Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– VIth EXAMINATION – SUMMER 2015

Subject Code: 160202 **Date:04/05/2015**

Subject Name: Automobile Heat Transfer

Time:10.30AM-01.00PM **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 the generalized equation for steady heat conduction in 3-dimensional Cartesian coordinates.	**07**
	(b)	Explain the concept of critical thickness of insulation and derive its equation for cylinder with usual notations.	**07**
Q.2	**(a)**	Explain the following terms.(i) Efficiency of fin (ii) Effectiveness of fin (iii) Biot number	**07**
	(b)	Derive the expression for fin efficiency for a fin insulated at the tip	**07**
		OR	
	(b)	A rod of 10 mm diameter and 80 mm length with thermal conductivity 16 W/m-deg protrudes from a surface at 160°C. The rod is exposed to air at 30°C with a convection coefficient of 25 W/m^2-deg. How does the heat flow from this rod get affected if the same material volume is used for two fins of the same length? Assume short fin with end insulated.	**07**
Q.3	**(a)**	Derive Von-Karman integral momentum equation for hydrodynamic boundary layer over a flat plate.	**07**
	(b)	Write short notes on the following: (a) Absoptivity, (b) Grey body, (c) Intensity of radiation and (d) Black body.	**07**
		OR	
Q.3	**(a)**	Explain heat exchanger effectiveness, fouling and NTU.	**07**
	(b)	State and explain Stefan Boltzmann law. Derive an expression for total emissive power of a Black body.	**07**
Q.4	**(a)**	Using Buckingham's π theorem , show that for forced convection Nu = Φ (Re , Pr)	**07**
	(b)	Explain the types of condensation. Mention some applications and unique features of boiling and condensation.	**07**
		OR	
Q.4	**(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) A flat plate 1m x 1m is placed in a wind tunnel. The velocity and temperature of free stream air are 80 m/s and 10°C respectively. The flow over the whole length of the plate is made turbulent by turbulizing grid placed upstream of the plate. Make calculation for the following parameters : **07**

(a) thickness of hydrodynamic boundary layer at trailing edge of the plate
(b) heat flow from the surface of the plate
The plate is maintained at 50°C and use the following thermo-physical properties of air $\rho = 1.25$ kg/m^3 ; k = 0.022W/m-deg ; v = 14.15x 10^{-6} m^2/s ; C_p = 1000J/kgK

Q.5 **(a)** Derive the relationship between effectiveness and number of transfer units for a parallel flow heat exchanger. **07**

(b) Calculate the surface area required for a heat exchanger which is required to cool 3600kg/hr of benzene (C_p=1.74 kJ/kgK) from 75°C to 45°C. The cooling water (C_p=4.18kJ/kgK) at 15°C has a flow rate of 2500 kg/hr. Consider Single pass counter flow arrangement. **07**

OR

Q.5 **(a)** What are the functions of cap which is used on a radiator? Explain construction and working of a radiator cap. **07**

(b) Write a short on Radiator used in Car including construction, working and application. **07**

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