R15

Code No: 126VF

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year II Semester Examinations, December - 2018
HEAT TRANSFER
(Common to ME, AME, MSNT)

Time: 3 hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART - A

(25 Marks)

1.a)	Give an example of combined convection and radiation mode of heat transfer.	[2]
b)	What is thermal diffusivity?	[3]
c)	How the fin thickness influences the efficiency of a fin.	[2]
d)	What is infinite long cylinder in analysis of transient heat conduction?	[3]
e)	How Prandtl number links the velocity and temperature fields.	[2]
f)	What is hydrodynamic layer while analyzing convective heat transfer?	[3]
g)	What is film wise and drop wise condensation.	[2]
h)	What is a grey body?	[3]
i)	How LMTD and AMTD differs.	[2]
j)	What is NTU method of a heat exchanger?	[3]

PART - B

(50 Marks)

2.a) Discuss about the thermal properties of matter.

b) An ice chest whose outer dimensions are 300mm × 400mm × 400mm is made of 30 mm thick Styrofoam (k =0.033W/m ^{0}C). Initially the chest is filled with 40 kg of ice at 0^0C, and the inner surface temperature of the ice chest can be taken to be 0^0C at all times. The heat of fusion of ice at 0^0C is 333.7kJ/kg, and the surrounding ambient air is at 30^0C. Neglecting any heat transfer from the 400mm × 400mm base of the ice chest, determine how long will it take for the ice in the chest to melt completely if the outer surfaces of the ice chest are at 8^0C. [5+5]

OR

3. Derive the heat conduction equation in a cartesian coordinate system. [10]

4.a) What criteria's are considered while deigning and selecting a fin?

b) Define the effectiveness of a fin while justifying its usage. [5+5]

OR

5. Briefly describe about lumped heat capacity system. Give its examples. [10]

6. Air at 27^0C and 1 atm flows over a flat plate at a speed of 2m/s. calculate the boundary layer thickness at a distance of 20 and 40 cm from the leading edge of the plate. Calculate the mass flow which enters the boundary layer between x= 20 cms and x = 40 cms. The viscosity of the air is at 27^0C is 1.85×10^{-5} kg/m s. Assume the unit depth in the z- direction. [10]

OR

7. Liquid bismuth flows at a rate of 4.5 kg/s through a 5 cm diameter stainless steel tube. The bismuth enters at 415^0 C and is heated to 440^0C as it passes through the tube. If a constant heat flux is maintained at along the tube and the tune wall is at a temperature 20^0C higher than bismuth bulb temperature, calculate the length of the tube required to affect the heat transfer. [10]

8. How the condensation and boiling phenomenon heat transfer takes place. Give basic equations. [10]

OR

9. Two perfectly black parallel planes 1.2 by 1.2 m are separated by a distance of 1.2 m. one plane is maintained at 800 K and the other at 500 K. The plates are located in a large room whose walls are at 300K. What is the net heat transfer between the planes? [10]

10.a) What are compact heat exchangers?

b) What is the purpose of a regenerator? [5+5]

OR

11. Hot oil (c_p = 2.09 kJ/kg K) flows through a counter flow heat exchanger at the rate of 0.7kg/s. it enters at 200^0C and leaves at 70^0C. the cold oil (c_p = 1.67 kJ/kg K) exits at 150^0C at the rate of 1.2 kg/s. Determine the surface area of the heat exchanger required for the purpose if the overall heat transfer coefficient is 650W/m^2K. [10]

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