K. K. Wagh Institute of Engineering Education & Research, Nashik

(An Autonomous Institute From A.Y. 2022-23)

SUMMER-2024	
Exam Seat No.:	
Academic Year: 2023-2024	Semester: IV
Class: SY	Program: B.Tech
Branch Code: CHE	Pattern: 2022
Name of Course: Heat Transfer	Course Code: CHE222012
Max. Marks: 60	Duration: 2.30 Hrs.

Instructions: Candidates should read carefully the instructions printed on the Question Paper and on the cover page of the Answer Book, which is provided for their use.

1. This question paper contains 02 page(s).
2. Answer to each new question is to be started on a new page.
3. Assume suitable data wherever required, but justify it.
4. Draw the neat labelled diagrams, wherever necessary.
5. The last columns indicates the Course Outcome and level of Blooms Taxonomy of the Question/sub-question.

Question No. 1 Attempt following Question

1	What is the physical mechanism of heat conduction in a solid, a liquid, and a gas?	(6)	CO1

Question No. 2 Attempt following Question

2	Consider a fluid whose volume does not change with temperature at constant pressure. What can you say about natural convection heat transfer in this medium?	(6)	CO2

Question No. 3 Attempt following Question

3.a)	Define : Kirchoff's Law, Wein's Displacement Law, Total Emissive power,	(6)	CO3
	OR		
3.b)	What is Radiation? Explain black body?	(6)	CO3
3.c)	Write about the laws of radiation	(6)	CO3
	OR		
3.d)	Write a short note on radiation shields	(6)	CO3
3.e)	The inner sphere of a Diwar flask is 30 cm diameter and outer sphere is 36 cm diameter. Both spheres are coated for which emissivity is 0.05. Determine the rate at which liquid oxygen (latent heat = 21.44 kJ/kg) would evaporate at 90 K when the outer sphere temperature is 293 K. Assume that the other modes of heat transfer are absent.	(4)	CO3
	OR		
3.f)	Calculate the rate of heat transfer by radiation from an unlagged steam pipe, 50 mm, o.d. at 393 K to air at 293 K. Assume emissivity 'e' of 0.9.	(4)	CO3

Question No. 4 Attempt following Question

4.a)	What is the NTU, and how is it related to the effectiveness of the heat exchanger?	(6)	CO4
	OR		
4.b)	Explain Fixed tube sheet 1-2 heat exchanger in detail with neat sketch	(6)	CO4
4.c)	Write about the Graphite block heat exchanger	(6)	CO4
	OR		
4.d)	Write short notes on baffles, pitch, clearance	(6)	CO4
4.e)	Hot oil at a rate of 1.2 kg/s [Cp = 2083 J/(kg·K)] flows through a double pipe heat exchanger. It enters at 633 K and leaves at 573 K . The cold fluid enters at 303 K and leaves at 400 K. If the overall heat transfer coefficient is 500 W/(m2·K), calculate the heat transfer area for parallel flow.	(4)	CO4
	OR		
4.f)	Write short note on Maintenance of Heat Exchanger	(4)	CO4

Question No. 5 Attempt following Question

5.a)	What is Capacity & Economy of evaporator? Drew a diagram for Vacuum evaporation?	(6)	CO5
	OR		
5.b)	Write the material and energy balance for single effect evaporator.	(6)	CO5
5.c)	Classification of various types of evaporators and explain any one of them with neat sketch.	(6)	CO5
	OR		
5.d)	What are the methods used for feeding a multiple evaporation system and drew with neat sketch for each method?	(6)	CO5
5.e)	Calculate the boiling point elevation of a solution and the driving force for heat transfer using the following Data: Solution boils at a temperature of 380 K and the boiling point of water at a pressure in the vapour space is 373 K Temperature of condensing steam is 399 K.	(4)	CO5
	OR		
5.f)	If the evaporator pressure is reduced to 38.58 kPa, what would be the change in heat transfer area?	(4)	CO5

Data: Saturated steam is supplied at 143.3 kPa

Overall heat transfer coefficient = 2862 W/(m2·K)

Boiling point of water / solution at 38.58 kPa = 348 K,

Enthalpy of water vapour = 2635.3 kJ/kg ,

Enthalpy of product = 313.93 kJ/kg

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