

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.

- 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**
- Q.3** (c) Derive the expression for NTU in parallel flow heat exchanger. **07**
 (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 $2350 \text{ W/m}^2\text{K}$. Calculate economy and heat transfer area for evaporator. **07**
 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
- 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**
