- (a) What is conduction? With example explain it. **03**
  - (b) State Fourier law of heat conduction and derive unit of conductivity. **04**
  - (c) Derive generalized equation of heat conduction in cartesian coordinate system. **07**
- Q.4**
- (a) Define thermal resistance and get its units. **03**
  - (b) Calculate heat flux if k is 0.23 w/m<sup>2</sup> for refractory wall of 46 mm thick having temperature difference of 100 degree celsius. **04**
  - (c) Derive equation for temperature profile in one dimension. **07**
- OR**
- Q.4**
- (a) State Newton's law of cooling and get proportionality constant unit. **03**
  - (b) Differentiate between free and forced convection. **04**
  - (c) Derive relation for heat transfer between two bodies by radiation. **07**
- Q.5**
- (a) What is radiative heat transfer? Give example of radiative heat transfer. **03**
  - (b) Define or explain emissivity, emissive power, black body and white body. **04**
  - (c) Explain Plank's and Wein's law. **07**
- OR**
- Q.5**
- (a) What is mass transfer and different modes of mass transfer? **03**
  - (b) Explain Fick's first law of diffusion and define diffusivity and get its units. **04**
  - (c) Derive generalized mass diffusion equation. **07**

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