**SIR ISSAC NEWTON COLLEGE OF ENGINEERNG AND TECHNOLOGY**

**PAPPAKOIL, NAGAPATTINAM**

**DEPARTMENT OF MECHANICAL**

**UNIT-I EXAM**

**SUB CODE/NAME:** ME8693 HEAT AND MASS TRANSFER **DATE: 27/04/2022**

**SEM/YEAR: III / V TIME DURATION**: 1.30 Hrs

**PART A (5×2=10)**

1. State the applications of fins.

2. State Fourier’s Law of conduction.

3. Define fins (or) extended surfaces.

4. Define convection.

5. Define fin efficiency.

**PART B (4×10=40)**

6. A wall is constructed of several layers. The first layer consists of masonry brick 20 cm. thick of thermal conductivity 0.66 W/mK, the second layer consists of 3 cm thick mortar of thermal conductivity 0.6 W/mK, the third layer consists of 8 cm thick lime stone of thermal conductivity 0.58 W/mK and the outer layer consists of 1.2 cm thick plaster of thermal conductivity 0.6 W/mK. The heat transfer coefficient on the interior and exterior of the wall are 5.6 W/m2K and 11 W/m2K respectively. Interior room temperature is 22C and outside air temperature is -5C. Calculate

i)Overall heat transfer coefficient

ii)Overall thermal resistance

iii)The rate of heat transfer

iv)The temperature at the junction between the mortar and the limestone.

7. An aluminium alloy fin of 7 mm thick and 50 mm long protrudes from a wall, which is maintained at 120C. The ambient air temperature is 22C. The heat transfer coefficient and conductivity of the fin material are 140 W/m2K and 55 W/mK respectively. Determine

i) Temperature at the end of the fin

ii) Temperature at the middle of the fin.

iii) Total heat dissipated by the fin.

8. An aluminium rod (k =204 W/mK) 2 cm in diameter and 20 cm long protrudes from a wall which is maintained at 300°C. The end of the rod is insulated and the surface of the rod is exposed to air at 30°C. The heat transfer coefficient between the rod's surface and air is 10 W/m2K. Calculate the heat lost by the rod and the temperature of the rod at a distance of 10 cm from the wall.

9. A pipe consists of 100 mm internal diameter and 8 mm thickness carries steam at 170°C. The convective heat transfer coefficient on the inner surface of pipe is 75 W/m2C. The pipe is insulated by two layers of insulation. The first layer of insulation is 46 mm in thickness having thermal conductivity of 0.14 W/m°C. The second layer of insulation is also 46 mm in thickness having thermal conductivity of 0.46 W/ m°C. Ambient air temperature = 33°C. The convective heat transfer coefficient from the outer surface of pipe = 12 W/m2C. Thermal conductivity of steam pipe = 46 W/m°C. Calculate the heat loss per unit length of pipe and determine the interface temperatures.

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