Roll No _____ **Examination May-2014** Total no of page-2

B. Tech. (AE)

Heat Transfer

Subject Code : BTAE-503

Paper ID-A2063

Time : 03 hours Maximum Marks : 60

Instructions to candidates:

1) Section -A is compulsory containing of ten questions carrying of two marks each.
2) Section – B contains five questions carrying five marks each and students have to attempt any four questions.
3) Section – C contains three questions carrying ten marks each and students have to attempt any two questions.

Section – A

Q1)

1. Define radiosity and emissive power.
2. Indicate the concept of boundary layer.
3. Is heat transfer a scalar or vector quantity? Explain. Answer the same question for temperature.
4. Sketch the temperature variations in parallel flow and counter flow heat exchangers.
5. What do you mean by energy balance in heat transfer of IC engines ?
6. List the parameters that influence the heat transfer coefficient.
7. What is the heat transfer mechanisms involved during heat transfer from the hot to the cold fluid?
8. What is the physical significance of Reynolds number?
9. What do you understand by a gray body and blackbody?
10. What is the physical significance of critical thickness of insulation? (2 ×10)

Section –B

Q2 A steel pipe line *(k = 50 W/mK)* of I.D. 100 mm and O.D = 110 mm is to be covered with two layers of insulation each having a thickness of 50 mm. The thermal conductivity of the

first insulation material is 0.06 *W/mK* and that of the second is 0.12 *W/mK*. Calculate the loss of heat per meter length of pipe and the interface temperature between the two layers of insulation when the temperature of the inside tube surface is 250°C and that of the outside surface of the insulation is 50°C. 5

Q 3) A turbine blade 6 cm long and having a cross-sectional area 4.65 cm^2 and perimeter 12 cm, is made of stainless steel (k = 23.3 W/mK). The temperature at the root is 500°C. The blade is exposed to a hot gas at 870°C. The heat transfer coefficient between the blade surface and gas is.442 W/m^2K. Determine the temperature distribution and rate of heat flow at the root of the blade. Assume the tip of the blade to be insulated. 5

Q 4). Explain temperature distribution and stresses in piston of IC engines. 5

Q 5) Differentiate between natural convection and forced convection.

Q 6) Starting from planks law radiation, derive the relation for Stefan Boltzman's law of radiation. 5

Section C

Q7) Derive the expression for LMTD of the parallel flow heat exchanger. State clearly the assumptions. 10

Q 8) Starting from basic derive the equation for heat dissipation and temperature distribution by a fin considering length of fin is very long. 10

Q 9) a) The temperature of a body of area 0.1 m^2 is 900 K. Calculate the total rate of energy emission, intensity of radiation in $W/(m^2$ sr), maximum monochromatic emissive power and wave length at which it occurs.

c) Write a short note on Critical thickness of insulation.

5+5 =10

End