

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– IV(NEW) EXAMINATION – SUMMER 2023

Subject Code:3142110

Date:13-07-2023

Subject Name:Introduction to Transport Phenomena

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.

		Marks
Q.1	(a) Define discharge (D) or flow rate (Q) for fluid. Give its mathematical formula and unit.	03
	(b) A liquid having density of 900 kg/m^3 is flowing through a pipe with diameter 15 cm at velocity of 2 m/sec. Calculate weight density of fluid and fluid flow rate.	04
	(c) Explain different type of fluid flow.	07
Q.2	(a) What do you mean by term “fluid”? List its characteristics and give example.	03
	(b) For Q 1 (a), calculate specific gravity of fluid, Reynold’s No and predict type of fluid flow. Consider fluid viscosity is 0.66 Pa.s	04
	(c) State Newton’s law of viscosity and get unit for dynamic viscosity. Also, explain kinematic viscosity and get its units. Classify fluid based on it.	07
	OR	
	(c) Derive differential momentum balance equation in rectangular coordinate system.	07
Q.3	(a) Explain terms conduction, convection and radiation in relation to heat transfer.	03
	(b) State Fourier Law of heat conduction and get unit for conductivity.	04
	(c) Derive general equation of heat conduction in rectangular co-ordinate.	07
	OR	
Q.3	(a) What is thermal resistance (R)? Give its unit.	03
	(b) Derive equation for temperature profile for infinite small thickness plate with very large length and width under steady state condition.	04
	(c) Derive equation for one dimensional steady state heat flow through composite wall.	07
Q.4	(a) State Newton’s Law of Cooling and give unit for coefficient of proportionality.	03
	(b) With suitable example explain free and forced convection.	04
	(c) Calculate heat flux for a furnace refractory material wall of 30 cm with thermal conductivity of 0.12 W/m K having inside temperature of 850°C and outside wall temperature 60°C . If wall is provided with water stream is which has temperature of 25°C . Calculate convective heat flux for water stream in reference to outside wall which is at 60°C . Consider coefficient of convective heat transfer for water as $200 \text{ W/m}^2 \text{ K}$.	07

OR

Q.4	(a) What is emissive power and emissivity?	03
	(b) What is meant by white body, gray body, and blackbody in terms of radiative heat transfer?	04
	(c) Explain Plank' law, Stefan Boltzman law and Wein's distribution law.	07
Q.5	(a) What are different modes of mass transfer? Explain briefly.	03
	(b) State Fick's law for diffusion in mass transfer.	04
	(c) Explain Molar concentration or Molar density, Mass fraction and Mole fraction in terms of mass transfer.	07
OR		
Q.5	(a) Explain mass transfer in fluid at solid fluid interface with mathematical equation.	03
	(b) A gas mixture of oxygen and nitrogen with partial pressure of 0.21 and 0.79 is contained in a vessel at 300 K. If total pressure of gas mixture is $1 \times 10^5 \text{ N/m}^2$ than calculate mass density, molar fraction and mass fraction for both.	04
	(c) Write short note on Kirkindal effect.	07