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

GUJARAT TECHNOLOGICAL UNIVERSITY
BE SEM-VI Examination-Nov/Dec-2011

Subject code: 160202 **Date: 23/11/2011**
Subject Name: Automobile Heat Transfer
Time: 10.30 am -1.00 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 an expression for one-dimensional steady-state heat conduction from composite wall with three layers. 07

Q.2 (a) Derive an expression for a solid cylinder temperature distribution under one dimensional steady state heat conduction with uniform heat generation. 07

(b) Define fin efficiency and fin effectiveness. Explain why fins are widely used. 07

OR

(b) Steel balls12mm in diameter are annealed by heating to 1150K and then slowly cooling to 400K in an air environment for which T_∞ is 325K and h=20 W/m^2 K . Properties of the steel k=40 W/m K, ρ=7800 kg/m^3 and Cp=600 J/kg K. Estimate the time required for the cooling process. 07

Q.3 (a) Explain the circumstances under which natural convection occurs. Differentiate between natural and forced convection. 07

(b) Explain the physical significance of (a) Reynolds number (b) Prandtl number (c) Nusselt number. 07

OR

Q.3 (a) Incident radiation 1577 W/m^2 strikes an object. The amount of energy absorbed is 472 W/m^2 and the amount of energy transmitted is 78.8 W/m^2. What is the value of reflectivity? 07

(b) Two very large parallel planes with emissivities 0.3 and 0.7 exchange heat. Find the percentage reduction in heat transfer when two polished aluminium radiation shield with emissivity 0.4 is placed between them. 07

Q.4 (a) Explain the film condensation. Write some industrial applications of condensation. 07

(b) Explain the Phenomenon of boiling and also mention some applications. 07

OR

Q.4 (a) Write short notes on the following: (a) Emissivity (b) grey body (c) Intensity of radiation (d) black body 07

(b) What is a radiation shield? When it is used? Also write the expression for radiation heat transfer between two parallel plates with one shield. 07

Q.5 (a) Explain the terms: Fouling factor, Effectiveness, NTU, LMTD. 07

(b) Drive an expression for the LMTD of a parallel flow heat exchanger. 07

OR

Q.5 (a) It is desired to cool oil from 120 °C to 50 °C using double pipe heat exchanger. The cooling water enters the heat exchanger at 20 °C and leaves it at 40 °C. Calculate the LMTD for parallel and counter flow arrangement. 07

(b) Oil at 100 °C (Cp=3.6 kJ/kg K) flows at a rate of 30,000 kg/h and enters into a parallel flow heat exchanger. Cooling water (Cp= 4.2 kJ/kg K) enters the heat exchanger at 10 °C at a rate of 50,000 kg/h. The heat transfer area is 10 m^2 and U=1000 W/m^2K. Calculate the outlet temperature of oil and water. 07

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