

III B.Tech II Semester Supplementary Examinations, Apr/May 2006
HEAT TRANSFER
(Mechanical Engineering)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

1. (a) Discuss the different modes by which heat be transferred. Give suitable example to illustrate your answer .
(b) Write the fourier rate equation for heat transfer by conduction. Give the units and physical significance of each term appearing in this equation. [8+8]
2. Determine the heat transfer rate through a spherical copper shell of thermal conductivity 386 W/mK, inner radius of 2- mm and outer radius of 60 mm. The inner surface and outer surface temperatures are 200°C and 100°C respectively. [16]
3. (a) Air at 20°C flows over a flat plate at 60°C at a velocity of 60 m/s. Determine the value of average convective heat transfer co-efficient upto a Reynolds number of 10^7
 - i. Considering the laminar region
 - ii. Considering that roughness causes turbulence even at the leading edge.(b) What is Reynolds analogy. [8+8]
4. (a) Sketch temperature and velocity profile of free convection of vertical wall.
(b) Water at 20°C was flowing over a plate of uniform heat flux of 9000 w/m². The flow velocity was 200 mm/s. The length of the plate was 1.3 m. Determine the temperature of the plate. [10+6]
5. (a) Distinguish between
 - i. Subcooled boiling & Saturated boiling
 - ii. Nucleate boiling & film boiling.(b) Water at atmospheric pressure is boiled in a Kettle made of copper. The bottom of the Kettle is flat, 35 cm in diameter and maintained at a temperature of 115°C by an electric heater. Calculate the rate of heat required to boil water. Also estimate the rate of evaporation of water from the Kettle. [4+12]
6. (a) Two rectangles 0.8 by 0.8m are placed perpendicularly with a common edge. One surface has $T_1 = 1000\text{K}$ $\varepsilon_1 = 0.6$, while the other surface is insulated and in radiant balance with a large surrounding room at 300K. Determine the temperature of the insulated surface and the heat lost by the surface at 1000K.
(b) Write brief notes on radiation shields [12+4]

7. Two identical counter flow type heat exchangers are available. Water ($C_p = 4.2$ KJ/Kg-K) at the rate of 1Kg/sec and at 30^0 C is heated by cooling an oil ($C_p = 2.1$ kJ/kg-K at 90^0 C. the oil flow rate is 0.75 Kg/sec. The heat transfer area in each heat exchanger is $4m^2$. The heat exchangers are connected in series on water side and in parallel on the oil side . The oil flow rate is split in the ratio 2:1 as 0.5 kg/sec in the first and 0.25 Kg/sec in the second exchanger .Water enters the first heat exchangers at 30^0 C. Calculate the final water and oil temperature. Overall heat transfer coefficient in each heat exchangers is $300 \text{ W}/m^2\text{-K}$. [16]
8. The molecular weight of the two components A and B of a gas mixture are 24 and 28. The molecular weight of gas mixture is 30. The mass concentration of the mixture is $1.2 \text{ kg } m^3$. Find
- (a) molar fractions
 - (b) mass fractions and
 - (c) total pressure if the temperature of mixture is 2900K . [16]
