337654(37)

B. E. (Sixth Semester) Examination, Nov.-Dec. 2021

(New Scheme)

(Mech. & Automobile Engg. Branch)

HEAT & MASS TRANSFER

Time Allowed : Three hours

Maximum Marks : 80

Minimum Pass Marks : 28

*Note : Part (a) is compulsory in each unit. Attempt any **one** part from (b) & (c) of each unit.*

Unit-I

1. (a) Define the term 'Thermal Diffusivity'.   2

   (b) Derive a general heat conduction in cylindrical coordinates system for a constant thermal conductivity materials.   14

(c) A plane wall 90 mm thick (K = 0·18 w/n deg) is insulated on one side while other side is exposed to environment at 80°C. The rate of heat generation with in the wall is $1·3×10^5$ w/m^3. If the convective heat transfer coefficient between the wall and the environment is 520 w/m^2 deg. Determine the maximum temperature to which the wall will be subjected. 14

Unit-II

2. (a) What are the application of fins. 2

(b) Derive temperature distribution and heat transfer rate of an infinitely long fin. 14

(c) Derive temperature distribution and instantaneous heat transfer rate for lumped parameter analysis. 14

Unit-III

3. (a) What is Reynolds analogy? 2

(b) Show by dimensional analysis that for forced convection : 14

$$Nu = f (Re, Pr)$$

Where, Nu = Nusselt number

Re = Reynolds number

Pr = Prandtl number

(c) Water at 50°C enters a 1·5 cm diameter 3 m 10 long tube with a vetocity of 1 n/sec. The tube wall is maintained at a constant temperature of 90°C. Calculate the heat transfer coefficient and the total amount of heat transferred if the exit water temperature is 64°C. 14

Unit-IV

4. (a) What is condensation and when does it occur? 2

(b) What is boiling? When does it occur? List some of the factor that affect boiling heat transfer. 14

(c) State Fick's law of diffusion. Find the relation for diffusion of component A into component B. 14

Unit-V

5. (a) Define effectiveness of heat exchanger. 2

(b) Derive the expression for log mean temperature difference of a counter flow heat exchanger. 14

(c) Determine the shape factor from the base of a cylinder to the curved surface to base and the curved surface itself. 14