

**B.Tech. MECHANICAL ENGINEERING
(COMPUTER INTEGRATED
MANUFACTURING)**

00388 **Term-End Examination**

December, 2016

BME-027(S) : HEAT AND MASS TRANSFER

Time : 3 hours

Maximum Marks : 70

Note : Answer any seven questions. All questions carry equal marks. Use of scientific calculator is permitted.

1. (a) State and explain Fourier's law of heat conduction. 5
- (b) Explain the principle of heat convection with suitable examples. 5

2. (a) Give the classification of heat exchangers. Explain the working principle of plate fin heat exchanger. 5
- (b) Explain the phenomenon of temperature distribution in heat exchangers. 5

3. Steam at a temperature of 380°C is flowing in a pipe ($K = 100 \text{ W/m K}$) of 8 cm inner diameter and 8.5 cm outer diameter. The pipe is covered with 10 cm thick insulation of thermal conductivity $K = 0.15 \text{ W/m K}$. Heat is lost to the surroundings at 8°C by natural convection and radiation, the combined h being $40 \text{ W/m}^2 \text{ K}$. Taking the heat transfer coefficient inside the pipe as $40 \text{ W/m}^2 \text{ K}$, determine
- the rate of heat loss from the steam per unit length of the pipe, and
 - the temperature drop across the pipe and the insulation. 10
4. (a) Explain the working principle of a 'Fire Tube Boiler' with a diagram. 5
- (b) What is a fin ? Explain why fins are attached to a heat exchanger. 5
5. Derive the general mass diffusion equation for a Cartesian coordinate system. 10
6. (a) What is meant by evaporation ? With the help of a neat diagram, explain the working principle of a single effect evaporator with sketch. 5
- (b) Derive Planck's law. 5
7. (a) What is Sherwood number ? 3
- (b) Using dimensional analysis, establish the relationship between the Sherwood number, Reynolds number and Schmidt number. 7

8. (a) Define the following terms : 6
- (i) Emissivity
 - (ii) Black body
 - (iii) Spectral intensity
- (b) Derive Wein's displacement law. 4
9. Explain the following in detail :
- (a) Laminar Flow and Turbulent Flow 5
 - (b) Film Condensation 5
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