Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII (NEW) EXAMINATION – SUMMER 2024

Subject Code: 3171911 Date:01-06-2024

Subject Name: Advanced Heat Transfer

Time:02:30 PM TO 05:00 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**
5. **Use of Steam table and Heisler's chart is permitted**

			MARKS
Q.1	**(a)**	Explain the function of extended surfaces with classification.	**03**
	(b)	Derive the equation of heat dissipation for infinitely long fin from the general equation.	**04**
	(c)	Explain graphical method used for two dimensional steady state conduction analysis.	**07**
Q.2	**(a)**	Explain high velocity flow.	**03**
	(b)	Explain lumped parameter analysis along with it's differences from Heisler's chart.	**04**
	(c)	One end of a long rod of 1 cm diameter is maintained at 500°C by placing it in a furnace. The rod is exposed to air at 30°C with a convection coefficient of 35 W/m^2K. The temperature measured at a distance of 78.6 mm was 147.5°C. Determine the thermal conductivity of the material.	**07**
		OR	
	(c)	A cylinder of diameter 0.6 m with surface temperature of 200°C is enclosed in a square of 1.2 m side, the material having a thermal conductivity of 2.5 W/mK. The outside surface is at 5°C. Determine the heat loss per 15 m length.	**07**
Q.3	**(a)**	State the assumptions required for the analysis of a long circular rod exposed to ambient air.	**03**
	(b)	State the applications of finned surfaces.	**04**
	(c)	Explain temperature distribution and heat loss for fins of uniform cross section with different tip conditions.	**07**
		OR	
Q.3	**(a)**	Define effectiveness of fin and state it's equation.	**03**
	(b)	Explain with neat sketch why is the flow separation in flow over cylinders delayed in turbulent flow?	**04**
	(c)	Compare the heat transfer coefficients for the condition of two-fold increase in the diameter of the tube; the flow velocity is maintained constant by a change in the rate of liquid flow; assume that there is no change in the temperatures of the liquid and the tube wall and the flow through the tube is turbulent in character.	**07**
Q.4	**(a)**	State the applications of boiling heat transfer.	**03**
	(b)	Draw the boiling curve and identify the burnout point on the curve.	**04**

	(c)	Discuss various theoretical and empirical equations available to predict natural convection heat transfer coefficient.	**07**

OR

Q.4	**(a)**	State the factors affecting Nucleate boiling.	**03**
	(b)	Differentiate between pool boiling and forced convection boiling.	**04**
	(c)	Discuss different types of processes for condensation of vapour on a solid surface.	**07**
Q.5	**(a)**	State reciprocity theorem for shape factors.	**03**
	(b)	Using Planck's equation derive the Stefan-Boltzmann equation for emissive power of a black surface.	**04**
	(c)	Explain combined heat transfer coefficient with convection and radiation.	**07**

OR

Q.5	**(a)**	Explain intensity of radiation.	**03**
	(b)	Define and explain the concept of shape factor in radiation heat exchange.	**04**
	(c)	The heat transfer coefficient including convection radiation is 30 W/m^2 °C for the outer surface of the pipe in a large enclosure. Assume pipe surface is black. Calculate the radiation heat transfer coefficient if walls of the pipe surface and enclosure are at 200°C and 100°C respectively. Also find heat transfer coefficient by convection.	**07**

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