

GUJARAT TECHNOLOGICAL UNIVERSITY
BE – SEMESTER – VI (OLD).EXAMINATION – WINTER 2016

Subject Code: 160202**Date: 27/10/2016****Subject Name: Automobile Heat Transfer****Time: 02:30 AM to 05:00 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)** Derive the general heat conduction equation in Cartesian coordinates. **07**
- (b)** Derive the energy equation for thermal boundary layer in usual notation. **07**
- Q.2 (a)** Derive an expression for the temperature distribution and heat dissipation from a fin insulated at the tip. **07**
- (b)** Explain the following terms.(i) Efficiency of fin (ii) Effectiveness of fin (iii) Biot number **07**

OR

- (b)** Explain the concept of critical thickness of insulation. How to decide the thickness of insulation for electrical wires and steam pipes. **07**
- Q.3 (a)** Discuss the modes of condensation. Why dropwise condensation is preferred? **07**
- (b)** Show by dimensional analysis that Nusselt number is a function of Grashoff number and Prandtl number for natural convection heat transfer. **07**

OR

- Q.3 (a)** Explain briefly any three of the following **07**
- [i] Plank's distribution law
 - [ii] Wein's displacement law
 - [iii] Surface irradiation
 - [iv] Kirchoff's law of radiation
- (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 $t_o = 230^\circ\text{C}$. **07**
- (1) 6-fin of 10 cm long
 - (2) 12-fin of 5 cm long
- Take $k = 200 \text{ W/m}^2\text{K}$, $h = 20 \text{ W/m-K}$, c/s area of fin = 2 cm^2 , perimeter of fin = 4 cm, surrounding air temperature = $30^\circ\text{C} = t_a$

- Q.4 (a)** Discuss the various regimes of boiling and explain the condition for the growth of bubbles. **07**

- (b) Assuming the sun to be a black body having a surface temperature of 5800 K, Calculate (a) the total emissive power, (b) the wavelength at which the maximum spectral intensity occurs, (c) the maximum value of $E_{b\lambda}$, (d) the total amount of radiant energy emitted by the sun per unit time if its diameter can be assumed to be 1.391×10^9 m. **07**

OR

- Q.4 (a)** Explain the following terms: **07**
1) NTU
2) Effectiveness of heat exchanger
3) Overall heat transfer coefficient.

- (b) Differentiate between followings: **07**
1) Direct and non-contact type heat exchanger
2) Recuperator and regenerator

- Q.5 (a)** Describe in brief construction and working of radiators used in cooling of IC Engines. Which are the main parameters used in their design. **07**

- (b) In a double pipe counter flow heat exchanger, oil ($C_p=1.45$ W/mk) is cooled from 230°C to 160°C using water ($C_p=4.187$ kJ/kgk) from 25°C to 65°C . The mass flow rate of oil is 0.9 kg/sec. Take overall heat transfer coefficient $U_s=420$ W/m²k. Calculate the heat transfer rate, mass flow rate of water and surface area of heat exchanger. **07**

OR

- Q.5 (a)** Derive an expression for log mean temperature difference for a parallel flow heat exchanger **07**

- (b) What are the functions of cap which is used on a radiator? Explain Construction and working of a radiator cap. **07**
