

B. Tech 5th Semester Examination

Heat Transfer (NS)

ME-313

Time : 3 Hours

Max. Marks : 100

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Candidates are required to give their answers in their own words as far as practicable. The figures in the margin indicate full marks. **Answer all five Questions.** HMT data book and steam table are allowed.

1. (i) What is thermal resistance? Drive an expression for the thermal resistance through a hollow spherical shell of inside radius r_1 and outer radius r_2 having a thermal conductivity K . (10)
- (ii) A wall of a house is made of 10 cm thick brick ($K=0.75 \text{ W/m}^\circ\text{C}$) and plastered with 4 cm thick plaster ($K=0.5 \text{ W/m}^\circ\text{C}$). Find out the thickness of rock wool insulation ($K=0.065 \text{ W/m}^\circ\text{C}$) to reduce the heat loss through the wall by 75%. (10)
2. (i) What are the various parameters which affects the values of heat transfer co-efficient? (8)
- (ii) Air flows over a flat plate at a velocity of 3 m/s and ambient conditions are the pressure is 760 mm of Hg and temperature is 15°C . The plate is maintained at a temperature of 85°C .

If the length of the plate is 100 cm along the flow of air, find out the heat lost by 50 cm of the plate which is measured from the trailing edge. Plate width is 50 cm.

(12)

3. (i) Differentiate between black body and white body. (4)
- (ii) State the Kirchoffs law of radiation. (6)
- (iii) Determine the heat lost by radiation per meter length of 8 cm diameter pipe at 300°C , if (a) Located in a large room with red brick walls at a temperature of 27°C (b) Enclosed in a 16 cm diameter red brick conduit at a temperature of 27°C . Take, ϵ (steel pipe) = 0.79, ϵ (brick conduit) = 0.93. (10)
4. (i) Drive the expression for LMTD for counter flow heat exchanger. (8)
- (ii) A counter flow heat exchanger of heat transfer area 12.5 m^2 is to cool oil ($C_p = 2000 \text{ J/kg}^\circ\text{C}$) with water. The oil enters at 100°C and flow rate of 2 kg/s, while water enters at 20°C and flow rate of 0.48 kg/s. The overall heat transfer co-efficient is $400 \text{ W/m}^2\text{-}^\circ\text{C}$. Calculate the exit temp. of water and heat transfer rate. (12)
5. Write short notes on any three of the following:
 - (i) Critical thickness of insulation
 - (ii) Hydro-dynamic and thermal boundary layers
 - (iii) Physical significance of different non-dimensional numbers
 - (iv) Gray body and emissive power of gray body. (20)