L.E.COLLEGE, MORBI

MECHANICAL ENGINEERING DEPARTMENT

ASSIGNMENTS-A.Y.2022-23

Subject: **Heat Transfer(**3151909)

Semester: 5th

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ASSIGNMENT-1: CONDUCTION HEAT TRANSFER- CO-1-10 Marks

1. With neat sketch explain the heat conduction through a plan wall with and without heat generation. State and explain Fourier's law for heat transfer. Mention the assumptions on which it is based. Define thermal conductivity and give its unit
2. Explain how fins can increase the rate of heat transfer. Mention the most common types of fins and sketch them. Give some practical examples of fins.
3. State and explain Ficks law of diffusion. Explain various symbols used in it. Show the similarity of this law to Fourier equation for conduction.
4. How is the thermal performance of a fin measured? Explain fin efficiency andeffectiveness.
5. Which of the following arrangement of pin fins will give higher heat transfer rate from a hot surface? (i) 6 fins of 10 cm length (ii) 12 fins of 5 cm length. The base temperature of the fin is maintained at 200 oC and the fin is exposed to a convection environment at 15 oC with h=25 W/m2C. Each fin has cross sectional area 2.5 cm2 , perimeter 5 cm and is made of a material having thermal conductivity 250 W/mC. Neglect the heat loss from the tip of fin.
6. A steel pipe (k= 35 W/m K) with inner diameter 50 mm and outer diameter 60 mm is insulated using insulation material having (K=0.055 W/m.K). The temperature interface between pipe and insulation is 573 K, while the temperature on outside of insulation must not exceed 343 K, with permissible heat loss of 700 W/m. calculate (1) the minimum thickness of insulation and (2) the temperature of inside surface of pipe.

ASSIGNMENT-2: CONVECTION HEAT TRANSFER-CO-2-10 Marks

1. Explain and differentiate natural and forced convection.
2. What is the limitation of Rayleigh's method of dimensional analysis? Which method is preferred in such case and how repeating variables are selected?
3. Prove with the usual notations that the Reynolds number for flow in a circular tube of diameter (d) can be expressed as $Re=4m/\pi d\mu$.
4. Define Boit number. What is the physical significance of it? The Biot numberduring a heat transfer process between sphere and it surrounding is 0.02. Would you use lumped system analysis for determining the centre temperature of the sphere? Why?
5. Steam at 350^{o}C flowing in a pipe (k=80 W/mK) 5 cm i.d., 5.6 cm o.d. is covered with 3 cm thick insulation (k=0.05 W/mK). Heat is lost to the surroundings at 5 ^{o}C by natural convection and radiation with combined h=20 W/m2K and hi=60 W/m2K. Find: (i) the rate of heat loss from the pipe per unit length (ii) the temperature drops across the pipe and the insulation.

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- To nurture engineers with basic and advance mechanical engineering concepts
- To impart Techno-Managerial skill in students to meet global engineering challenges
- To create ethical engineers who can contribute for sustainable development of society

6. A copper pipe (temperature 55 °C) is kept in atmosphere (temperature 35 °C). The length and diameter of pipe is 1m and 50 mm respectively. The air velocity is 3 m/s. use the co-relation Nu= 0.0239 (Re) 0.805. Calculate heat loss from the pipe.

ASSIGNMENT-3: RADIATION HEAT TRANSFER-CO-3--10 Marks

1. Distinguish between: (i) Black body and white body (ii) Absorptivity and emissivity of a surface
2. Explain the following as applied to radiation heat transfer. (i) Wien's displacement law (ii) Lambert's cosine law (iii) Shape factor
3. Explain what do you mean by absorptivity ,reflectivity and Transmissivity
4. Define momochromatic emissive power and total emissive power
5. Explain radiosity
6. A thermo flask has a double walled bottle and the space between the walls is evacuated so as to reduce the heat flow. The bottle surfaces are silver plated, and the emissivity of each surface is 0.025. If the contents of the bottle are at 375 K, find the rate of heat loss from the thermos bottle to ambient air at 300 K. What thickness of cork (k=0.03 W/mK) would be required if the same insulating effect is to be achieved by the use of cork?
7. A square room 4 m x 4 m and height 3 m has all its walls perfectly insulated. The floor and ceiling are maintained at 300 K and 280 K respectively. Assuming an emissivity value 0.75 for all the surfaces, make calculation for the wall temperature and net heat interchange between the floor and ceiling. Take floor to ceiling shape factor as 0.28.

ASSIGNMENT-4: HEAT EXCHANGER-CO-4-10 Marks

1. Draw the sketch of variation of temperature along the length for parallel andcounter flow heat exchangers and write their comparisons.
2. Derive LMTD for parallel flow heat exchangers.
3. Derive expression for effectiveness of parallel flow heat exchanger
4. Derive expression for effectiveness of counter flow heat exchanger.
5. What are the applications of heat exchangers?
6. Water (Cp=4.187 kJ/kg K) is heated at the rate of 1.4 kg/s from 40 oC to 70 oC by an oil (Cp=1.9 kJ/kg K) entering at 110 oC and leaving at 60 oC in a counter flow heat exchanger. If Uo=350 W/m2K, calculate the surface area required. Using the same entering fluid temperature and the same oil flow rate, calculate the exit temperature of oil and water and the rate of heat transfer, when the water flow rate is halved.
7. Saturated steam at 120 °C is condensing on the outer tube surface of a single pass heat exchanger. The overall heat transfer coefficient is 1800 W/m2 K. Determines the surface area of a heat exchanger capable of heating 1000 kg/h of water from 20 °C to 90 °C. Also calculate the rate of condensation of steam. Assume latent heat of steam is 2200 KJ/Kg.

ASSIGNMENT-5: BOILING AND CONDENSATION-CO-5-10 Marks

1. Explain different regimes of boiling heat transfer phenomena
2. What is nucleate boiling explain
3. Write the correlations for boiling heat transfer incase of nucleate Boiling
4. Explain film boiling explain.
5. Explain dropwise condensation and film condensation.