School of Engineering
B.TECH Mechanical Engineering
Mid Term Examination - Nov 2023

Duration : 90 Minutes
Max Marks : 50

Sem V - G3UB504B - Heat and Mass Transfer

General Instructions
Answer to the specific question asked
Draw neat, labelled diagrams wherever necessary
Approved data hand books are allowed subject to verification by the Invigilator

1) Explain the significance of the conduction shape factor in analyzing heat conduction problems. — K2 (2)

2) List and briefly explain the three modes of heat transfer. — K1 (3)

3) Consider a metal rod of length 'L,' cross-sectional area 'A,' and thermal conductivity 'k.' If one end of the rod is maintained at a temperature 'T1' and the other end at 'T2,' derive the equation for steady-state heat conduction through the rod. Show all relevant steps in your derivation. — K2 (4)

4) Explain the concept of fin efficiency and its significance in the design and performance of heat transfer systems. — K2 (6)

5) Explain the physical significance of the Biot number — K3 (6)

6) Explain the concept of thermal contact resistance and illustrate its effects on heat transfer in composite walls, cylinders, and spheres. — K3 (9)

7) Outline the electrical analogy approach in modeling heat transfer problems and rephrase it in simple terms for better understanding. — K4 (8)

8) A copper fin (k=380W/mK) having a diameter of 25 mm is attached to a wall at 1200C. The ambient temperature is 250C and the heat transfer coefficient is 10 W/m2K. Determine the rate of heat dissipation from the fin. How long the fin should be in order to be considered infinite? — K4 (12)

OR

A steel pipe with a 50 mm outer diameter is covered with 6.4 mm asbestos insulation (K= 0.166 W/m0C) followed by a 25 mm layer of fiberglass insulation (K= 0.0485 W/m0C). The pipe wall temperature is 393 K and the outside insulation temperature is 311 K. Determine the interface temperature between the asbestos and fiberglass. — K4 (12)