

No. of Printed Pages : 3

BIME-034

**B.Tech. - VIEP - MECHANICAL ENGINEERING
(BTMEVI)**

Term-End Examination

June, 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) Brief about various modes of heat transfer and explain the mechanism of thermal conduction in liquids. 7

(b) A brick wall, 25 cm thick, is faced with concrete 5 cm thick. The thermal conductivity of brick is 0.69 W/m-K while that of the concrete is 0.93 W/m-K. If the temperature of the exposed brick face is 30°C and that of concrete is 5°C, find the heat lost per hour through a wall of 10 m × 5 m. Also determine the interface temperature. 7

2. (a) Brief about effectiveness and efficiency of the fin and also explain the variation of heat loss from fins along the length of the fin. 7

(b) A plane wall is fitted with rectangular fins of thermal conductivity of $50 \text{ kcal/m-hr}^\circ\text{-C}$ and profile area of 1.75 cm^2 . The atmospheric temperature is 30°C and surface conductance is $200 \text{ kcal/m}^2\text{-hr}^\circ\text{-C}$. If the fin base temperature is 250°C , find the maximum heat dissipation possible from one metre width of fin. 7

3. (a) What do you understand by "critical thickness of insulation" ? Brief about McMillan's Analysis of "economical thickness of insulation" for flat surfaces. 7

(b) An electric cable of 10 mm diameter is to be laid in atmosphere at 20°C . The estimated surface temperature of the cable due to heat generation is 65°C . Find the maximum percentage increase in heat dissipated when the wire is insulated with rubber having $K = 0.155 \text{ W/m-K}$. Take $h = 8.5 \text{ W/m}^2\text{-K}$. 7

4. (a) Brief about Energy Transfer mechanism through the Boundary layer. Also explain about Hydrodynamic and Thermal Boundary layers. 7
- (b) Derive an expression for heat flow over a flat plate. 7
5. (a) Explain about the mechanism of heat flow by natural convection, with suitable diagram. 7
- (b) A vertical pipe of 5 cm diameter carrying hot water is exposed to ambient air at 15°C. If the outer surface of the pipe is 65°C, find the heat loss from one metre height of the pipe per hour. 7
6. (a) Explain about Black Body and Monochromatic Radiation using a suitable diagram. 7
- (b) Derive an expression for Lambert's Cosine Law. 7
7. Write short notes on the following : $4 \times 3 \frac{1}{2} = 14$
- (a) Kirchhoff's Law
- (b) Fick's Law of Diffusion
- (c) Compact Heat Exchanger
- (d) Effect of Non-condensable Gases