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BIME-026

DIPLOMA – VIEP – MECHANICAL ENGINEERING (DMEVI)

Term-End Examination

June, 2016

00476

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 allowed.*

1. (a) What is the difference between the steady state and unsteady state of heat transfer ?

(b) What are the applications of heat transfer study ? Give some suitable examples. 7+7

2. (a) Natural convection in water in lakes plays an important role in saving the lives of fishes when the atmospheric temperature falls below 0°C. Comment.

(b) What is Fourier's law of heat conduction ? What are the assumptions made for Fourier's law of heat conduction ? 7+7

3. (a) A plane wall, 20 cm thick, has a thermal conductivity given by the following relation :

$$K = 2t\ 0{\cdot}005\ T\ W/m\text{-}K,$$

where T is temperature in Kelvin. If two surfaces of the wall are at 150°C and 50°C, determine the rate of heat transfer for a wall of 3 m × 5 m.

(b) A hot plate 1 m × 2 m is maintained at 320°C. Air at 20°C moves over the plate. If h = 40 watts/m^2°C, find the rate of heat transfer. 7+7

4. (a) Derive an expression for the critical radius of insulation for a cylinder.

(b) The walls of a house are 0·3 m thick and the total surface area of the walls is 100 m^2. Thermal conductivity (K) of the walls = 1 W/m-K. Temperature of outside air is 37°C and inside air is 27°C. Heat transfer coefficients inside and outside are 20 W/m^2-K and 10 W/m^2-K respectively. Calculate the inside and outside wall temperature, and heat transfer rate through the walls. 7+7

5. (a) What do you understand by fin effectiveness and fin efficiency ?

(b) A composite slab has two layers of different materials with thermal conductivity 'K_1' and 'K_2'. Find the equivalent thermal conductivity of the slab, if each layer has the same thickness. 7+7

6. (a) What is Prandtl Number (Pr) ? What is its significance ?

(b) The sun emits maximum radiation at $\lambda = 0{\cdot}52\ \mu$. Assuming the sun as a black body, find the surface temperature of the sun, and emissive power at that temperature. 7+7

7. (a) Explain absorptivity, reflectivity and transmissivity.

(b) Find the shape factors for the hemispherical surface and a plane surface as shown in Figure 1. 7+7

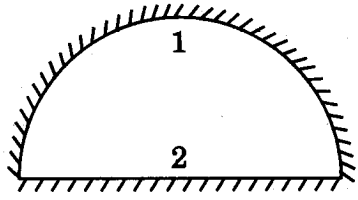

Figure 1