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BIME-026

DIPLOMA – VIEP – MECHANICAL ENGINEERING (DMEVI)

01116

Term-End Examination

June, 2015

BIME-026 : HEAT TRANSFER

Time : 2 hours *Maximum Marks : 70*

Note : *Attempt any **five** questions. All questions carry equal marks. The use of scientific calculator is allowed.*

1. (a) Explain about the mechanism of thermal conduction in solids. 7

(b) What do you understand by heat transfer coefficient ? Explain its utilities. 7

2. (a) Briefly describe Fourier's conduction equation (no derivation) with a flow diagram. 7

(b) Determine the loss of heat through the wall of a rotating sphere shaped boiling pan with an inner diameter d_1 = 1·5 m and total boiler wall thickness δ = 20 cm. Inner surface temperature is 200°C and that of outer surface T_2 = 50°C. The equivalent thermal conductivity is 0·12 kcal/m-hr-°C. Also find the heat flux. 7

3. (a) A current of 300 amps is passed through a stainless steel wire 2·5 mm in diameter. The resistivity of the wire may be taken as 70 μ ohm-cm and the length of the wire is 1·5 metre. If the outer surface temperature of the wire is maintained at 180°C, calculate the centre temperature of the wire. (For stainless steel, take K = 25 kcal/m-hr-°C) 7

(b) Is there any difference between a fin and an extended surface ? With neat diagrams describe few extended surfaces. 7

4 (a) Find the heat loss from a rod 4 cm in diameter and infinitely long when its base is maintained at 100°C. The conductivity of the material is 50 kcal/m-hr-°C and the heat transfer coefficient on the surface of the rod is 40 kcal/m^2-hr-°C. The temperature of the air surrounding the rod is 20°C. 7

(b) Briefly discuss about Biot and Fourier Numbers. Also explain the criteria for neglecting internal temperature gradient. 7

5. (a) Briefly discuss about Newton's law of cooling and Boundary layer theory. 7

(b) What are the advantages and limitations of Dimensional Analysis ? 7

6. (a) Calculate the heat transfer coefficient for water flowing through a 2 cm diameter tube with a velocity of 2·5 m/s. The average temperature of water is 50°C and the surface temperature of the tube is slightly below this temperature. 7

[Assume that the flow is turbulent, and the properties at 50°C are :

C_p = 4182 J/kg K, K = 0·643 W/mK

ρ = 988 kg/m^3, $\mu = 544 \times 10^{-6}$ kg/ms]

(b) Briefly discuss about Forced convection and Natural convection with suitable examples. 7

7. (a) The Sun emits maximum radiation at λ = 0·52 μ. Assuming the Sun as a black body, find the surface temperature of the Sun and emissive power at that temperature. 7

(b) What is condensation ? Write down the assumptions in deriving the mathematical solution given by Nusselt for laminar film condensation. 7
