FirstRanker.com
Firstranker's choice
Seat No.: _____ www.FirstRanker.com Enrolment No. www.FirstRanker.com

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– VII (New) EXAMINATION – WINTER 2019

Subject Code: 2170102 **Date: 26/11/2019**

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)** Explain the following terms: **03**

(a) Thermal diffusivity

(b) Thermal Conductivity

(c) Thermal contact resistance

(b) Define fin effectiveness. When the use of fins is not justified **04**

(c) An air stream at 0 ^{0}C is flowing along a heated plate at 90 ^{0}C at a speed of 75 m/s. The plate is 45 cm long and 60 cm wide. Assuming the transition of boundary layer takes place at $Re_{cr} = 5 \times 10^5$. Calculate the average value of friction coefficient and heat transfer coefficient for full length of the plate. Also calculate the heat dissipation from the plate. **07**

The thermo-physical properties at of air are as follows:

$\rho = 1.113$ kg/m^3, $k = 0.0276$ W/m-K, $Pr = 0.693$, $\mu = 1.928 \times 10^{-5}$ kg/ms

Q.2 **(a)** What is transient heat conduction? How does transient heat conduction differ from steady state heat conduction? **03**

(b) What is the "critical radius" of insulation? Derive an expression for the same for cylinders. **04**

(c) A steel pipe is covered with two layers of insulation, first layer being 3 cm thick and second 5 cm. The pipe is made of steel (k=58 W/m-K) having internal diameter of 160 mm and Outside diameter of 170 mm. The inside and outside film coefficients are 30 and 5.5 W/m^2-K, respectively. Calculate the heat lost per metre of pipe, if the steam temperature is 300°C and air temperature is 50°C. The thermal conductivity of two insulating material are 0.17 and 0.093 W/m-K, respectively. **07**

OR

(c) Derive an expression for heat transfer for an adequately long of Rectangular fin with insulated tip. **07**

Q.3 **(a)** Differentiate: **03**

1. Mean film temp and bulk mean temp
2. Velocity and thermal boundary layer

(b) Explain lumped heat capacity method of heat transfer and state its assumptions. **04**

(c) Using dimensional analysis, obtain a general form of equation for forced Convective heat transfer. **07**

OR

Q.3 **(a)** Distinguish between natural and forced convection heat transfer. **03**

www.FirstRanker.com

FirstRanker.com
Firstranker's choice
www.FirstRanker.com www.FirstRanker.com

	(b)	Show using momentum equation that in the case of incompressible boundary layer flow with negligible pressure gradient, $\partial^3u/\partial y^3 = 0$ at y = 0.	**04**
	(c)	Discuss the concept of thermal boundary layer in case of flow over the plates. How it differ from velocity boundary?	**07**
Q.4	**(a)**	What is a heat exchanger and where are they used?	**03**
	(b)	Explain mechanism of nucleate boiling?	**04**
	(c)	Obtain an expression for overall heat transfer coefficient for tubular heat exchanger, subjected to fouling on its two sides of heat transfer surface.	**07**

OR

Q.4	**(a)**	Why is counter-flow Heat Exchanger more effective than a parallel flow heat exchanger.	**03**
	(b)	What are the fouling factors? Explain their effect in Heat Exchanger design.	**04**
	(c)	Prove that the effectiveness of parallel flow heat exchanger is given by $\varepsilon = \frac{1-\exp[-NTU(1+C)]}{1+C}$	**07**
Q.5	**(a)**	Explain Kirchhoff's law of radiation?	**03**
	(b)	Explain dropwise and filmwise condensation.	**04**
	(c)	Derive a general relation for the radiation shape factor in case of radiation between two surfaces. Explain Wein's displacement law of radiation.	**07**

OR

Q.5	**(a)**	What does the view factor represent? When is the view factor from a surface to itself not zero?	**03**
	(b)	Define following: 1) Absorptivity 2) Reflectivity 3) Transmissivity 4) Total Emissivity	**04**
	(c)	Define Radiation Intensity? State & Explain the Wien Displacement Law. Show that $E_{b\lambda}$ will be maximum, when λ_{max}. T = 2900 μK	**07**

****

www.FirstRanker.com

www.FirstRanker.com