Seat No.: _____ Enrolment No._____

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 arrangment will give higher heat transfer rate? Take $t_o = 230^oC$. **07**
(1) 6-fin of 10 cm long
(2) 12-fin of 5 cm long
Take k = 200 W/m^2K, h = 20 W/m-K, c/s area of fin = 2 cm^2, perimeter of fin = 4 cm, surrounding air temperature = $30^oC = t_a$

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 occur, (c) the maximum value of $E_{b\lambda}$, (d) the total amount of radiant energy emitted by the sun per unit time if it's diameter can be assumed to be 1.391 x 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) **07**

In a double pipe counter flow heat exchanger, oil (Cp=1.45 W/mk) is cooled from 230ºC to 160ºC using water (Cp=4.187 kJ/kgk) fom 25ºC to 65ºC. The mass flow rate of oil is 0.9 kg/sec. Take overall heat transfer coefficient t_s =420 W/m^2k. Calculate the heat transfer rate, mass flow rate of water and surface area of heat exchanger.

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**

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