Question Paper Code: R18A32ME01

R18

ANURAG Engineering College

(An Autonomous Institution)

III B.Tech II Semester Regular/Supplementary Examinations, June/July-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 meant by periodic heat transfer?	CO1	L1	2M
2.	Which are the different modes of heat transfer? Explain giving suitable examples.	CO1	L1	3M
3.	What is coefficient of Thermal conductivity?	CO2	L2	2M
4.	Give governing differential equation for the one-dimensional transient heat flow.	CO2	L2	3M
5.	What is Convective heat transfer?	CO3	L1	2M
6.	What are the limitations of Dimensional analysis?	CO3	L2	3M
7.	What is effectiveness of a heat exchanger?	CO4	L2	2M
8.	Discuss the advantage of NTU method over the LMTD method	CO4	L2	3M
9.	What is meant by condensation?	CO5	L1	2M
10.	Distinguish between Absorptivity & Transmittivity of radiation	CO5	L1	3M

Section B (Essay Questions)

Answer all questions, each question carries equal marks. (5 X10M = 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 is found to be 130°C and 110°C respectively. The diameter of the rod is25mm 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.	CO1	L3	10M
	OR			
B)	Derive the general heat conduction equation in Cartesian Coordinate system.	CO1	L3	10M
12. A)	Derive the expression for temperature distribution under one dimensional steady state heat conduction through composite cylinder	CO2	L4	10M
	OR			
B)	Define thermal conductivity, thermal diffusivity and thermal resistance and write their equations.	CO2	L4	10M
13. A)	A steel tube k=43.26 W/mK of 5.08 cm 10 and 7.62 cm 00 is covered with 2.54 cm of asbestos Insulation k=0.208 W/mK The inside surface of the tube receives heat by convection from a hot gas at a -temperature of 316°C with heat transfer coefficient ha=284 W/m^2K while the outer surface of Insulation is exposed to atmosphere air at 38°C with heat transfer coefficient of 17 W/m^2K Calculate heat loss to atmosphere for 3 m length of the tube and temperature drop across each layer.	CO3	L4	10M
	OR			

B)	State the buckinghums π theorem. Utilize the various parameter used in forced convection, using dimensional analysis obtain an expression for Nusset numbers in term of Reynolds and Prantl numbers	CO3	L3	10M
14. A)	How heat exchangers are classified?	CO4	L3	10M
	OR			
B)	A double-pipe (shell-and-tube) heat exchanger is constructed of a stainless steel (k = 15.1 W/m ^{0}C) inner tube of inner diameter D = 1.5 cm and outer diameter Do = 1.9 cm and an outer shell of inner diameter 3.2 cm. The convection heat transfer coefficient is given to be hi = 800 W/m^2 ^{0}C on the inner surface of the tube and h0 = 1200 W/m2 ^{0}C on the outer surface. For a fouling factor of Rri = 0.0004 m^2 ^{0}C/ W on the tube side and Rro = 0.0001 m^2 ^{0}C/ W on the shell side, determine: i) The thermal resistance of the heat exchanger per unit length. ii) The overall heat transfer coefficients, U; and Uo based on the inner and outer surface areas of the tube, respectively.	CO4	L4	10M
15. A)	Discuss the different processes of condensation of vapour on solid surface with suitable diagrams	CO5	L3	10M
	OR			
B)	The sun emits maximum radiation at λ = 0.52 μ. Assuming the sun to be a black body, calculate the surface temperature of the sun. Also calculate the monochromatic emissive power of the sun's surface.	CO5	L3	10M

Note: Heat and Mass Transfer Data Book is permitted