

GUJARAT TECHNOLOGICAL UNIVERSITY
BACHELOR OF ENGINEERING – SEMESTER 4 – EXAMINATION – SUMMER 2026

Subject Code: 3140503

Date: 21/05/2026

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.**

- Q.1**
- (a) Enlist the property of Insulating material. **03**
 - (b) Explain how does thermal conductivity of gases, liquid and solids depend upon temperature? **04**
 - (c) Explain in brief various laws of radiation. **07**
- Q.2**
- (a) Enlist different types of fins with neat sketch. **03**
 - (b) Develop an expression for radial heat conduction through tubes **04**
 - (c) A furnace is constructed with a 24 cm thick layer of fire brick, 12 cm thick layer of insulating brick and followed by a 24 cm thick layer of building brick. The inside temperature of the furnace is 950 °C and the outside temperature is 55 °C. The thermal conductivities of fire brick, insulating brick and building brick are 6.05, 0.59 and 2.4 W/(m °C). Find the heat loss per unit area and the temperature at the interfaces. **07**
- OR
- Q.2**
- (c) Calculate the critical radius of insulation for asbestos ($K = 0.17 \text{ W/m K}$) surrounding a pipe & exposed to room air at 293K with $h = 3 \text{ W/m}^2 \text{ K}$. Calculate the heat loss from a 473 K, 50 mm diameter pipe when covered with the critical radius of insulation and without insulation. Would any fiber glass insulation having thermal conductivity of 0.04 W/m K cause decrease in heat transfer? **07**
- Q.3**
- (a) Give the physical significance of Prandtl No., Nusselt No. and Grashoff No. **03**
 - (b) Explain natural convection phenomenon. **04**
 - (c) Using Dimension analysis derive expression for forced convection for the fluid flowing inside tube in a turbulent flow. **07**
- OR
- Q.3**
- (a) Define the black body and Give applications where this concept is used in heat transfer. **03**
 - (b) Explain the terms absorptivity, emissivity, transmissivity and reflectivity for heat transfer by radiation. **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**
- 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) Derive an equation for Overall heat transfer coefficient in double pipe heat exchanger. **04**

	(c) Explain in details with neat sketch: Shell & Tube heat exchangers.	07
	OR	
Q.4	(a) When LMTD correction factor is used in heat exchanger calculation?	03
	(b) Discuss the Concept of fin Effectiveness.	04
	(c) Derive the equation for LMTD and explain its importance.	07
Q.5	(a) Define capacity and economy of evaporator.	03
	(b) Differentiate between filmwise and dropwise condensation.	04
	(c) Derive the material and energy balances for multi effect evaporator.	07
	OR	
Q.5	(a) Differentiate between forward feed and backward feed in a multiple effect evaporator with a neat sketch	03
	(b) Discuss the effect of non-condensable gases on condensation.	04
	(c) Explain Multiple Effect Evaporator with neat sketch	07
