Seat No.: _____ Enrolment No.

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– V (New) EXAMINATION – WINTER 2019

Subject Code: 2153613 **Date: 04/12/2019**

Subject Name: Basics of Heat Transfer

Time: 10:30 AM TO 01:00 PM **Total Marks: 70**

Instruction0073:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

			MARKS
Q.1	**(a)**	Explain Fourier's law of heat transfer.	**03**
	(b)	Explain convection heat transfer with suitable example.	**04**
	(c)	Derive the general heat conduction equation in Cartesian co-coordinates.	**07**
Q.2	**(a)**	Derive an expression for steady state heat conduction through composite wall.	**03**
	(b)	The wall of an industrial furnace is constructed from 0.2 m thick fireclay brick having a thermal conductivity of 2.0 W/mK. Measurements made during steady state operation reveal temperatures of 1500 and 1250 K at the inner and outer surfaces, respectively. What is the rate of heat loss through a wall which is 0.5 m by 4 m on a side?	**04**
	(c)	Explain various types of extended surfaces. Derive the expression for heat transfer through the rectangular fin.	**07**
		OR	
	(c)	What do you mean by critical radius of insulation? Explain the significance of critical radius, Derive expression of critical radius for Spherical shape.	**07**
Q.3	**(a)**	The heat flux through a wood slab 50 mm thick, whose inner and outer surface temperaturesare 40 and 20°C, respectively, has been determined to be 40 W/m^2. What is the thermalconductivity of the wood?	**03**
	(b)	Explain laws of radiation heat transfer in detail (any two).	**04**
	(c)	Calculate the rate of heat loss through the vertical walls of a boiler furnace of size 4 m by 3 m by 3 m high. The walls are constructed from an inner fire brick wall 25 cm thick of thermal conductivity 0.4 W/mK, a layer of ceramic blanket insulation of thermal conductivity 0.2 W/mK and 8 cm thick, and a steel protective layer of thermal conductivity 55 W/mK and 2 mm thick. The inside temperature of the fire brick layer was measured at 600^0 C and the temperature of the outside of the insulation 60^0 C. Also find the interface temperature of layers.	**07**
		OR	
Q.3	**(a)**	The convection heat transfer coefficient between a surface at 40°C and ambient air at 20°C is20 W/m^2K. Calculate the heat flux leaving the surface by convection.	**03**
	(b)	Explain Reynolds number, Nusselt Number in detail.	**04**
	(c)	Elaborate the different feeding method for multi effect evaporator with neat sketch.	**07**
Q.4	**(a)**	Elaborate plate type heat exchanger.	**03**
	(b)	Derive the expression for L.M.T.D. in counter current heat exchanger.	**04**
	(c)	Derive the expression for Prandtl analogy	**07**

OR

Q.4	**(a)**	Explain boiling point elevation.	**03**
	(b)	Explain the shell and tube heat exchanger.	**04**
	(c)	Explain the construction and working of calendria type evaporators with neat sketch.	**07**
Q.5	**(a)**	What is condensation? List the factors on which condensation is depend.	**03**
	(b)	What is economy of evaporator? Explain any one method used to increase the economy of evaporator.	**04**
	(c)	Elaborate with neat sketch, falling film evaporator.	**07**

OR

Q.5	**(a)**	Explain film wise and drop wise condensation.	**03**
	(b)	Define following terms 1. Effectiveness 2. Absorptivity 3. Reflectivity 4. Transmissibility	**04**
	(c)	A hot fluid enters a concentric pipe apparatus at a temperature of 148 °C and is to cooled to 93 °C by a cold fluid entering at 37°C and heated to 65 °C. Shall they be directed in parallel flow or counter flow?	**07**

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