Code No.: ME602PC | R20 | H.T.No. | | | 8 | R | | | | | |

CMR ENGINEERING COLLEGE: : HYDERABAD
UGC AUTONOMOUS
III–B.TECH–II–Semester End Examinations (Supply) - January- 2024
HEAT TRANSFER
(MECH)

[Time: 3 Hours] **[Max. Marks: 70]**

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

PART-A **(20 Marks)**

1. a)	List out the assumptions of Fourier law of heat conduction.	[2M]
b)	Define thermal conductivity.	[2M]
c)	What is fin resistance and what are its units?	[2M]
d)	Define Fourier number.	[2M]
e)	What is the significance of Reynolds number?	[2M]
f)	Define forced convection.	[2M]
g)	Define effectiveness of a heat exchanger.	[2M]
h)	When NTU method is useful in heat exchanger analysis?	[2M]
i)	Define shape factor.	[2M]
j)	What is black body?	[2M]

PART-B **(50 Marks)**

2. Derive the heat conduction equation for Cartesian coordination system? [10M]

OR

3. An ice chest whose outer dimensions are 300mm × 400mm × 400mm is made of 30 mm thick Styrofoam (k =0.033W/m ^{0}C). Initially the chest is filled with 40 kg of ice at 0°C, and the inner surface temperature of the ice chest can be taken to be 0°C at all times. The heat of fusion of ice at 0°C is 333.7kJ/kg, and the surrounding ambient air is at 30°C. Neglecting any heat transfer from the 400mm × 400mm base of the ice chest, determine how long will it take for the ice in the chest to melt completely if the outer surfaces of the ice chest are at 8°C. [10M]

4. Explain longitudinal fins, circumferential fins and Pin fin and write its applications and assumptions? [10M]

OR

5. A long carbon steel rod length 50cm and diameter 10mm (k=50W/mK) is placed in such that one of its end is at 600°C and the ambient temperature is 20°C.The film coefficient is 10W/m^{2}K.Find i. Temperature at mid length of fin ii. Fin efficiency [10M]

6. Describe Buckingham's method of π-terms to formulate a dimensionally homogenous equation. [10M]

OR

7. A flat plate 1m wide and 1.5 m long is to be maintained at 90°C in air when free stream temperature is 10°C.Determine the heat transfer coefficient at which air must flow over the plate so that the rate of energy dissipation from the plate is 3.75kW. [10M]

8. Explain following Heat Exchangers [10M]
   i. Parallel flow Heat Exchanger.
   ii. Counter flow Heat Exchanger.
   iii. Cross flow Heat Exchangers.

OR

9. It is required to design a shell and tube heat exchanger for heating 9000 kg/hr of water from 15°C to 88°C by hot engine oil (C_p = 2.35 kJ/kg-K) flowing through the shell of the heat exchanger . The oil makes a single pass, entering at 150°C and leaving at 95°C with an average heat transfer coefficient of 400 W/m^2-K, the water flow through 10 thin walled tubes of 25mm diameter with each tube making 8 passes through the shell. The heat transfer efficient on the water side is 3000 W/m^2-K. Find the length of the tube required the heat exchanger. [10M]

10. Explain the following: [10M]
    i. Plank distribution law.
    ii. Absorptivity, reflectivity and transmissivity.
    iii. Emissivity.

OR

11. A long, thin walled horizontal tube 94 mm in diameter is maintained at 118°C by the passage of steam through its interior. A radiation shield is installed around the tube, providing an air gap of 10 mm between the tube and shield and reaches a surface temperature of 32°C. The tube and shield are diffuse, grapy surfaces with emissivities of 0.82 and 0.14 respectively. Calculate the radiant heat transfer from the tube per unit length. [10M]

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