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

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (OLD) - EXAMINATION – SUMMER 2017

Subject Code: 160202 **Date: 15/05/2017**

Subject Name: Automobile Heat Transfer

Time: 10:30 AM to 01:00 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)** What is Fourier law of heat conduction? Derive a 3- dimensional general conduction equation in Cartesian co-ordinates and deduce the Poisson's equation from it. **07**

(b) An exterior of the house is 0.1m layer of common brick of thermal conductivity (k) 0.7 w/m. deg. c. followed by 0.05m layer of gypsum plaster of thermal conductivity 0.5 w/m deg. c. What thickness of rock wool insulation of thermal conductivity (k) 0.1w/m deg. c. should be added to reduce the heat loss or gain through the wall by 80 percent? **07**

Q.2 **(a)** What are extended surfaces and their applications? Explain briefly fin efficiency and effectiveness. **07**

(b) Derive the general equation for steady state temperature distribution for a heat generating cylinder and amount of heat transfer in usual notations. **07**

OR

(b) A flat plate at 90^0C temperature is kept in a air stream at temperature of 30^0 C. The velocity of air is 2 m/s. The plate measures 60 x30 cm. Compare the heat loss from the plate when the air flows parallel to 60 cm and parallel to 30 cm side. Assume Nusselt number for laminar flow in forced convection as $Nu_x = 0.3329(Rex)^{1/2} (Pr)^{1/3}$. Thermo physical properties of air at 60^0 C temperature are **07**

ρ =1.06 kg/m^3, γ= 18.97 x10-6 m^2/s, k= 2.894 x 10^{-2} W/ m K, Pr = 0.7

Q.3 **(a)** Using Buckingham's π theorem, show that the free convection is given by Nu= ϕ (Gr.) (Pr.) **07**

(b) Explain briefly the phenomena of convection heat transfer. Explain with neat sketch hydrodynamics and thermal boundary layers over a flat plat. What is the effect of Prandtl number on these layers? **07**

OR

Q.3 **(a)** Derive the Von – Karman momentum integral equation for flow over a flat plate. **07**

(b) Distinguish between mechanism of film wise and drop wise condensation. Which type has higher heat transfer coefficient and explain why this so.? **07**

Q.4 **(a)** Explain briefly any three of the followings. **07**

[i] Kirchoff's law of radiation

[ii] Lambert's cosine law

[iii] Radiosity

[iv] Black Body

(b) Two large parallel plates are exchanging radiation heat only. First plate has emissivity of 0.7 & temperature of 900 K and second plate has emissivity of 0.95 and temperature of 300k. Calculate the radiation exchange between these plates. If a thin polished metal sheet of 0.15 emissivity is incorporated between two plates, calculate the steady state temperature of the metal sheet and the new radiation exchange. **07**

OR

Q.4 **(a)** An industrial furnace in the form of a black body emits radiation at 4000K temperature. Calculate the followings **07**

[i] Monochromatic emissive power at 1 μ wave length

[ii] Wave length at which the emission is the maximum

[iii] Total emissive power

[iv] Maximum spectral emissive power

[v] Compare the total emissive power of the furnace, if it is assumed as a real surface having emissivity equal to 0.7

(b) Explain briefly various types of heat exchangers. Explain with a neat diagram a counter flow heat exchanger and specify its application. **07**

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

(b) Specify various types of heat pipes known to you. Explain with a neat sketch principle of operation, working and applications of the heat pipe. **07**

OR

Q.5 **(a)** Explain with a neat sketch function, construction and working of a radiator which is used for cooling of an I C Engines. **07**

(b) Write short notes on any three of the followings **07**

[i] Nucleate boiling

[ii] Radiator cap

[iii] NTU

[iv] Effectiveness of heat exchangers

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