D17002068

Registration No: | | | | | | | | | | |

Total Number of Pages : 02 **M.TECH**

M.TECH 1ST SEMESTER REGULAR EXAMINATIONS, DECEMBER 2017
HEAT TRANSFER - I
Branch: TE, Subject Code:MTEPC1020
Time: 3 Hours
Max Marks : 70
The figures in the right hand margin indicate marks.

PART-A (10 X 2=20 MARKS)

1. Answer the following questions.

a. What is a conduction shape factor? How is it related to the thermal resistance?
b. Write down the different types of initial and boundary conditions associated with the heat conduction problem.
c. Explain Prevost's theory of heat exchange?
d. Write the formula of critical radius of insulation for a sphere.
e. What are the conditions for applying separation of variable method for heat transfer problem?
f. Explain about the radiation pressure
g. What do you mean by critical thickness of insulation? Give the expression of critical thickness for a spherical body with insulation.
h. A 100W light bulb may be considered to be an isothermal black sphere at a temperature of 3001^0C.Find out the efficiency of the bulb if the light flux (i.e., visible light,0.4 μm<λ<0.7 μm)
i. Explain Prevost's theory of heat exchanger?
j. What is Hausen's Chart? Where is it used?

PART-B (5 X 10=50 MARKS)

Answer any five questions from the following.

2(a) Derive the general heat conduction equation in orthogonal curvilinear coordinate system. 6+4
b) From the above equation derive the heat conduction equation in Cartesian coordinate system.

3(a) Derive the relation for heat flux in a circular fin of rectangular profile with adiabatic tip. 4+6
(b) A 25 mm OD pipe of thermal conductivity 26 W/mK is fitted with circular fins of rectangular profile of 8 mm wide and 2 mm thick. These fins are made of the same material as the pipe and the heat transfer coefficient is 568 W/m^2K. For adiabatic tip Compute.
i) The percentage increase in heat flux in the presence of fins ii) Fin efficiency.

4 a) Derive the mathematical expression for steady state temperature distribution for Triangular fin with base b and height h 6+4
b) Derive the mathematical expression for heat transfer for Triangular fin with base b and height h.

5. (a) Write short notes on Planck's law of radiation and derive Wien's law from it? 3+7

(b) Determine the rate of heat loss by radiation from a steel tube of outside diameter 70mm and 3m long at a temperature of 227^0C if the tube is located in a brick conduit of square cross-section of 0.3m side. The conduit temperature is 27^0C. Take emissivity for steel =0.79 and for brick= 0.93.

6. a) A semi-infinite solid having uniform temperature of T, is suddenly dipped into a fluid medium of temperature $T_0 = T_\infty$. The heat transfer coefficient between the fluid and outer surface of the plate is too large. The plate attains the fluid temperature upon dipping. Find the temperature distribution in the plate 6+4

b) State and explain Duhamel's Theorem

7.a) A small area A_1 is radiating heat with a parallel circular disc A_2 . A_l is located on the axis of the disc and the semi vertex angle of the cone formed with the disc as base and A_l as the vertex is a. Prove that $F_{12} = Sin^2a$ 6+4

b).A cubical oven has inside sides equal to 0.4m. One of the faces of the oven forms the door. If the five others side faces are black and maintained at 600°C, find the rate of heat loss if the oven door is kept open. Assume outside temperature is zero Kelvin.

8. a) State and explain reciprocity theorem? 4+6

b) Derive the expression for heat transfer for fin with heat losing at the tip by convection

==0==