B. Tech. (ME) 6th Semester (F-Scheme)
Examination, July–2022
HEAT TRANSFER
Paper– ME-306-F

Time allowed :3 hours] *[Maximum marks : 100*

Note: ***Question No. 1 is compulsory.*** *Students have to attempt at least* ***one*** *question from each section.*

1. (a) Explain convection as a mode of heat transfer.

   (b) Define filmwise condensation and dropwise condensation.

   (c) Define Emissive power or a black surface

   (d) Give expression for heat transfer coefficient in Nucleate Boiling. 20

Section-A

2. Derive the heat conduction equation in cylindrical co-ordinates using an elemental volume for a stationary isotropic solid. 20

3. A long rod is exposed to air at 298°C. It is heated at one end. At steady state conditions, the temperature at two points along the rod separated by 120 mm are found to be 130°C and 110°C respectively. The diameter of the rod is 25 mm OD and its thermal conductivity is 116 W/m°C. Calculate the heat transfer coefficient at the surface of the rod and also the heat transfer rate.

Section-B

4. (a) Explain briefly the concept or critical thickness of insulation and state any two applications of the same. 10

   (b) Discuss fin efficiency and its effectiveness. 10

5. A 6 cm long copper rod (k = 300 *W/mK)* 6 mm in diameter is exposed to an environment at 20°C. The base temperature of the rod is maintained at 160°C. The heat transfer co-efficient is *20 W/m²/K.* Calculate the heat given by the rod and efficiency and effectiveness of the rod. 20

Section-C

6. (a) Write down the momentum equation for a steady, two dimensional flow of an incompressible, constant property Newtonian fluid in the rectangular coordinate system and mention the physical significance of each term. 10

   (b) What is Reynold's analogy? Describe the relation between fluid friction and heat transfer. 10

7. (a) Discuss how the radiation from gases differ from that of solids? 10

   (b) Two very large parallel plates with emissivities 0.5 exchange heat. Determine the percentage reduction in the heat transfer rate if a polished aluminium radiation shield of c = 0.04 is placed in between the plates. 10

Section-D

8. Describe the principle of parallel flow and counter flow heat exchangers showing the axial temperature distribution in detail with expression. 20

9. A parallel flow heat exchanger has hot and cold water stream running through it, the flow rates are 10 and 25 kg/min respectively. Inlet temperatures are 75° C and 25° C on hot and cold sides. The exit temperature on the hot side should not exceed 50° C. Assume *hi = ho= 600W/m K.* Calculate the area of heat exchanger using E –NTU approach. 20