

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE - SEMESTER-IV EXAMINATION – SUMMER 2016****Subject Code:140503****Date:06/06/2016****Subject Name:Process 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.

- Q.1** (a) Discuss mechanism of combine heat transfer and derive equation for the overall heat transfer coefficient **07**
- (b) The door of a domestic refrigerator has an area of  $0.7 \text{ m}^2$  and it basically consists of a thin metal sheet with a 25 mm thick layer of insulation on the inside. The thermal conductivity of the insulation is  $0.25 \text{ W /m- deg}$  and the heat transfer coefficient on each side of the door is  $10 \text{ W/m}^2\text{-deg}$ . Determine the heat flow rate through the door and the temperature of the metal sheet. The refrigerated chamber and the room temperature are at  $0^\circ\text{C}$  and  $20^\circ\text{C}$  respectively. Neglect thermal resistance due to the sheet metal. **07**
- Q.2** (a) Explain concept of critical thickness of insulation and derive equation for the critical thickness of insulation. **07**
- (b) Discuss various boiling regimes and factors affecting on nucleating boiling. **07**
- OR**
- (b) Derive equation of the film thickness for laminar film condensation on vertical surface. **07**
- Q.3** (a) Differentiate between free and forced convection? Mention the factors on which the heat transfer coefficient depends. **07**
- (b) Write formula and physical significance of , Biot number, Fourier number, Thermal time constant, Thermal diffusivity, Nusselt number, Grashoff number and Prandtl number **07**
- OR**
- Q.3** (a) Define: Black body, White body, Grey body, Transparent body, Transmittivity, Absorptivity, and Reflectivity. **07**
- (b) List out various laws of radiation and discuss any one in details. **07**
- Q.4** (a) Discuss construction and working of forced circulation evaporators. **07**
- (b) Explain advantages and limitations of different modes of feed supply to multiple-effect evaporators. **07**
- OR**
- Q.4** (a) Explain the Chilton-Colburn analogy. **07**
- (b) Define dirt factors and discuss parameters affecting the fouling of heat exchanger. **07**
- Q.5** (a) Derive the equation for L.M.T.D. in counter flow heat exchanger. State all the assumption made in derivation. **07**
- (b) Define fin efficiency and derive equation for the temperature distribution along the length of the fin. **07**

**OR**

- Q.5** (a) A very long copper rod 20 mm in diameter extends horizontally from a plane heated wall maintained at  $100^{\circ}\text{C}$ . The surface of the rod is exposed to an air environment at  $20^{\circ}\text{C}$  with convective heat transfer coefficient of  $8.5\text{ W/m}^2\text{-deg}$ . Workout the heat loss if the thermal conductivity of copper is  $400\text{ W/m-deg}$ . Assume fin tip is insulated. **07**
- (b) Discuss general characteristic and application of insulating materials. **07**

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