Question Paper Code: R18A32ME02

R18

ANURAG Engineering College

(An Autonomous Institution)

III B.Tech II Semester Supplementary Examinations,Dec–2023/Jan-2024

HEAT TRANSFER

(MECHANICAL ENGINEERING)

Time: 3 Hours **Max.Marks:75**

Section – A (Short Answer type questions) (25 Marks)

Answer All Questions

		Course Outcome	B.T Level	Marks
1.	What is Fourier's Law of heat conduction?	CO1	L1	2M
2.	Define heat flux.	CO1	L1	3M
3.	Explain the concept of fins or extended surfaces	CO2	L2	2M
4.	Explain Fin effectiveness	CO2	L2	3M
5.	Compare laminar flow and turbulent flow	CO3	L2	2M
6.	Explain the significance of the boundary layer	CO3	L2	3M
7.	List the examples of non-mixing type heat exchangers	CO4	L1	2M
8.	What is the overall heat transfer coefficient in a heat exchanger?	CO4	L1	3M
9.	What is meant by sub-cooled or local boiling?	CO5	L1	2M
10.	Define Wien's displacement law.	CO5	L1	3M

Section B (Essay Questions)

Answer all questions, each question carries equal marks. **(5 X 10M = 50M)**

11. A)	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 25mm OD and its thermal conductivity is 116 W/m°C. solve the heat transfer coefficient at the surface of the rod and also the heat transfer rate	CO1	L3	10M
	OR			
B)	Develop a general heat conduction equation for a hollow cylinder	CO1	L3	10M
12. A)	Circumferential aluminium fins of rectangular profile (1.5cm wide and 1mm thick) are fitted onto a 90 mm engine cylinder with a pitch of 10 mm. The height of the cylinder is 120 mm. The cylinder base temperature before and after fitting the fins are 200°C and 150°C respectively. Take ambient at 30°C and h(average)=100 W/m^2 K. Estimate the heat dissipated from the finned and the unfinned surface areas of the cylinder body	CO2	L3	10M
	OR			
B)	A 40x40 cm copper slab 5 mm thick at a uniform temperature of 250°C suddenly has its surface temperature lowered to 30°C. Estimate the time at which the slab temperature becomes 90°C, ρ=900 kg/m^3, C= 0.38 kJ/kg K, K=370 W/mk and h= 90 W/m^2 k	CO2	L3	10M
13. A)	Develop a three-dimensional general continuity equation in Cartesian coordinates.	CO3	L3	10M
	OR			

	B)	A steam pipe 10 cm outside diameter runs horizontally in a room at 23°C. Take the outside surface temperature of the pipe as 165°C. solve the heat loss per unit length of the pipe	CO3	L3	10M
14.	A)	Draw the profile of a boundary layer on a flat plate showing the velocity profiles and identify the significance of the boundary layer.	CO4	L3	10M
		OR			
	B)	A vertical cylinder 1.5 m high and 180 mm in diameter is maintained at 100°C in an atmosphere of 20°C. Solve the heat loss by free convection from the surface of the cylinder. Assume properties of air as p = 1.06 kg/m^3 and u = 18.97x 10^{-6} m^2 /s, cp = 1.004kJ/kg°C and k = 0.1042 kJ/m.K	CO4	L3	10M
15.	A)	Compare film-wise condensation and drop-wise condensation.	CO5	L3	10M
		OR			
	B)	A thin aluminium sheet with an emissivity of 0.1 on both sides is placed between two very large parallel plates that are maintained at uniform temperatures Tl = 800 K and T2 = 500 K and have an emissivity of 0.2 and 0.7 respectively. Analyze the net rate of radiation heat transfer between the two plates per unit surface area of the plates and compare the result to that without a shield	CO5	L3	10M