Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V (NEW) EXAMINATION – WINTER 2022

Subject Code:3151909 **Date:06-01-2023**

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)**	Define the conduction, convection and radiation modes of heat transfer with suitable example.	**03**
	(b)	Describe the thermal conductivity and explain its significance in heat transfer.	**04**
	(c)	A steel fin (k = 54 W/mK) with a cross section of an equilateral triangle, 5 mm in side and 80 mm long. It is attached to a plane wall maintained at 400°C. The ambient air temperature is 50°C and convective heat transfer coefficient at surface is 90 W/m^2K. Calculate the heat dissipation rate from the rod.	**07**
Q.2	**(a)**	Define fin efficiency and fin effectiveness.	**03**
	(b)	Give eight examples related to heat transfer from the routine life.	**04**
	(c)	Write the most general equation in Cartesian co-ordinates for heat transfer by conduction. Deduce above equation for the following cases with suitable assumptions; (i) Laplace equation, (ii) Poisson equation, and (iii) Fourier equation.	**07**
		OR	
	(c)	Derive general heat conduction equation in cylindrical coordinates	**07**
Q.3	**(a)**	Define Grashof number. Explain its significance in natural convection heat transfer.	**03**
	(b)	Differentiate between: 1) Nusselt number and Reynolds number. 2) Free convection and forced convection.	**04**
	(c)	Using Buckingham – π theorem show that Nusselt number for free convection is a function of Grashof Number and Prandtl number.	**07**
		OR	
Q.3	**(a)**	Describe mean film temperature and bulk mean temperature.	**03**
	(b)	Explain the concept of thermal boundary layers.	**04**
	(c)	A horizontal fluorescent tube which is 3.8 cm in diameter and 120 cm long stands in still air at 1 bar and 20 °C. If the surface temperature is 40 °C and radiation is neglected, calculate heat transfer rate by convection. Use $\bar{N}u = 0.53\ (Gr.Pr)^{0.25}$ From Air Table (Properties of Air) at Tmf ν =15.06 X 10-6 m2/sec Pr=0.701 K= 2.673 X 10-2 W/mK	**07**

Q.4	**(a)**	Define absorptivity, emissivity and monochromatic emissive power.	**03**
	(b)	Describe shape factor. Discuss salient features of shape factor.	**04**
	(c)	Define total emissive power (Eb) and intensity of radiation (Ib). Show that $Eb = \pi \times Ib$	**07**

OR

Q.4	**(a)**	It is desirable to wear white clothes instead of black during the summer season. Give reason.	**03**
	(b)	Draw temperature variation for condenser and evaporator of thermal power plant.	**04**
	(c)	Two large parallel plates with $\epsilon = 0.4$ each are maintained at different temperatures and are exchanging heat only by radiation. Two equally large radiation shields with surface emissivity 0.04 are introduced in parallel to the plates. Find the percentage reduction in net radiation heat transfer.	**07**

Q.5	**(a)**	Justify that a good absorber is also a good emitter for radiation heat transfer.	**03**
	(b)	Give broad classification of heat exchangers.	**04**
	(c)	Derive the equation of LMTD for counter-flow heat exchangers.	**07**

OR

Q.5	**(a)**	Define fouling factor in case of heat exchanger? List the causes of fouling.	**03**
	(b)	Discuss the various regimes of boiling.	**04**
	(c)	Define condensation? Explain film-wise condensation and drop-wise condensation.	**07**

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