



GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-IV (OLD) - EXAMINATION – SUMMER 2018

Subject Code:142101

Date:19/05/2018

Subject Name: Transport Phenomena In Materials Processing

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.

- Q.1** (a) State Newton's Law of Viscosity and classify fluid. Explain fluid properties. **07**
(b) What are different methods to study fluid flow? Explain different types of fluid flow. **07**
- Q.2** (a) Derive differential momentum balance equation. **07**
(b) If velocity distribution for fluid of density 713.5 kg/m^3 and dynamic viscosity 0.863 N-s/m^2 is passing through pipe is given by $U = 0.67 Y - Y^2$ where U is velocity in m/sec and Y is distance in meter. Determine shear stress at $Y = 0 \text{ m}$ and $Y = 0.25 \text{ m}$. Also calculate specific weight, specific gravity and weight for 1 liter of fluid. **07**
- OR**
- (b) State Euler's equation and derive Bernoulli's equation from it. **07**
- Q.3** (a) Derive differential mass balance equation. **07**
(b) i] Consider copper slab of thickness 0.25 m with thermal conductivity $[k] = 385.6 \text{ W/m K}$. If heat flux across the slab is 154.240 KW/m^2 and temperature on one side is 373 K . Calculate temperature on other side of slab. **07**
ii] If same copper slab of high temperature side is lined with brick wall of 250 mm with thermal conductivity $[k] = 0.5 \text{ W/m K}$ with heat flux of 500 W/m^2 . Calculate temperature on other side of brick wall.
- OR**
- Q.3** (a) State Fourier law of heat conduction and derive general equation of heat conduction. **07**
(b) What is convection? Differentiate between free and forced convection. **07**
- Q.4** (a) Explain mass concentration, molar concentration, mass fraction and molar fraction. **07**
(b) What is mass transfer? Explain different modes of mass transfer. **07**
- OR**
- Q.4** (a) Calculate mass concentration, molar concentration, mass fraction and molar fraction for a binary mixture of oxygen (O_2) and nitrogen (N_2) having total pressure $1 \times 10^5 \text{ N/m}^2$ and partial pressure 0.21 and 0.79 respectively at 300 K . **07**
(b) State Fick's laws of mass diffusion and explain Kirkindall effect. **07**
- Q.5** (a) Derive general equation of mass diffusion in stationary media. **07**
(b) Write note on pseudo steady diffusion. **07**
- OR**
- Q.5** (a) In terms of radiation explain white body, gray body, black body, emissivity. **07**
(b) Explain Planck's Law, Wein's distribution Law and Lambert's Law. **07**
