Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– IV(NEW) EXAMINATION – SUMMER 2015

Subject Code: 2140503 **Date:03/06/2015**

Subject Name: Process Heat Transfer

Time: 10:30am-1.00pm **Total Marks: 70**

Instructions:

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

Q.1	**(a)**	Derive equation for heat transfer through a composite wall made up of 3 different materials in close thermal contact with each other, with no heat loss to surrounding when temperatures of hot and cold ends are T_h and T_c.	**07**
	(b)	A flat surface wall is constructed of a 115 mm layer of sil-o –cell brick with a thermal conductivity 0.4651 watt/m c backed by a 230 mm layer of common brick with thermal conductivity4.651watt/m c. The temperature of inner surface of the wall is 760° C and that of outer surface is 77° C. (i) What is the heat loss through the wall in Kw? (ii) What is temperature of the interface between the refractory brick and common brick?	**07**
Q.2	**(a)**	Draw the temperature profiles of cold and hot fluids for true co-current and counter –current flow in double pipe heat exchanger, Derive expression relating Rate of heat transfer and Log mean temperature difference.	**07**
	(b)	Water flowing at the rate 0.15 kg/sec is heated from 40° C to 80°C in a counter flow double pipe heat exchanger. The hot fluid is oil and enters exchanger at 105 °C and leaves at 70° C . Calculate heat transfer area if overall heat transfer coefficient is 300 w/m^2 °C. Sp. heat of water is 4.186 kj/kg °C.	**07**
		OR	
	(b)	Discuss Natural convection. Show the velocity and temperature profile for natural convection from heated vertical plate.	**07**
Q.3	**(a)**	With the help of Diagram of 1-2 Shell & Tube heat exchanger explain function of various parts of exchanger.	**07**
	(b)	Methyl Alcohol flowing in the inner pipe of a double pipe exchanger is cooled with water flowing in the jacket. The ID and OD of inner pipe are 25 and 32 mm respectively.The thermal conductivity of Steel is 45 W/m C . The individual coefficient and fouling factors are as under. Alcohol Co-eeficient , h_i 1020 W/m^2 C WaterCo-eeficient , h_o 1700 W/m^2 C Inner Fouling factor, h_{di} 5680 W/m^2 C Outer Fouling factor, h_{do} 5680 W/m^2 C What is overall heat transfer coefficient based on outside area of inner pipe?	**07**
		OR	
Q.3	**(a)**	Using Dimension analysis derive expression for forced convection for the fluid flowing inside tube in a turbulent flow.	**07**
	(b)	With the neat diagram show various ways to provide extended surface in an exchanger.	**07**
Q.4	**(a)**	State laws of radiation. Explain Black body.	**07**

(b) Determine the net radient interchange between two parallel oxidized iron plates at a distance of 25 mm, having side of 3m × 3m . The surface temperature of the two plates are 100 C and 40 C respectively. Emmissivities of the plates are 0.736. **07**

OR

Q.4 **(a)** Show different type of feeding arrangement for triple effect evaporator with advantages and disadvantage. **07**

(b) An evaporator is to be fed with 5000 Kg/hr of 10 % sugar solution by weight. The feed at 40°C is to be concentrated to a solution containing 40 % by wt of solute under an absolute pressure of 1.03 kg/cm^2. Steam is available at an absolute pressure of 3atm (Saturation temp of 134°C). The overall heat transfer coefficient is 1750 w/m^2 C. Calculate heat transfer area required and the steam requirement. **07**

Q.5 **(a)** Discuss with the help of diagram various regimes of pool boiling. What is the use of finding critical flux and critical temperature drop ? **07**

(b) Discuss condensation on Vetical surface. **07**

OR

Q.5 **(a)** Discuss construction and working of Plate type heat exchanger. **07**

(b) Discuss LMTD correction factor. **07**

Data for **Q.4(b)** (OR)

Temperature, °C	Enthalpy.kj./kg	
	Vapor	Liquid
40	2568	169.5
100	2675.7	418.6
134	2726.75	562.6

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