Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII (NEW) EXAMINATION – SUMMER 2021

Subject Code:2170102 Date:04/08/2021

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. **Tables for properties of air and water are permitted.**

Q.1	**(a)**	What is thermal contact resistance? Upon what parameters does this resistance depend?	**03**
	(b)	Define extended surfaces with neat sketch?	**04**
	(c)	A wall 30 cm thick has size 5 m × 3 m made of red bricks (k = 0.35 W/m.K). It is covered on both sides by the layers of plaster 2 cm thick (k = 0.6 W/m.K). The wall has a window of size 1 m × 2 m. The window door is made of glass, 12 mm thick having thermal conductivity 1.2 W/m.K. Estimate the rate of heat flow through the wall. Inner and outer surface temperatures are 10°C and 40°C, respectively.	**07**
Q.2	**(a)**	What do you mean by transient analysis? Define Biot Number?	**03**
	(b)	Define critical thickness? Explain critical radius for cylinder?	**04**
	(c)	Derive equations of temperature distribution and heat dissipation for Fin insulated at tip.	**07**
		OR	
	(c)	Using dimensional analysis, obtain a general form of equation for forced Convective heat transfer	**07**
Q.3	**(a)**	Write temperature profile equation and heat transfer from fin for 1) Infinte long fin 2) Tip insulated fin 3) Tip non insulated fin	**03**
	(b)	What is lumped system analysis? What are the assumptions and when is it applicable?	**04**
	(c)	Estimate the heat transfer rate from a 100 W incandescent bulb at 140°C to an ambient at 24°C. Approximate the bulb as 60 cm diameter sphere. Calculate the percentage of power lost by natural convection. Use following correlation and air properties ; Nu = 0.60 (Gr.Pr)1/4	**07**

The properties of air at 82°C are: $\nu = 21.46 \times 10–6$ m2/s, $K_f = 30.38 \times 10^{-3}$ W/m.K, Pr = 0.699.

OR

Q.3	**(a)**	Define Nusselt Number. Explain its significance in convection heat transfer.	**03**
	(b)	What do you mean by Dimensional analysis? What are the assumptions used in it?	**04**
	(c)	Explain the Reynolds-Colburn analogy for laminar flow over a flat plate.	**07**
Q.4	**(a)**	Define heat exchanger? Classify heat exchanger in detail?	**03**
	(b)	Explain Film-wise and drop-wise condensation with neat sketch?	**04**
	(c)	Derive an expression for log mean temperature difference of parallel flow heat exchanger	**07**

OR

Q.4	**(a)**	Explain the following terms with reference to heat exchanger : (i) NTU (ii) Effectiveness	**03**
	(b)	Explain correction factor for multi-pass arrangement heat exchanger? Also define fouling factor?	**04**
	(c)	State & explain Kirchhoff's identity. What are conditions under which it is applicable	**07**
Q.5	**(a)**	State & explain Lambert's cosine law.	**03**
	(b)	What are the radiation space and surface resistances? How are they expressed? For what kind of surface, the radiation surface resistance is zero?	**04**
	(c)	Define total emissive power (E_b) and intensity of radiation (I_b). Show that $Eb = \pi \times Ib$	**07**

OR

Q.5	**(a)**	Explain the following : (i) Grey Body (ii) Spectral Intensity of Radiation (iii) Black body	**03**
	(b)	Explain the following terms: (i)Radiation shield (ii) Radiation geometrical factor.	**04**
	(c)	Derive an expression for rate of radiation exchange, when a radiation shield is inserted between two large parallel plates.	**07**

****