Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V (NEW) EXAMINATION – WINTER 2018

Subject Code:2151909 Date:27/11/2018

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. **Use of air table, steam table, heat exchanger chart is permitted.**

			MARKS
Q.1	**(a)**	What is insulation? State its six applications in engineering field.	**03**
	(b)	It is observed that the intensity of the radiation emitted by the sun is maximum at a wavelength of 0.5 μ. Assuming the sun to be black body. Calculate its surface temperature and emissive power.	**04**
	(c)	Saturated steam at 120 °C is condensing on the outer tube surface of a single pass heat exchanger. The overall heat transfer coefficient is 1800 W/m^2 K. Determines the surface area of a heat exchanger capable of heating 1000 kg/h of water from 20 °C to 90 °C. Also calculate the rate of condensation of steam. Assume latent heat of steam is 2200 KJ/Kg.	**07**
Q.2	**(a)**	What is dimensional analysis? Explain dimensional homogeneity.	**03**
	(b)	A copper pipe (temperature 55 °C) is kept in atmosphere (temperature 35 °C). The length and diameter of pipe is 1m and 50 mm respectively. The air velocity is 3 m/s. use the co-relation $Nu= 0.0239 (Re)^{0.805}$. Calculate heat loss from the pipe.	**04**
	(c)	Derive the two dimensional energy equation for thermal boundary layer over a flate plate.	**07**
		OR	
	(c)	By dimensional analysis, show that for force convection Nusselt Number is a function of Reynold Number and Prandtl Number.	**07**
Q.3	**(a)**	Explain film wise condensation.	**03**
	(b)	Emissivity of two large parallel plates maintained at 800 °C and 300 °C are 0.3 and 0.5 respectively. Find the net radiant heat exchange per square meter for these plates.	**04**
	(c)	Derive equation of net heat transfer by radiation between two infinite parallel plates.	**07**
		OR	
Q.3	**(a)**	Define shape factor. What is shape factor with respect to itself if the surface is concave, convex or flat?	**03**
	(b)	Differentiate between 1. Subcooled and saturated boiling 2. Nucleate and film boiling	**04**
	(c)	State and prove Kirchof's law of radiation. Derive Wein's displacement law.	**07**

Q.4	**(a)**	What is difference between heat transfer and thermodynamics?	**03**
	(b)	What is fouling? State the causes of fouling. State the limitations of LMTD method. What is heat pipe?	**04**
	(c)	Derive equation of LMTD for counter flow heat exchanger.	**07**
		OR	
Q.4	**(a)**	Which are the basic laws governing the heat transfer. State any one.	**03**
	(b)	What is compact, multipass and regenerator type heat exchanger? State six application of heat exchanger in the field of engineering.	**04**
	(c)	Derive equation of effectiveness for parallel flow heat exchanger.	**07**
Q.5	**(a)**	What is Fourier's law of heat conduction? State its assumptions.	**03**
	(b)	A steel pipe (k= 35 W/m K) with inner diameter 50 mm and outer diameter 60 mm is insulated using insulation material having (K=0.055 W/m.K). The temperature interface between pipe and insulation is 573 K, while the temperature on outside of insulation must not exceed 343 K, with permissible heat loss of 700 W/m. calculate (1) the minimum thickness of insulation and (2) the temperature of inside surface of pipe.	**04**
	(c)	Derive expression for temperature distribution and heat dissipation in a straight infinitely long fin of rectangular profile.	**07**
		OR	
Q.5	**(a)**	Define fin efficiency. Explain the situation, when addition of fin to a surface is not useful.	**03**
	(b)	A steel rod (K= 54 W/ m° K) with a cross section of an equilateral triangle (each side 5 mm) is 80 mm long. It is attached to a furnace wall which is maintained at a temperature of 400 °C. The surrounding is at 50 °C and surface conductance is 90 W/m^2K. Calculate the heat dissipated by the rod. Assume tip of the rod is insulated.	**04**
	(c)	Derive expression for temperature distribution, under one dimensional steady state heat conduction for the hollow cylinder.	**07**

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