R18 Regulation *Subject code: 2P6CB*

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous, Accredited by NAAC with 'A' Grade)

B.Tech VI Semester Regular/Supplementary Examinations, June 2022

HEAT TRANSFER

(MECHANICAL ENGINEERING)

Maximum Marks: 70 Date:20.06.2022 Duration: 3 hours

Note: 1.This question paper contains two parts A and B.
2. Part A is compulsory which carries 20 marks. Answer all questions in Part A.
3. Part B consists of 5 Units. Answer any one full question from each unit which carries 10M.
4. Each question carries 10 marks and may have a, b, c, d as sub questions.

Part-A

All the following questions carry equal marks (10x2M=20 Marks)

1 Define convection process.
2 Define critical radius of insulation and state its significance.
3 State significance of Fourier's number.
4 What do you mean by transient heat conduction?
5 Define momentum equation in Thermal systems.
6 What is significance of dimensional analysis.
7 Define Thermal boundary layer.
8 Classify heat exchangers.
9 What is drop wise condensation.
10 Define Planks law.

Part-B

Answer All the following questions. (5X10M=50Marks)

11 Derive generalized heat conduction equation in spherical coordinates. (10M)

OR

12 The inner surface of a plane brick wall is at 60°C and the outer surface is at 35°C. Calculate the rate heat transfer per m^2 of surface area of the wall, which is 220 mm thick. The thermal conductivity of the brick is 0.51 W/m°C. (10M)

13 A rod of 10mm diameter and 80mm length with thermal conductivity 16 W/m°C protrudes from a surface of 160° C. The rod is exposed to air a 30°C with a convention coefficient of 25 W/m^2°C. How does the heat flow from this rod get affected if the same material volume is used for two fins of the same length? Assume short fin with end insulated. (10M)

OR

14 An iron (k = 65 W/mK) billet measuring 20 x 15 x 80 cm is exposed to a convective flow resulting in convection coefficient h = 11.5 W/m^2K. Determine the Biot number and the suitability of a lumped analysis to represent the cooling rates if the billet is initially hotter than the environment. (10M)

15 (a) What are the advantages and limitations of dimensional analysis. (5M)

(b) Explain the procedure of using the Buckingham π theorem for dimensional analysis. (5M)

OR

16 A heat-treat steel plate measures 3m x 1m and is initially at 30°C. It is cooled by blowing air parallel to 1m edge at 9 km/hr. If the air is at 10°C, calculate the convective heat transfer from both sides of the plate. (10M)

17 Derive the equation for parallel flow heat exchanger using LMTD method?. (10M)

OR

18 In a counter flow double pipe heat exchanger, water is heated from 25^0C to 65^0C by an oil with a specific heat of 1.45 kJ/kg K and mass flow rate of 0.9 kg/s. The oil is cooled from 230^0C to 160^0C. If the overall heat heat transfer coefficient is 420 W/m $^{2\,0}$C, Calculate the following:

(i)The rate of heat transfer (ii)The mass flow rate of water

(iii) The surface heat of the heat exchanger. (10M)

19 Discuss in detail the various regimes in boiling and explain the condition for the growth of bubbles. What is the effect of bubble size on boiling? (10M)

OR

20 Consider a thin hollow cylinder of 8cm diameter and 10cm length. If the radiant shape factor of the circular surface of this cylinder is 0.172, make calculations for the shape factor of the curved surface of the cylinder with respect to itself. (10M)

Note: Data book allowed