Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**BE - SEMESTER–IV (NEW) EXAMINATION – WINTER 2023**

**Subject Code:3140503 Date:17-01-2024**

**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.**

| | | | MARKS |
|---|---|---|---|
| **Q.1** | **(a)** | Explain how thermal conductivity of gases, liquid and solids depends upon temperature? | **03** |
| | **(b)** | Discuss the Concept of Internal temperature gradient for unsteady state heat transfer. Also mention its correlation with Biot Number. | **04** |
| | **(c)** | List out various laws of radiation and discuss any one in details. | **07** |
| **Q.2** | **(a)** | Enlist different types of fins with neat sketch. | **03** |
| | **(b)** | Derive an expression for heat flow through a Sphere. | **04** |
| | **(c)** | A furnace is constructed with a 23 cm thick layer of fire brick, 75 cm thick layer of insulating brick and followed by a 89 cm thick layer of building brick. The inside temperature of the furnace is 800 °C and the outside temperature is 60 °C. The thermal conductivities of fire brick, insulating brick and building brick are 1.22, 0.121 and 0.865 W/(m.K). Find the heat loss per unit area and the temperature at the interfaces. | **07** |
| | | **OR** | |
| | **(c)** | Derive the equation for critical radius of insulation. | **07** |
| **Q.3** | **(a)** | Write down difference between free and forced convection. | **03** |
| | **(b)** | Give the physical significance of Prandlt No., Nusselt No. and Grashoff No. and Stanton No. | **04** |
| | **(c)** | Discuss with the help of diagram various regimes of pool boiling. What is the use of finding critical flux and critical temperature drop? | **07** |
| | | **OR** | |
| **Q.3** | **(a)** | State and explain Stefan-Boltzmann Law of radiation. | **03** |
| | **(b)** | Define the black body and Give applications where this concept is used in heat transfer. | **04** |
| | **(c)** | Using Dimension analysis derive expression for forced convection for the fluid flowing inside tube in a turbulent flow. | **07** |
| **Q.4** | **(a)** | Draw the temperature profiles of cold and hot fluids for true co-current and counter –current flow in double pipe heat exchanger. | **03** |
| | **(b)** | Discuss the Concept of Effectiveness. | **04** |
| | **(c)** | Discuss construction and working of Plate type heat exchanger. | **07** |
| | | **OR** | |
| **Q.4** | **(a)** | Give the advantages of square pitch arrangement over the triangular pitch in case of heat exchanger tubes? | **03** |
| | **(b)** | Derive an equation for Overall heat transfer coefficient in double pipe heat exchanger. | **04** |

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|---|---|---|---|
| | **(c)** | Explain in details with neat sketch: Shell & Tube heat exchangers. | **07** |
| **Q.5** | **(a)** | Draw the sketch of various methods of feeding the multiple effect evaporators | **03** |
| | **(b)** | Explain Boiling Point Elevation (BPE) | **04** |
| | **(c)** | Derive the material and energy balances for multi effect evaporator. | **07** |

**OR**

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|---|---|---|---|
| **Q.5** | **(a)** | Define capacity and economy of evaporator. | **03** |
| | **(b)** | Differentiate between forward feed and backward feed in a multiple effect evaporator with a neat sketch | **04** |
| | **(c)** | Write a short note on Multiple Effect Evaporator | **07** |

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