

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-IV EXAMINATION – SUMMER 2025****Subject Code:3142110****Date:15-05-2025****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) How transport phenomena is different than Material thermodynamics?	03
	(b) Determine mass density and specific weight of liquid having sp.gravity 1.25.	04
	(c) Explain different type's fluid flows.	07
Q.2	(a) Differentiate Natural convection and Force convection.	03
	(b) Define the following terms: (1) Mass density (2) Weight density (3) Specific gravity (4) Viscosity	04
	(c) Derive differential mass balance equation	07
	OR	
	(c) Define fluid and classify fluid based on newton's law of viscosity	07
Q.3	(a) Explain concept of black body.	03
	(b) Derive and explain thermal conductivity and its unit with help of empirical Fourier's Law of heat conduction.	04
	(c) Derive differential momentum balance equation.	07
	OR	
Q.3	(a) Explain Newton's law cooling.	03
	(b) Explain thermal conductivity and derive its unit.	04
	(c) Derive differential equation of heat conduction in rectangular coordinate system	07
Q.4	(a) Explain Newton's law cooling. How radiation is different than the conduction and radiation in heat transfer.	03
	(b) Explain Fick's first law of diffusion & what its limitations are?	04
	(c) Explain Plank's law and Lambert's law for radiation.	07
	OR	
Q.4	(a) Discuss Kirkindal effect.	03
	(b) Explain pseudo steady diffusion.	04
	(c) Derive equation of viscosity measurement by Stoke' method.	07
Q.5	(a) For a fluid of specific Gravity 0.85, calculate density and weight density. Calculate flow rate for water flowing through a pipe of 25 cm diameter at velocity of 4 m/sec.	03
	(b) A plane wall is 150 mm thick and its wall area is 4.5 m^2 . If its conductivity is $9.35 \text{ W/m}^\circ\text{C}$ and surface temperatures are steady at 150°C and 50°C . Determine (i) Heat flow across the plane wall. (ii) Temperature gradient in the flow direction.	04
	(c) Derive Hagen-Poiseulle equation for fluid flowing through pipe.	07
	OR	
Q.5	(a) Calculate heat transfer per unit area through a copper plate 44 mm thick whose one face is maintained at 380°C and other face is at 60°C . Take	03

thermal conductivity of copper as $370 \text{ W/m } ^\circ\text{C}$.

- (b) A hollow sphere is having inside and outside temperature 60°C and 26°C inside and outside radius 50 mm and 100 mm . Calculate thermal conductivity of sphere material if it is heated under steady state condition with heat flux of 50 W/m^2 **04**
- (c) State Euler's equation of motion. And derive Bernoulli's equation. **07**
