Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV EXAMINATION – WINTER 2015

Subject Code: 142101 **Date:22/12/2015**

Subject Name: Transport Phenomena in materials processing

Time: 02:30pm to 05:00pm **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)**	What is heat transfer? Write types of heat transfer. Why study of Heat transfer is useful in metallurgical processes?	**07**
	(b)	State laws of conservation of mass and derive equation of continuity	**07**
Q.2	**(a)**	Define fluid and viscosity. State Newton's law of viscosity, explain dynamic and kinematic viscosity and classify fluids	**07**
	(b)	What is Mass Transfer? Explain following terms: Mass Concentration, Molar Concentration, Mass Fraction, Molar Fraction	**07**
		OR	
	(b)	Derive an expression for the terminal velocity of a solid sphere falling through a liquid following Stoke's law.	**07**
Q.3	**(a)**	Explain steady state heat conduction through composite walls	**07**
	(b)	A wall of 0.5mm thickness is constructed using a material which has thermal conductivity of 1.4W / m-K. The wall is insulated with a material having K= 0.35W/m-K. So that heat loss per m2 is 1500 W. Inner & Outer surface are at temperatures of 1000 °C & 100 °C. Calculate the thickness of insulation required and temperature of the interface between two layers.	**07**
		OR	
Q.3	**(a)**	Explain Fourier's law of heat conduction and define thermal Conductivity (k).	**07**
	(b)	Derive generalized equation of heat conduction in rectangular, cylindrical and spherical co-ordinates.	**07**
Q.4	**(a)**	What is dimensionless Analysis? Explain the significance of it.	**07**
	(b)	Air at 30 ° C is flowing across a tube with a velocity of 25 m/s. the tube is circular cylinder with diameter 5 cm. the tube surface temperature is 124° C. calculate the rate of heat flow. Consider the correlation $NuD = 0.027\ Re\ D^{0.805}\ Pr^{0.33.}$ At 77 ° C the properties of Air are: $U = 20.92 \times 10^{-6}\ M^2/Sec$, $K= 3\times 10^{-2}$ w/mk, and Pr=0.7	**07**
		OR	
Q.4	**(a)**	What do you mean by convective heat transfer? Explain mechanism of convective heat transfer	**07**
	(b)	Explain Plank's Law, Kirchoff's and Stefan Boltzman Law	**07**
Q.5	**(a)**	Explain following terms: Gray Body, White Body, Black Body, Emissive Power, Emissivity	**07**
	(b)	Discuss Black body radiation & lambert's law	**07**

OR

Q.5	**(a)**	Explain Fick's laws of Diffusion and define Diffusivity	**07**
	(b)	Find out the heat transfer rate per unit area due to radiation between two infinitely long parallel planes. The first plane has an emissivity = 0.4 and I is maintained at 200°C. The emissivity of second plane is 0.2 and it is maintained at 30°C. Take $\sigma = 5.67 \times 10^{-8}$	**07**

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