Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– IV(NEW) EXAMINATION – SUMMER 2023

Subject Code:3140503 Date:11-07-2023

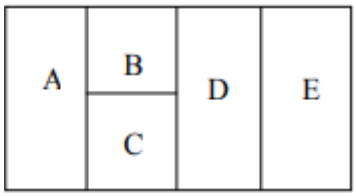
Subject Name:Heat Transfer

Time:10:30 AM TO 01:00 PM Total Marks:70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			Mark
Q.1	**(a)**	Distinguish between Heat transfer and Thermodynamics.	**03**
	(b)	Derive an expression for critical radius of insulation for Sphere.	**04**
	(c)	Determine the heat transfer through the composite wall shown in the figure below. Take the conductives of A, B, C, D & E as 50, 10, 6.67, 20& 30 W/mK respectively and assume one dimensional heat transfer.Take area of A=D=E=1m^2 and B=C=0.5 m^2. Temperature entering at wall A is 800^{0}C and leaving at wall E is 100^{0}C.	**07**

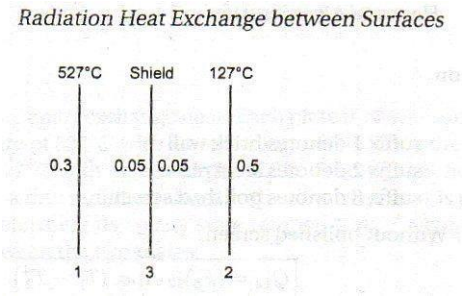


Q.2	**(a)**	Write Dittus-Boeltier equation and Sieder-Tate equation explaining each term and highlight the difference.	**03**
	(b)	Explain Reynold analogy for heat transfer.	**04**
	(c)	Define fin effectiveness and derive an expression for Temperature profile for Insulated Fin at the tip.	**07**
		OR	
	(c)	Derive equation for LMTD with suitable assumptions. Why correction factor is necessary to include with LMTD?	**07**
Q.3	**(a)**	Give Comparision about Conductors and insulators.	**03**
	(b)	Explain the terms absorptivity, emissivity, transmissivity and reflectivity for heat transfer by radiation.	**04**
	(c)	Explain different regimes of pool boiling of saturated liquid with neat sketch.	**07**
		OR	

Q.3 **(a)** Explain how does thermal conductivity of gases, liquid and solids depend upon temperature? **03**

(b) Two large parallel planes with emissivities of 0.3 and 0.5 are maintained at temperatures of 527^0C and 127^0C respectively.A radiation shield having emissivities of 0.05 on both sides is placed between them. Calculate(i) Heat transfer rate between them without shield. (ii) Heat transfer rate between them with shield. **04**

$Q_{w/t\ shield}$ and $Q_{with\ shield}$



(c) Compare drop wise condensation and film wise condensation. **07**

Q.4 **(a)** Define : Segmental baffle, Tie rods, Passes **03**

(b) Differentiate Square and Triangular pitch. List out drawbacks of double pipe heat exchanger. **04**

(c) A counter flow double pipe heat exchanger using super heated steam is used to heat water at the rate of 10500 kg/hr. The steam enters the heat exchanger at 180^oC and leaves at 130^oC. The inlet and exit temperature of water are 30^oC and 80^oC respectively. If theoverall heat transfer coefficient from steam to water is 814 W/m^2K, calculate the heat transfer area. What would be the increase in area if the fluid flow were parallel? **07**

OR

Q.4 **(a)** Draw a neat sketch of 1-2 shell and tube heat exchanger and label its parts. **03**

(b) State advantages and disadvantages of a floating head heat exchanger. Why floating tube bundle head arrangement is used in shell and tubeheat exchanger? **04**

(c) A counter flow heat exchanger is employed to cool 0.55 kg/s (C_p = 2.45 kj/kg^oC) of oil from 115^oC to 40^oC by the use of water.The inlet and outlet temperature of cooling water are 15^oC and 75^oC respectively. The overall heat transfer coefficient is expected to be 1450 $W/m^2\ ^oC$. Using NTU method, calculate the following: **07**

(i) The mass flow rate of water. (ii) The effectiveness of heat exchanger. (iii) The surface area required.

Q.5	**(a)**	How we can choose steam pressure for evaporators?	**03**
	(b)	Draw schematic temperature profile of evaporator. List out material of construction for evaporators. Enlist disadvantages of thermal recompression and Calendria type evaporator.	**04**
	(c)	Explain Material and enthalpy balances for single effect evaporator.	**07**

OR

Q.5	**(a)**	1.Single effect evaporator has low economy though it is used in industries. Why? 2.State applications of falling film evaporator.	**03**
	(b)	Explain Boiling Point Elevation (BPE).	**04**
	(c)	A single effect evaporator is to concentrate 15000 kg/h of a solution having a concentration of 7% salt to a concentration of 14% salt by weight. Steam is fed to the evaporator at a pressure corresponding to the saturation temperature of 399 K. The evaporator is operating at atmospheric pressure and the boiling point rise is 7 K. Calculate heat load and steam economy. Data : Feed temperature=298K, Specific heat of feed=4.0 kj/kg.K Latent heat of condensation of steam at 399 K=2185 kj/kg, Latent heat of vaporization of water at 373 K=2257 kj/kg	**07**

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