

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-V (NEW) EXAMINATION – SUMMER 2019****Subject Code: 2153502****Date: 31/05/2019****Subject Name: Introduction to Heat Transfer****Time: 02:30 PM TO 05:00 PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

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|------------|-----|---|-----------|
| Q.1 | (a) | What are the modes of heat transfer? | 03 |
| | (b) | What is emissivity? Explain briefly. | 04 |
| | (c) | Derive the expression of critical thickness of sphere. | 07 |
| Q.2 | (a) | What are the application of fins? | 03 |
| | (b) | Derive equation to calculate the rate of heat flow through sphere. | 04 |
| | (c) | Derive the expression for LMTD in parallel flow heat exchanger. | 07 |
| | | OR | |
| | (c) | Derive the expression for NTU in parallel flow heat exchanger. | 07 |
| Q.3 | (a) | Based on types, classify heat exchangers. | 03 |
| | (b) | Explain the concept of Black body. | 04 |
| | (c) | Explain effect of temperature on thermal conductivity. | 07 |
| | | OR | |
| Q.3 | (a) | Explain natural convection phenomena. | 03 |
| | (b) | Give the physical significance of (i) Biot number (ii) Fourier number. | 04 |
| | (c) | Which side of shell and tube heat exchanger will you select to pass corrosive, viscous and high pressure fluid? | 07 |
| Q.4 | (a) | Explain about various feed arrangement used in multiple effect evaporator. | 03 |
| | (b) | Explain significance of Nusselt, Prandtl and Reynold's number. | 04 |
| | (c) | State the differences between film wise and Drop wise condensation. | 07 |
| | | OR | |
| Q.4 | (a) | State the parts of heat exchangers. | 03 |
| | (b) | A small blackbody has a total emissive power of 5 kW/m ² . Determine its surface temperature. | 04 |
| | (c) | Using Fourier's law derive an expression for heat transfer by conduction through cylindrical surface. | 07 |
| Q.5 | (a) | Discuss in brief about Boiling point elevation. | 03 |
| | (b) | Discuss briefly about multiple effect evaporation. | 04 |
| | (c) | An evaporator is operating at atmospheric pressure. It is desired to concentrate the feed from 5% solute to 20% solute at a rate of 5000 kg/h. Dry saturated steam at a pressure corresponding to saturation temperature of 399 K is used. The feed is at 298 K and boiling point rise is of 5 K. Overall heat transfer coefficient is 2350 W/m ² K. Calculate economy and heat transfer area for evaporator.
Latent heat of condensation of steam at 399 K is 2185 kJ/kg
Latent heat of evaporation of water at atmospheric pressure and 373 K is 2257 kJ/kg
Specific heat of feed = 4.187 kJ/kg K | 07 |
| | | OR | |
| Q.5 | (a) | An evaporator operating at atmospheric pressure is fed at rate of 10000 kg/h of weak liquor containing 4 % caustic soda. The liquor leaving the evaporator contains 25% caustic soda. Find capacity of evaporator. | 03 |
| | (b) | Explain Wien's displacement. | 04 |
| | (c) | Explain in detail various regions in pool boiling. | 07 |
