Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI- EXAMINATION – SUMMER 2016

Subject Code:160202 **Date:21/05/2016**

Subject Name:Automobile 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.**

Q.1 **(a)** Distinguish between the conduction, convection and radiation heat transfer. **07**

(b) Explain the concept of critical thickness of insulation. How to decide the thickness of insulation for electrical wires and steam pipes. **07**

Q.2 **(a)** Under what circumstances from the heat transfer point of view, will the use of finned walls be better? **07**

(b) Discuss the electrical analogy for radiant heat transfer. **07**

OR

(b) What is the function of radiator in an automobile? Explain with a neat sketch construction of a radiator. Which are the main parameters that affect the performance of a radiator? **07**

Q.3 **(a)** Derive an expression for log mean temperature difference for a parallel flow heat exchanger. **07**

(b) Find the heat flow rate through a composite wall as shown in the figure 1. Assume one-dimensional flow. K_A = 150 W/m^{0}C; K_B = 30 W/m^{0}C; K_C = 65W/m^{0}C; K_D = 50W/m^{0}C. **07**

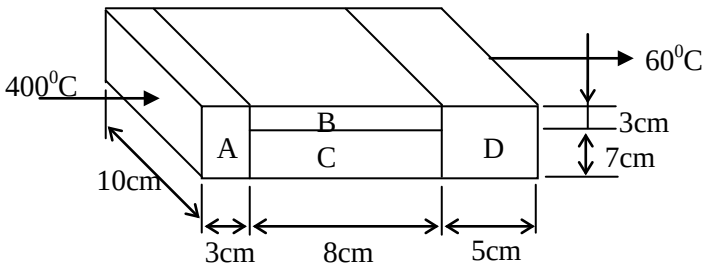

Figure 1

OR

Q.3 **(a)** Differentiate parallel flow and counter flow heat exchangers. **07**

(b) In an open-heart surgery under hypothermic conditions, the patient's blood is cooled before the surgery & rewarmed afterwards. It is proposed that a concentric tube counter flow heat exchanger of length 0.5m is to be used for this purpose, with a thin walled inner tube having a diameter of 55mm. If water at 60^{0}C & 0.1kg/sec is used to heat blood entering the exchanger at 18^{0}C & 0.05kg/sec, what is the temperature of the blood leaving the exchanger & the heat flow rate? **07**

Take U = 500 W/m^2 ^{0}C, Cp_{blood}=3.5kJ/kg, Cp_{water}=4.183kJ/kg

Q.4 **(a)** By dimensional analysis show that for forced convection heat transfer, Nusselt number can be expressed as a function of Prandtl number and Reynolds number. **07**

	(b)	Find out the average Nusselt number from the given local Nusselt number for a laminar flow past a flat plate; $$Nu_x = 0.332\,(Re_x)^{0.5}\,(Pr)^{0.33}$$	**07**
		OR	
Q.4	**(a)**	Explain the circumstances under which natural convection occurs. Differentiate between natural and forced convection.	**07**
	(b)	An electric heating system is installed in the ceiling of a room 5m (length)* 5m(width)*2.5m(height). The temperature of the ceiling is 320K whereas under equilibrium condition, the walls are at 300K. The floor is non-sensitive to radiation & the emissivities of the ceilings & walls are 0.7 & 0.6 respectively, Calculate the radiant heat loss from the ceiling to the walls. Take shape factor(F_{12}) between ceiling and a single wall =0.15.	**07**
Q.5	**(a)**	Differentiate between : (i) Emissive power and intensity of radiation , (ii) Absorptivity and emissivity of a surface , (iii) Gray surface and real surface.	**07**
	(b)	Write a short note on HEAT PIPE stating principle of operation, construction and application.	**07**
		OR	
Q.5	**(a)**	Discuss the various regimes of boiling and explain the condition for the growth of bubbles. What is the effect of bubble size on boiling?	**07**
	(b)	State any three laws of radiation.	**07**

****