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BIME-026

DIPLOMA – VIEP – MECHANICAL ENGINEERING (DMEVI)

00992

Term-End Examination

December, 2017

BIME-026 : HEAT TRANSFER

Time : 2 hours *Maximum Marks : 70*

Note : *Attempt **five** questions in all. Question no. **1** is **compulsory**. All questions carry equal marks. Use of scientific calculator is permitted. Assume missing data, if any, suitably.*

1. Choose the correct answer from the given four alternatives : *7×2=14*

(a) A black body absorbs all radiations. As a result of absorption of these radiations

(i) The black body shines

(ii) The temperature of the black body rises

(iii) The black body radiates energy to other bodies

(iv) The black body becomes a good conductor of heat

(b) Which one of the following materials will have the highest value of thermal conductivity ?

(i) Steel

(ii) Aluminium

(iii) Brass

(iv) Copper

(c) The temperature inside a furnace is measured by

(i) Mercury thermometer

(ii) Alcohol thermometer

(iii) Gas thermometer

(iv) Optical pyrometer

(d) The rate of heat flow from a 50 mm thick wall of material having thermal conductivity of 40 W/m-K for a temperature difference of 10°C will be

(i) 80 W/m^2

(ii) 800 W/m^2

(iii) 8000 W/m^2

(iv) 200 W/m^2

(e) The ratio of heat flow $\frac{Q_A}{Q_B}$ from two walls of same thickness having thermal conductivity $K_A = 2K_B$ for the same temperature difference will be

(i) 1

(ii) 0·5

(iii) 2

(iv) 0·25

(f) Three rods, one made of glass, one of pure aluminium and one made of wrought iron, are heated to 150°C. All the rods are 15 mm in diameter and 300 mm long. The lowest temperature at the free end of the rods will occur in case of

(i) Aluminium rod

(ii) Wrought iron rod

(iii) Glass rod

(iv) Temperature will be same for all the three rods at free end

(g) If a body reflects entire radiation incident on it, then it is known as

(i) Black body

(ii) Grey body

(iii) White body

(iv) Transparent body

2. (a) State the Fourier law of heat conduction and by using it derive an expression for steady state heat conduction through a plane wall of thickness L, maintaining its two surfaces at temperatures T_1 and T_2 respectively.

(b) Determine steady state heat transfer rate per unit area through a 3·8 cm thick homogeneous wall with its two faces maintained at uniform temperatures of 35°C and 25°C. Thermal conductivity of the wall material is 0·19 W/m-K. 7+7

3. (a) 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.

(b) Compute radiation heat transfer rate per unit area between two black bodies at temperatures 900° and 40° (in kW/m^2).

Take $\sigma = 5{\cdot}67 \times 10^{-8}$ $W/m^2\text{-}K^4$. 7+7

4. (a) Why are extended surfaces most commonly used ? Also define Fin efficiency.

(b) Define Fin effectiveness. When is the use of fins not justified ? 7+7

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

(b) Explain Absorptivity, Reflectivity and Transmissivity. 7+7

6. Write short notes on any ***four*** of the following : $4 \times 3\frac{1}{2} = 14$

(a) Turbulent Flow

(b) Black Body and Grey Body

(c) Film and Dropwise Condensation

(d) Pool Boiling Curve

(e) Radiation Shape Factor

(f) Nusselt Number