QP Code: RD21BTECH065 | Reg. No | | | | | | | | | | | AR 21

GIET UNIVERSITY, GUNUPUR – 765022

B. Tech(Third Semester - Regular) Examinations, December – 2022

21BCHPC23001– HEAT TRANSFER

(Chemical Engineering)

Time: 3 hrs | Maximum: 70 Marks

Answer ALL questions

(The figures in the right hand margin indicate marks)

PART – A **(2 x 5 = 10 Marks)**

	Q.1. Answer ***ALL*** questions	CO #	Blooms Level
a.	Write the different modes of heat transfer.	1	1
b.	Write conductive resistance in a cylindrical pipe whose thermal conductivity is K and length is L and d_i and d_o are the inside and outside diameters.	1	1
c.	Define Biot and Fourier number.	1	1
d.	Define capacity and steam economy in evaporator.	3	1
e.	State Newton's Law of Cooling.	2	1

PART – B **(15 x 4 = 60 Marks)**

	Answer ***ALL*** the questions	Marks	CO #	Blooms Level
2. a.	A pipe 7 cm outside diameter is lagged with a 6 cm layer of asbestos (conductivity = 0.14) and a 5 cm layer of cork (conductivity = 0.04). If the temperature of the outer surface of the pipe is 160^0C and the temperature of the outer surface of the cork is 30^0C, calculate the heat loss in kcal/hr.m.	8	1	2
b.	Derive the general expression for the heat transfer by conduction through a plane wall	7	1	2
	(OR)			
c.	A 50 cm ×30 cm copper slab of 6.25 mm thick has a uniform temperature of 300^0C. It is suddenly dipped into the liquid at 36^0C whose heat transfer coefficient is 90 W/m^2 ^{0}C. Calculate the time required for the slab to reach the temperature 108^0C. Properties of copper slab : Density= 9000kg/m^3, Specific heat=0.38 KJ/kg^{0}C, Thermal conductivity=370 W/m^{0}C	8	1	2
d.	Derive the expression for temperature profile in lumped parameter model	7	1	2
3.a.	Explain convection heat transfer phenomena.	8	2	2
b.	Differentiate between drop-wise and film-wise condensation.	7	2	3
	(OR)			
c.	A vertical flat plate is 600 m in height and is exposed to steam at atmospheric pressure. If the surface of the plate is maintained at 60ºC, then calculate the total heat transfer rate and rate of steam condensation. Data: Saturation steam temperature = 100ºC Latent heat of vaporization(h_{fg}) = 2257 KJ/Kg ρ_v = 0.596 Kg/m^3 The properties of saturated vapour at the mean film temperature are: μ = 355.3 × 10-6 Ns/m^2 ρ = 971.8 Kg/m^3 k = 67.413 × 10-2 w/mºC	8	2	2

d.	Discuss the effect of non-condensable gas presence in condensation	7	2	2
4.a.	Derive Nusselt equation by Dimensional analysis for forced convection heat transfer.	8	2	2
b.	Mention the different stages boiling phenomena with the help of boiling curve	7	2	1
	(OR)			
c.	Explain the types of feeding in Multiple effect evaporators with neat sketch.	8	3	2
d.	Write the expression for effectiveness of heat exchanger for Parallel Flow and Counter Flow. Explain the NTU and R used in those expression.	7	3	3
5.a.	Derive the LMTD expression for Parallel flow heat exchanger	8	3	2
b.	Find LMTD for PF and CF arrangement. T_{hi}=80, T_{h0}=50, T_{ci}=30, T_{co}=40,	7	3	1
	(OR)			
c.	Crude oil flows at the rate of 1100 kg/hr through the inside pipe of a double pipe heat exchanger and is heated from 28^0C to 86^0C. The heat is supplied by kerosene initially at 180^0C flowing through the annular space. If the temperature of approach (minimum temperature difference) is 10^0C, determine the heat transfer area for co-current flow and the kerosene flow rate. Data: C_P for crude oil and kerosene = 0.51 and 0.62 kcal/kg.^{0}C andU_0 = 412 kcal/hr.m^2.^{0}C	8	3	2
d.	Mention the basic laws used in radiation heat transfer with their statements.	7	4	1

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