GUJARAT TECHNOLOGICAL UNIVERSITY
BE- SEMESTER–IV EXAMINATION – WINTER 2025

Subject Code:3140503   **Date:15-11-2025**

Subject Name: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.**

			MARKS
Q.1	**(a)**	Discuss the fourier's law of conduction.	**03**
	(b)	Define thermal conductivity and discuss the effect of temperature on thermal conductivity of gas and liquid.	**04**
	(c)	Explain conduction and flow of heat through a composite wall when resistances are in series.	**07**
Q.2	**(a)**	Enlist different types of fins with neat sketch.	**03**
	(b)	Explain concept of critical thickness of insulation and derive equation for the critical thickness of insulation.	**04**
	(c)	Using Dimension analysis derive expression for forced convection for the fluid flowing inside tube in a turbulent flow.	**07**

OR

	(c)	A pin fin 2.5 mm diameter is made of copper (k=396 w/m K). It protrudes from a wall maintained at 95 ^{o}C and placed in 25 oC air. The convective heat transfer coefficient over the fin is 10 W/m^2 K. Calculate the heat loss for the two cases. (1) Fin length 25 mm, (2) Fin length infinite	**07**
Q.3	**(a)**	Give the physical significance of (i) Nusselt Number (ii) Prandtl Number	**03**
	(b)	Differentiate between free and forced convection? Mention the factors on which the heat transfer coefficient depends.	**04**
	(c)	Differentiate between film wise and drop wise condensation.	**07**

OR

Q.3	**(a)**	Explain the significance of Biot, Graetz and Peclet numbers	**03**
	(b)	Discuss Condensation of vapor on Vertical and horizontal surface.	**04**
	(c)	Calculate the heat transfer coefficient for water at 60 ^{o}C flowing through a 0.625 cm diameter tube with a velocity of 0.9 m/sec. The tube wall temperature is 40 ^{o}C. Viscosity of water = 2.167 kg/m hr, thermal conductivity = 2.27 kJ/m hr K, heat capacity=4.187 kJ/Kg K.	**07**
Q.4	**(a)**	Define: Transmitivity, Absorptivity, and Reflectivity with example	**03**
	(b)	State and derive Kirchhoff's Law for radiation	**04**

(c)	Two large parallel plates with temp 400 °C & 900 °C & emissivity 0.4 and 0.75 are engaged in radiative heat transfer. Calculate the rate of heat transfer. {$\sigma = 56.7 \times 10^{-9}$ W/m^2 K^4}		**07**

<div align="center">OR</div>

Q.4	**(a)**	Define: White body and Grey body	**03**
	(b)	List out various laws of radiation and discuss any one in details.	**04**
	(c)	Discuss the various regimes of pool boiling with neat sketches.	**07**
Q.5	**(a)**	Discuss the classification of heat exchanger briefly.	**03**
	(b)	Derive the equation for L.M.T.D. in parallel flow heat exchanger. State all the assumption made in derivation.	**04**
	(c)	Hot oil (sp. Heat = 0.5 kcal/kg C) with a capacity of 5000 kg/hr flows through double pipe heat exchanger. It enters at 360 °C and leaves at 300 °C and cold fluid enters at 30 °C and leaves at 200 °C. if the overall coefficient is 800 kcal/hr m^2 C, determine the heat transfer area required for parallel flow.	**07**

<div align="center">OR</div>

Q.5	**(a)**	Define Capacity and Economy of evaporators.	**03**
	(b)	Explain Boiling Point Elevation (BPE).	**04**
	(c)	Discuss about feed forward and feed backward arrangement is multiple effect evaporators.	**07**

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