Seat No.: _____ *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject code: 712101N **Date: 01-12-2014**

Subject Name: Applied Thermodynamics and Heat Transfer

Time: 10:30 am - 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.**

Q.1	**(a)**	What is Applied Thermodynamics? Explain in brief laws of thermodynamics.	**07**
	(b)	Explain the following terms : (i) Exergy (ii) Irreversibility (iii) Entropy	**07**
Q.2	**(a)**	Explain Modes of Heat transfer with suitable examples. Write short note on 'Significance of Heat transfer.'	**07**
	(b)	With usual notations derive an expression for change in internal energy of gas obeying vanderwaal's equation.	**07**
		OR	
	(b)	Derive the generalized equation for a fin.	**07**
Q.3	**(a)**	Explain in brief Clausius-Clapeyron equation, Joule Thomson coefficient and Maxwell relations.	**09**
	(b)	A cylinder piston device contains 0.05 kg of steam at 1 MPa and 300^0C. The steam now expands to a final state of 200 kPa and 150^0 C, during work. Heat losses from a system to the surroundings are estimated to be 2 kJ during this process. Assuming the surroundings to be at $T_0 = 25^0$ C and $P_0 = 100$ kPa. Calculate the availability of steam at the initials and the final states.	**05**
		OR	
Q.3	**(a)**	State and explain the following : (i) Nusselt number (ii) Grashof number (iii) Prandtl number (iv) Lewis number	**07**
	(b)	Air at 10^0C and at a pressure of 100 kPa is flowing over a plate at a velocity of 3 m/s. If the plate is 30 cm wide and at a temperature of 60^0C, calculate the following quantities at x = 0.3. (1) Velocity boundary layer thickness (2) Thermal boundary layer thickness (3) Heat transfer from the plate.	**07**
Q.4	**(a)**	With usual notations derive generalized two dimensional steady state heat conduction equation in semi-infinite plate when two boundaries are at zero temperature.	**07**
	(b)	What are Heisler charts? Explain the significance of Heisler charts in solving transient conduction problems.	**07**
		OR	
Q.4	**(a)**	Explain the fluid flow along a flat plate 1) Temperature distribution in thermal boundary layer 2) Velocity distribution in hydrodynamic boundary layer 3) Variation of local heat coefficient along the flow	**07**
	(b)	What are the criteria of thermodynamic equilibrium? What are different types of equilibriums? Discuss in detail.	**07**

Q.5	**(a)**	What is shape factor? Discuss the salient features of the shape factor for analysis of radiant heat exchange between surfaces.	**06**
	(b)	Explain the term absorptivity α, reflectivity ρ and transmissivity τ of $\alpha + \rho + \tau = 1$ radiant energy. How are they related to each other for a black body and an opaque body? Establish the expression and comment on the statement.	**08**

OR

Q.5	**(a)**	Derive necessary Von-Karnan's expression for convective heat transfer.	**07**
	(b)	Explain the following : (1) Emissivity (2) Lambert's cosine law (3) Wein's displacement law of radiation	**07**

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