Hall Ticket Number :										

Code: 4G555

R-14

III B.Tech. I Semester Supplementary Examinations August 2021

Heat Transfer

(Mechanical Engineering)

Max. Marks: 70 Time: 3 Hours

Answer *all five* units by choosing one question from each unit (5 x 14 = 70 Marks)

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UNIT–I

1. a) Explain Fourier's law of heat conduction.
   b) Differentiate between thermodynamics and Heat transfer.

OR

2. a) Explain the concept of combined heat transfer mechanism with the help of Examples.
   b) Differentiate between Steady, Unsteady and Periodic heat transfer.

UNIT–II

3. a) Derive the equation for heat transfer for composite slab.
   b) Spherical shaped vessel of 1.5 m diameter is 75 mm thick. Find the rate of heat leakage, if the temperature difference between the inner and outer surfaces is 300^{o} C. Thermal conductivity of material is 0.3 kJ /mh^{o}C.

OR

4. a) Explain the criteria for lumped system analysis.
   b) Derive the expression for temperature distribution under one dimensional steady state heat conduction for a plane wall and generate the expression for heat flow through a plane wall.

UNIT–III

5. a) Explain the method of Buckingham π-theorem and its limitations.
   b) List out the dimensionless numbers used in forced convection situation and their mathematical expressions.

OR

6. a) Derive the governing equation and its solution by integral method in free convection.
   b) A furnace door, 1.5m high and 1m wide, is insulated from inside and has an outer surface temperature of 70^{0}C. If the surrounding ambient air is at 30^{0}C, calculate the steady state heat loss from the door.

UNIT–IV

7. a) Draw the flux plot and explain different regimes in it.
   b) Two large parallel planes with emissivities of 0.3 and 0.5 are maintained at temperatures of 527^{0}C and 127^{0}C respectively. A radiation shield having emissivities of 0.05 on both sides is placed between them. Calculate (i) Heat transfer rate between them without shield. (ii) Heat transfer rate between them with shield.

OR

8. a) Obtain the relation between intensity of radiation and emissive power.
   b) The net radiation from the surface of two parallel plates maintained at temperatures T1 and T2 is to be reduced by 79 times. Calculate the number of screens to be placed between two surfaces to achieve this reduction in heat exchange, assuming the emissivity of screens as 0.05 and that of surfaces as 0.8.

UNIT–V

9. a) Water flows at the rate of 60 kg/min through a double pipe counter flow heat exchanger. Water is heated from 50^{o}C to75^{o}C by oil flowing through the tube. The specific heat of the oil is 1.7kj/kg.K. The oil enters at 120^{o}C and leaves at 70^{o}C.The overall heat transfer co-efficient is 340 W/m^{2}K.Calculate the following (i) Heat exchanger area. (ii) Rate of heat transfer.
   b) What is a Heat exchanger? Classify the heat exchangers and its applications.

OR

10. a) Derive NTU-Effectiveness relation for counter flow heat exchanger.
    b) Derive an equation for LMTD for counter flow heat exchanger.

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