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Total No. of Questions : 09] [Total No. of Pages : 02

Paper ID [ME303]

(Please fill this Paper ID in OMR Sheet)

B.Tech. (Sem. - 5th)

HEAT TRANSFER (ME - 303)

Time : 03 Hours **Maximum Marks : 60**

Instruction to Candidates:

1) Section - A is **Compulsory**.
2) Attempt any **Four** questions from Section - B.
3) Attempt any **Two** questions from Section - C.

Section - A

(10 × 2 = 20)

Q1)

a) Define thermal conductance and thermal resistance.
b) Why thermal conductivity of metals higher than that of fluids?
c) What is thermal diffusivity ?
d) Describe efficiency and effectiveness of fin.
e) What is log mean area as applied to hollow cylinder?
f) What is Biot and fourier numbers?
g) Define the velocity and thermal boundary layers.
h) What is sub-cooled boiling?
i) Why aluminium is used as a fin material?
j) What is critical heat flux?

Section - B

(4 × 5 = 20)

Q2) Establish general heat conduction equation in cylindrical co - ordinates.

Q3) An electric cable of 20 mm diameter is insulated with rubber, which is exposed to the atmosphere at 30°C . Calculate the most economic thickness of the rubber insulation (K= 0.175W/mK) . When the cable surface temperature with and without insulation is at 70°C. Also calculate the percentage increase in heat dissipation and current carrying capacity when most economical thickness is provided. Take heat transfer coefficient = 9.3W/m²K.

Q4) Derive expression for temperature distribution and heat dissipation in a straight fin of rectangular profile for fin insulated at the tip.

Q5) A long cylindrical heater 25 mm in diameter is maintained at 660°C and has the surface resistively of 0.8. The heater is located in a large room whose walls are at 27°C. How much will the radiant heat transfer from the heater be reduced if it is surrounded by a 300 mm diameter radiation shield of aluminium having an emissivity of 0.2 ?

Q6) Explain briefly the condensation mechanism.

Section - C

(2 × 10 = 20)

Q7) A thin hollow steel tube with ID = 7.6 mm and OD = 8mm is heated with a current 250A intensity. The outer surface of the tube is insulated and all the heat generated in the tube wall is transferred through its inner surface. The specific resistance and thermal conductivity of steel are 85μΩ cm and 18.6 W/mK resp. Calculate :
(a) Volumetric rate of heat generated
(b) Temp. drop across the wall.

Q8) A heat exchanger is to be designed to condense an organic vapour at a rate of 500 kg/min which is available at its saturation temp 355 K. cooling water at 286 K is available at a flow rate of 60 kg/s. The overall heat transfer coefficient is 475 W/m²C. Latent heat of condensation of the organic vapour is 600 kJ/kg. Calculate:
(a) The no. of tubes required, if 25 mm outer diameter, 2 mm thick and 4.87 m long tubes are available.
(b) The no. of tube passes, if the cooling water velocity should not exceed 2m/s.

Q9) Write short notes on any three of the following:
(a) Nucleate Boiling.
(b) Optimum thickness of insulation
(c) Black and grey bodies
(d) Type of heat exchangers