No. of Printed Pages : 4

BIME-034

B.Tech. – VIEP – MECHANICAL ENGINEERING (BTMEVI)

Term-End Examination

December, 2015

BIME-034 : HEAT AND MASS TRANSFER

Time : 3 hours   *Maximum Marks : 70*

Note : Attempt any *five* questions. Assume suitable missing data, if any. Use of scientific calculator is permitted.

1. (a)   Explain the mechanism of thermal conduction in solids with the help of a suitable example.   7

    (b)   Derive an expression for heat flow through the composite cylinders, using a sectional diagram.   7

2. (a)   What is unsteady state heating or cooling ? Explain about Newtonian heating or cooling.   7

BIME-034   1   P.T.O.

(b) A copper plate 2 mm thick is heated upto 400°C and then quenched into water at 20°C. Find the time required for the plate to reach the temperature of 40°C. (Assume h = heat transfer coefficient = 80 kcal/m^2 hr°C, Plate dimensions = 30 cm × 30 cm, C_p = 0·091 kcal/kg-°C, ρ = 8800 kg/m^2).   7

3. (a) Derive the expression for heat transfer coefficient, when temperature distribution is known.   7

   (b) Air flows over a thin plate with a velocity of 2·5 m/s. The plate is 100 cm × 100 cm. Estimate the boundary layer thickness at the traiting edge of the plate and the force necessary to hold the plate.   7
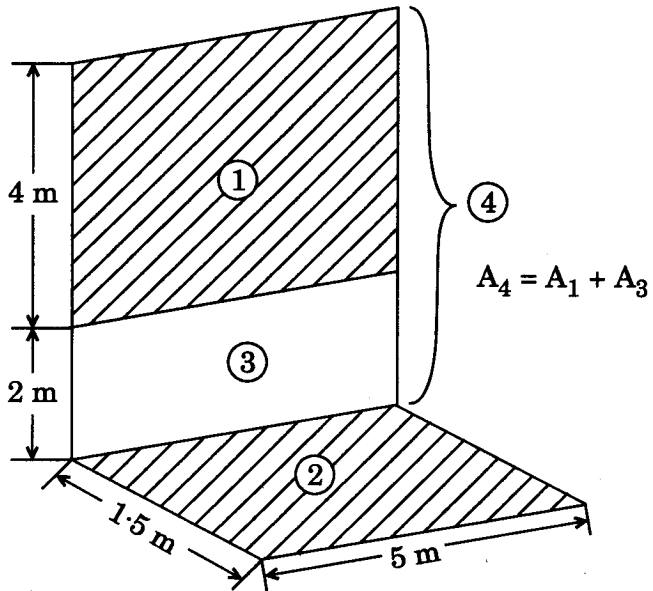
   (Take μ = 0·86 × 10^{-5} Ns/m^2 and
   $$\rho = 1·12 \text{ kg/m}^3)$$

4. (a) With reference to radiation, explain about the special properties of the shape factor.   7

(b) Find the shape factor for the given configuration and heat exchange between 1 and 2, if $T_1 = 400°C$, $T_2 = 200°C$, $\varepsilon_1 = 0\cdot8$ and $\varepsilon_2 = 0\cdot9$. 7

5. (a) Explain briefly the different types of heat exchangers. 7

(b) What is fouling of heat exchangers ? Brief about fouling processes and factors affecting them. 7

6. (a) Briefly write about Boiling Heat Transfer and Nature of Vaporization Phenomena. 7

(b) Steam at 0·65 bar condenses on a vertical plate 0·6 m square. If the surface temperature of the plate is maintained at 15°C, estimate the rate of condensation. 7

[Take $T_s = 37\cdot7°C$,

h_{fg} (at 0·065 bar) $= 2412 \times 10^3$ J/kg.

The properties of water at mean temperature of $26\cdot4°C = \left(\dfrac{37\cdot7+15}{2}\right)$ are given below :

$\rho = 1000$ kg/m^3, $\mu = 864 \times 10^{-6}$ kg/ms,

$k = 0\cdot913$ W/mK]

7. Write short notes on the following : $4\times3\dfrac{1}{2}=14$

(a) Solar Radiation

(b) Heisler Charts

(c) Logarithmic Mean Temperature Difference (LMTD)

(d) Transient Heat Conduction