Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

B. E. - SEMESTER – IV • EXAMINATION – WINTER 2012

Subject code: 142101 Date: 27/12/2012

Subject Name: Transport Phenomena in Materials Processing

Time: 02.30 pm - 05.00 pm Total Marks: 70

Instructions:

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

Q.1 **(a)** Define fluid and viscosity. State Newton's law of viscosity, explain dynamic and kinematic viscosity and classify fluids. **07**

(b) What are different methods to explain fluid flow? Explain different types of fluid flow in detail. **07**

Q.2 **(a)** Derive differential mass balance equation (continuity equation) for fluid flow in rectangular co-ordinates. **07**

(b) Derive differential momentum balance equation (equation of motion) for fluid flow in rectangular co-ordinates. **07**

OR

(b) From differential momentum balance equation get Euler's equation and derives Bernoulli's equation by integration of Euler's equation. **07**

Q.3 **(a)** Derive equation for flow around spherical particle. **07**

(b) Derive equation for flow through packed bed of solid **07**

OR

Q.3 **(a)** What are the different modes of heat transfer? Differentiate between them. Explain Fourier's law of heat conduction and conductivity. **07**

(b) Derive generalized equation of heat conduction in rectangular, cylindrical and spherical co-ordinates. **07**

Q.4 **(a)** A heater receives current of 15 amp having resistance 3 Ω heats copper plate of uniform thickness 9.5 cm and cross section area 50 cm^2. If temperature on hot and cold surface of copper plate is 102 ^{o} C and 37 ^{o} C. Calculate Heat transfer coefficient of conduction. Consider zero heat loss. **07**

(b) What is Convection? Give Newton's Law of Cooling and give relationship between h and k. Differentiate between free and forced convection. **07**

OR

Q.4 **(a)** Explain following terms: Gray Body, White Body, Black Body, Emissive Power, Emissivity **07**

(b) Explain Plank's Law, Kirchoff's and Stefan Boltzman Law. **07**

Q.5 **(a)** Explain Fick's laws of Diffusion and define Diffusivity. **07**

(b) What is Mass Transfer? Explain following terms: Mass Concentration, Molar Concentration, Mass Fraction, Molar Fraction **07**

OR

Q.5 **(a)** Derive general mass transfer equation. **07**

(b) I. Calculate convective heat flux for a pipe having temperature 45 ^{o} C and fluid at temperature 33 ^{o} C with h= 35 W/ m^2 K **07**

II. Calculate the density, specific weight and weight of one liter of petrol of specific gravity 0.7.

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