Enrollment No./Seat No.:

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering - SEMESTER - V EXAMINATION - WINTER 2025

Subject Code: 3151909 **Date: 19-11-2025**

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)**	How does the heat conduction differ from convection?	**03**
	(b)	What is lumped heat capacity analysis? List out the assumptions made in lumped heat capacity analysis.	**04**
	(c)	Derive expression for temperature distribution under one dimensional steady state heat conduction for plane wall.	**07**
Q.2	**(a)**	Define thermal capacity and thermal diffusivity of a material.	**03**
	(b)	Explain the criteria of selection of fins.	**04**
	(c)	Explain following: 1. Fin efficiency 2. Fin effectiveness	**07**
		OR	
	(c)	Derive the heat conduction equation through composite wall.	**07**
Q.3	**(a)**	Sate comparison between natural and forced convection heat transfer.	**03**
	(b)	Explain Newton's law of cooling and convection heat transfer coefficient	**04**
	(c)	Derive the two dimensional energy equation for thermal boundary layer over a flat plate.	**07**
		OR	
	(a)	Explain that heat transfer coefficient for free convection is lower than forced convection.	**03**
	(b)	Explain physical significance of following dimensionless numbers: 1. Grashoff number 2. Reynolds number	**04**
	(c)	By dimensional analysis show that for forced convection, $Nu = f(Re, Pr)$	**07**

Q.4 **(a)** Define: **03**

1. Black body
2. White body
3. Opaque body

(b) Sate and explain Wien's displacement law. **04**

(c) A hot body at 800 K having an area of 0.12 m^2. Calculate: (i) Total rate of energy emitted, (ii) intensity of normal radiation. **07**

OR

(a) Define Absorptivity, Reflectivity and transmissivity of radiation. **03**

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

(c) State Stephen Boltzman law. Determine the surface temperature of sun and emissive power at that temperature when the sun emits radiation at λ =0.52 μm. Assuming sun as black body. **07**

Q.5 **(a)** Differentiate between subcooled and saturated boiling. **03**

(b) Explain condensation process. What are the two modes of condensation. **04**

(c) Derive an expression for LMTD in case of parallel flow heat exchanger. **07**

OR

(a) Differentiate between nucleate and film boiling. **03**

(b) Explain why condenser tubes are horizontal. **04**

(c) In counter flow heat exchanger, 2.78 kg/sec of an oil having specific heat of 2.095 kJ/kg K is cooled from 80^oC to 50^oC by 2.22 kg/sec of water entering at 25^oC. Determine the area of heat exchanger. Take U = 300 W/m^2K and C_P = 4.18 kJ/kg K. **07**

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