Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–VII EXAMINATION – WINTER 2025

Subject Code:3170102 Date:01-12-2025

Subject Name:Theory of 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.**
5. **Use of property table is permissible.**

			MARKS
Q.1	**(a)**	Define conduction, convection and radiation.	**03**
	(b)	Discuss the important laws governing modes of heat transfer in real applications.	**04**
	(c)	With a neat figure, derive the expression of general heat conduction equation in cartesian coordinates.	**07**
Q.2	**(a)**	Give the applications of rectangular fins and circular fins in the field.	**03**
	(b)	Define critical thickness of insulation and derive its expression for a cylinder.	**04**
	(c)	Derive equation for temperature distribution and heat dissipation for fin insulated at the tip.	**07**
		OR	
	(c)	What is lumped capacitance method? When and in which applications it is used? Derive the expression of temperature distribution using it for a transient heat transfer.	**07**
Q.3	**(a)**	Define convective heat transfer coefficient. On which factor it depends on?	**03**
	(b)	Explain the development of thermal boundary layer over the hot flat plate.	**04**
	(c)	Define Reynolds number, Nusselt number and Prandtl number. Explain their importance in convection heat transfer.	**07**
		OR	
Q.3	**(a)**	Derive the expression of conductive resistance and convective resistance for a one dimensional heat transfer through a plane wall.	**03**
	(b)	Define fin efficiency and fin effectiveness?	**04**
	(c)	Derive the expression of overall heat transfer coefficient for a composite cylindrical wall.	**07**
Q.4	**(a)**	What is heat exchanger? Why it is used in heat transfer applications?	**03**
	(b)	Explain the pros and cons of heat transfer in a co-current and countercurrent type of heat exchanger.	**04**
	(c)	Using dimensional analysis, obtain a general form of Nusselt number for Natural Convective heat transfer.	**07**
		OR	
Q.4	**(a)**	What do you mean by fouling in heat exchangers?	**03**
	(b)	Discuss filmwise and dropwise condensation with neat sketch.	**04**
	(c)	Derive the expression of LMTD for a parallel flow heat exchanger.	**07**
Q.5	**(a)**	What is radiation? Which are the factors affecting emission intensity of the body.	**03**
	(b)	Define following: 1) Total emissive power 2) Emissivity	**04**

3) Radiation intensity
4) Monochromotic Emissive Power

(c) What is the Stephen-Boltzmann Law? Explain the concept of total emissive power of a surface. **07**

OR

Q.5 **(a)** Define Lambert's law of radiation. **03**

(b) State and prove the Kirchoff's law of radiation. **04**

(c) Define a shape factor. Derive its expression in case of radiation exchange between two surfaces. **07**

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