Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – I • EXAMINATION – SUMMER • 2014

Subject Code: 712101 Date: 13-06-2014

Subject Name: Applied Thermodynamics and Heat Transfer

Time: 02:30 pm - 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)**	Derive the maximum work obtainable from a finite body at temperature T and TER at temperature T_0.	**07**
	(b)	Derive the expression for temperature distribution along the length of the fin insulated at tip.	**07**
Q.2	**(a)**	Write Waalôs equation. Find the value of co-efficient of volume expansion ß and isothermal compressibility k using this equation.	**07**
	(b)	Derive the expression for temperature distribution during Newtonian heating or cooling.	**07**
		OR	
	(b)	Derive the expression for availability associated with the fluid stream from open system in steady state condition.	**07**
Q.3	**(a)**	Derive Maxwellôs equations.	**07**
	(b)	25 kg of water at 95° C is mixed with 35° C. find decrease in available energy. T_{atm}=15° C and C_p for water is 4.2 kJ/kg k.	**07**
		OR	
Q.3	**(a)**	Explain that violation of clausious statement violates Kelvin plank statement and vice versa.	**07**
	(b)	In a steam turbine the steam enters at 50 bar 600° C and 150 m/s and leaves as saturated vapour at 0.1 bar, 50 m/s. during expansion work 1000 kJ/kg is delivered. Determine the inlet steam availability. Take dead state temperature as 15° C.	**07**
Q.4	**(a)**	Derive the expression for maximum temperature for one dimensional heat flow under steady state conditions and uniform heat generation.	**07**
	(b)	A plate 2 cm thick and 10 cm wide is used to heat a fluid at 30° C. The heat generation rate inside the plate is $7*10^{-6}$ w/m^3. Determine the heat transfer co-efficient to maintain the temperature of the plate below 180° C. k of plate is w/m° C. neglect heat losses from the edge of the plate.	**07**
		OR	
Q.4	**(a)**	Derive necessary von-karmanôs expression for convection heat transfer.	**07**
	(b)	A steel ball 50 mm in diameter and at 900° C is placed in still atmosphere of 30° C. find the temperature of ball after one minute. Take density=7800 kg/m^3	**07**
Q.5	**(a)**	State and explain the following 1. Gressof number 2. Prandlt number 3. Nusselt number 4. Reynoldôs number	**07**
	(b)	Explain hydrodynamic boundary layer, boundary layer thickness and thermal boundary layer with neat sketch.	**07**
		OR	

Q.5 **(a)** State and explain any three laws of radiation. **07**

(b) Two large parallel plates with $\mathring{U} = 0.5$ each, are maintained at different temperature and are exchanging heat only by radiation. Two equally large radiation shields with surface emissivity 0.05 are introduced in parallel to the plates. Find the percentage reduction in net heat transfer by radiation. **07**

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