DIPLOMA – VIEP – MECHANICAL ENGINEERING (DMEVI)

Term-End Examination

December, 2015

BIME-026 : HEAT TRANSFER

Time : 2 hours   *Maximum Marks : 70*

Note : *Attempt any five questions. All questions carry equal marks. Use of scientific calculator is permitted.*

1. (a) State and explain about Laplace equation and Poisson's equation (No derivation).   7

   (b) Explain about "Heat Transfer" at the interface of two solids.   7

2. (a) Explain about the analogy between heat flow and electricity with a suitable example.   7

   (b) Briefly write about Critical Radius of insulation and Economic Thickness of insulation.   7

3. (a) A rotor of a gas turbine is 14 cm thick at the centre and 4 cm at the top. The radius of the rotor is 50 cm. The temperatures measured at 10 cm and 50 cm are 320°C and 600°C respectively. The thermal conductivity of the rotor material is 0·37 W/m-°C. Determine the radial heat flow through the rotor.   7

(b) Brief about overall heat transfer coefficient, concept of thermal resistance and conductance. 7

4. (a) A stainless steel wire, 3 mm in diameter and one meter long, carrying 200 amp current is submerged in a liquid at 80°C. [Assume K = 25 W/m-°C; resistivity (ρ) = 70 $\mu\Omega$-cm^2/cm; h (heat transfer coefficient on wire surface) = 4000 W/m^2-C] Determine the centre temperature of the wire. 7

(b) Briefly write about the physical significance of different Non-dimensional numbers. (at least four numbers) 7

5. (a) What do you understand by thermal radiation ? Also briefly write about Black Body radiation. 7

(b) A steam pipe of 10 cm diameter maintained at 170°C is exposed to air at 30°C. The length of the pipe is 2 m and is kept horizontal. Taking the following properties of air at mean temperature of (170 + 30) = 100°C, find the heat lost by the pipe per hour. 7

[Take k = 0·0322 W/mK,
$v = 23\cdot3 \times 10^{-6}$ m^2/sec, P_r= 0·69 and
$\beta = 1/T_m = (1/373)$ K^{-1}]

6. (a) Water is passed through the annulus formed by the two tubes of 5 cm and 3 cm diameter at a velocity of 0·5 m/sec. If the inlet temperature of the water is 20°C and 3 cm diameter tube temperature is maintained at 80°C, find the heat transfer coefficient between the water and small tube surface. 7

[Take ρ = 988 kg/m^3;
C_p = 0·997 kcal/kg-°C
k = 0·557 kcal/m-hr-°C;
v = 0·55 × 10^{-6} m^2/sec]

(b) Write about Gas Radiation, Solar Radiation and Radiosity. 7

7. (a) Write about Absorption, Reflection and Transmission with suitable examples. 7

(b) State and explain about Planck's distribution law. 7

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