## **GUJARAT TECHNOLOGICAL UNIVERSITY** ME - SEMESTER-1 (NEW) EXAMINATION - WINTER 2016

Subject Code: 2711101Date:04/01/2017Subject Name: Advanced Thermodynamics and Heat Transfer			17
Ti Ins	me: 2 tructio 1. 2. 3.	2:30 pm to 5:00 pm Total Marks:   ons: Attempt all questions.   Make suitable assumptions wherever necessary. Figures to the right indicate full marks.	70
Q.1	(a)	Enumerate the basic laws which govern the heat transfer. Derive the 3-D, steady state heat conduction equation without internal heat generation in Cartesian coordinate system	07
	<b>(b)</b>	What is critical radius of insulation? Deduce the expression for it.	07
Q.2	(a)	Derive the expressions for temperature distribution, under one dimensional steady state heat conduction, for the following systems:	07
		(i) Cylinder (ii) Sphere.	
	<b>(b)</b>	Explain the following: (i) Efficiency of fin (ii) Effectiveness of fin.	07
	<b>(b</b> )	Explain critical Reynolds number? State its approximate values for flow over flat plate and through a circular tube.	07
Q.3	(a) (b)	Explain the applications of Heisler Charts in transient heat conduction. What is the operation in heat pipe. Why is a wick needed in a heat pipe? Write its advantages.	07 07
		OR	
Q.3	(a) (b)	Write about Kirchhoff's law of radiation and prove it. Define Lambert's law of radiation. What is 'Intensity of radiation'?	07 07
Q.4	<b>(a)</b>	Derive the following relation for laminar film condensation on vertical plate.	07
		$\delta = \left[\frac{4 \mu x (T_{sat} - T_s) x}{g \rho_t (\rho_t - \rho_v) h_{fg}}\right]^{\frac{1}{4}}$	
	<b>(b)</b>	Differentiate between pool boiling and forced convection boiling.	07
Q.4	(a)	Derive the three <i>T.ds</i> equations as stated below:	07
		(i) $Tds = C_{v}dT + T\left(\frac{\partial p}{\partial T}\right)_{v}dv$ ; (ii) $Tds = C_{p}dT - T\left(\frac{\partial v}{\partial T}\right)_{p}dp$	
	(b)	Discuss the Clausius inequality. Define the entropy. Explain the difference between isentropic process and adiabatic process.	07
Q.5	(a)	Discuss Gouy–Stodola theorem.	07
	<b>(b)</b>	What is entropy transfer? Why is entropy transfer associated with heat transfer and not with work transfer?	07
		OR	
Q.5	(a)	Derive the expression for irreversibility in a process executed by a (i) closed system (ii) steady flow system in a given environment.	07
	<b>(b</b> )	What is the difference between free expansion and throttling processes?	07

(b) What is the difference between free expansion and throttling processes?

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