Seat No.: _____ Enrolment No.

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII(NEW) EXAMINATION – SUMMER 2019

Subject Code:2170102 **Date:14/05/2019**

Subject Name:Theory of Heat Transfer

Time:02:30 PM TO 05:00 PM **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	What are the modes of Heat Transfer? Also mention their governing laws.	**03**
	(b)	Differentiate Conduction & Convection heat transfer.	**04**
	(c)	Derive general heat conduction equation in Cartesian coordinate system.	**07**
Q.2	**(a)**	Differentiate Natural & Forced Convection.	**03**
	(b)	Compare Electrical Analogy & Thermal Analogy for Plane Wall in terms of Voltage and Temperature Difference respectively.	**04**
	(c)	0.5cm thick glass (k= 0.78 W/mK) is exposed to air at 25° C (inner side) with convection heat transfer coefficient of 15 W/m²K. The outside air at -15° C with convection coefficient of 50 W/m²K. Determine: (1) Temperature at inner and outer glass surfaces (2) Heat transfer rate	**07**
		OR	
	(c)	An outer wall of a house may be approximated by a 0.1m layer of common brick (k= 0.7 W/m°C) followed by a 0.04m layer of Gypsum plaster (k= 0.48 W/m°C). What thickness of loosely packed rockwool insulation (k= 0.065 W/m°C) should be added to reduce the heat loss or gain the wall by 80% ?	**07**
Q.3	**(a)**	What are the common applications of Extended surfaces?	**03**
	(b)	What are the different types of Extended surfaces?	**04**
	(c)	Derive an expression for heat flow through Rectangular fins.	**07**
		OR	
Q.3	**(a)**	What is (1) Prandtl Number (2) Grashoff Number & (3) Nusselt Number?	**03**
	(b)	Briefly discuss the concept of Hydrodynamic boundary layer.	**04**
	(c)	Using Rayleigh's Method, Prove that when a sphere of diameter 'd', moves with a uniform velocity 'V', through a fluid of density 'ρ' and dynamic viscosity 'μ', the resistance 'R' will be $R = \rho d^2 V^2 \emptyset \left[\frac{\mu}{\rho V d}\right]$	**07**
Q.4	**(a)**	Define Emissive Power & Emissivity.	**03**
	(b)	Define Absorptivity, Reflectivity & Trasnmissivity.	**04**
	(c)	A black body of total area 0.045 m² is completely enclosed in a space bounded by 5 cm thick walls. the walls have a surface area 0.5 m² and thermal conductivity 1.07 W/m°C. If the inner surface of the	**07**

enveloping wall is to be maintained at 215 °C and the outer wall surface is at 30°C, calculate the temperature of the black body. Neglect the difference between inner and outer surface areas of enveloping material.

OR

Q.4	**(a)**	What is Overall heat transfer coefficient?	**03**
	(b)	Classify Heat Exchangers on the basis of its Mechanical Design.	**04**
	(c)	Derive an expression for Radiation between two non-black parallel surfaces.	**07**
Q.5	**(a)**	What do you mean by Heat Exchanger effectiveness?	**03**
	(b)	Differentiate Filmwise and Dropwise condensation.	**04**
	(c)	Derive LMTD Method.	**07**

OR

Q.5	**(a)**	Define Boiling, Condensation & Evaporation?	**03**
	(b)	Discuss Fouling/Scale deposition phenomenon in Heat Exchangers. Also state it's Disadvantages.	**04**
	(c)	Write a short note on Boiling Phenomenon.	**07**

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