Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–VII EXAMINATION – WINTER 2025

Subject Code:3171911 Date:01-12-2025

Subject Name:Advanced Heat Transfer

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.**

Q.1	**(a)**	Define: Thermal resistance, Thermal conductivity, Thermal diffusivity.	**03**
	(b)	Differentiate between conduction, convection and radiation.	**04**
	(c)	A cold storage room has walls made of 200 mm of brick on the outside, 80 mm of plastic foam, and finally 20 mm of wood on the inside. The outside and inside air temperatures are 25° C and -3° C respectively. If the outside and inside convective heat transfer coefficients are respectively 10 and 30 W/m^2 °C and the thermal conductivities of brick, foam and wood are 1.0, 0.02 and 0.17 W/m °C respectively. Determine: (i) Overall heat transfer coefficient. (ii) The rate of heat removed by refrigeration if the total wall area is 100 m^2. (iii) Outside and inside surface temperatures and mid-plane temperatures of composite wall.	**07**
Q.2	**(a)**	Explain fin efficiency and fin effectiveness.	**03**
	(b)	A cooper rod 0.5 cm diameter and 50 cm long protrudes from a wall maintained at a temperature of 500° C. The surrounding temperature is 30° C. Convective heattransfer coefficient is 40 W/m^2K and thermal conductivity of fin material is 300 W/mK. Show that this fin can be considered as infinitely long fin. Determine total heat transfer rate from the rod.	**04**
	(c)	Derive general heat conduction equation for cartesian co-ordinates.	**07**
		OR	
	(c)	Derive equation for heat dissipation from a fin insulated at the tip.	**07**
Q.3	**(a)**	Define: Peclet number, Stanton number, Prandtl number.	**03**
	(b)	Differentiate between free convection and forced convection.	**04**
	(c)	Explain lumped parameter analysis with neat sketch.	**07**
		OR	
Q.3	**(a)**	Define biot number. State its significance in transient heat.	**03**
	(b)	Explain characteristics for typical vapor bubbles.	**04**
	(c)	Write a short note on hydrodynamic boundary layer.	**07**
Q.4	**(a)**	Define: Absorptivity, Reflectivity, Transmissivity.	**03**
	(b)	Define boiling. Also classify boiling.	**04**
	(c)	Derive energy equation for thermal boundary layer.	**07**

OR

Q.4	**(a)**	Explain specular radiation and diffused radiation with neat sketch.	**03**
	(b)	Explain salient features and characteristics of radiation.	**04**
	(c)	Write a short note on boiling regimes.	**07**
Q.5	**(a)**	Define: Plane angle, Solid angle, Intensity of radiation.	**03**
	(b)	Differentiate between drop and film wise condensation.	**04**
	(c)	Write a short note on heat pipe.	**07**

OR

Q.5	**(a)**	Differentiate between laminar flow and turbulent flow.	**03**
	(b)	Explain wien's displacement law.	**04**
	(c)	Derive heat conduction equation for composite wall.	**07**

****