Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE – SEMESTER – VI EXAMINATION – WINTER 2015

Subject Code:160202 **Date:17/12/ 2015**

Subject Name: Automobile Heat Transfer

Time:2:30pm to 5:00pm **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) What is Fourier's law of heat conduction and provide its electrical analogy? Derive the expression for critical thickness of insulation for sphere. **07**

(b) Derive an expression for the temperature distribution and heat dissipation from a fin insulated at the tip. **07**

Q.2 (a) What is Biot number? What is its significance? Is the Biot number more likely to larger for highly conducting solids or insulating ones? **07**

(b) Pin fin is provided to increase the heat transfer rate from furnace wall which of the following arrangement will give higher heat transfer rate? Take $t_0=230^0C$. **07**

(1) 6-fin of 10cm length (2) 12-fin of 5cm length

Take k=200W/mK, h= $20W/m^2$-K, C/S, area of fin=$2cm^2$, perimeter of fin=4cm,Surrounding air temperature=$30^0C=t_a$

OR

(b) Define shape factor. What is the shape factor with respect to itself if the surface is concave, convex or flat? **07**

Q.3 (a) Explain the mechanism of convection heat transfer. Also explain natural and forced convection. **07**

(b) State and explain Wien's displacement law. **07**

OR

Q.3 (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) Show by dimensional analysis, show that for forced convection, Nu = Ǿ(Re,Pr). **07**

Q.4 (a) Briefly explain the significance of following dimensionless numbers. **07**
Reynolds number, Grashof number and Prandtl number.

(b) Air flow over a plate (28 cm wide) with a velocity of 3m/s. The temperature of plate and air are 56^0C and 20^0C respectively. Calculate the following parameters at distance of 28cm from leading edge. The properties of air at the temperature of 38^0C are : $\rho=1.1374kg/m^3$, $k=0.02732W/m^0C$, Cp=1.005kJ/kgK, $\upsilon=16.768m^2/s$, Pr=0.7 **07**

(i) Boundary layer thickness

(ii) Local friction coefficient

(iii) Average friction coefficient

OR

Q.4	**(a)**	What is the function of radiator in an automobile? Explain with a neat sketch construction of a radiator.	**07**
	(b)	Write a short note on heat pipe stating principle of operation, types and applications.	**07**
Q.5	**(a)**	Differentiate between followings: 1) Direct and non contact type heat exchanger 2) Recuperator and regenerator	**07**
	(b)	Derive the relationship between effectiveness and number of transfer units for a counter flow heat exchanger.	**07**

OR

Q.5	**(a)**	Derive the LMTD equation for parallel flow heat exchanger.	**07**
	(b)	In a counter flow heat exchanger, flue gases at 800^0C (Cp=1.1kJ/kg k) with flow rate of 4kg/sec. The air on other side is flowing with 6kg/sec at 400^0C inlet temperature and 551.5^0C at outlet .Take U=100W/m^2k. Determine (a) Heat transfer area needed (b) NTU	**07**

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