Seat No.: _____ *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject code: 711101N **Date: 01-12-2014**

Subject Name: Advanced 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)** Write short notes on the following: **07**
Thermodynamic properties, process, closed system, isolated system, open system, extensive and intensive properties.

(b) Write brief note on Concept of Exergy and Entropy **07**

Q.2 **(a)** Derive the two *T.ds* equations as stated below: **07**

$$Tds = C_p dT - T\left(\frac{\partial v}{\partial T}\right)_p dp \text{ and } Tds = C_v\left(\frac{\partial T}{\partial p}\right)_v dp + C_p\left(\frac{\partial T}{\partial v}\right)_p dv$$

(b) Derive Vander Waal's equation. **07**

OR

(b) What do you understand by Joule-Thomson coefficient? Explain. **07**

Q.3 **(a)** Show that for a polytropic process, $Q = \left(\frac{\gamma - n}{\gamma - 1}\right)W$ **07**

Where, *Q* and *W* are heat and work interactions and *n* is polytropic index.

(b) Derive the Clapeyron equation with usual notations. $\left(\frac{dp}{dT}\right)_{sat} = \left(\frac{h_{fg}}{Tv_{fg}}\right)$ **07**

OR

Q.3 **(a)** Derive general heat conduction equation in Cartesian coordinates **07**

(b) Derive equations of temperature distribution and heat dissipation for infinite long fin. **07**

Q.4 **(a)** Explain lumped heat capacity method and state its assumptions. **07**

(b) What are Heisler Charts? Explain their significance in solving transient conduction problems. **07**

OR

Q.4 **(a)** Define Reynolds, Nusselt, Prandlt and Stanton numbers. Explain their importance in convective heat transfer. **07**

(b) Define Grashof number. Explain its significance in natural convection heat transfer. **07**

Q.5 **(a)** Write Von-karman integral momentum equation, for the hydrodynamic laminar boundary layer of fluid flowing over stationary plate. Using this equation, derive the expression for hydrodynamic boundary layer thickness considering the cubic velocity profile. **07**

(b) What is the Stephen-Boltzmann Law? Explain the concept of total emissive power of a surface. **07**

OR

Q.5 **(a)** Write short note on the Lambert's Cosine law **07**

(b) State and explain the Wien-Displacement law. Show that $E_{b\lambda}$ will be maximum when $\lambda_{max} T = 2900\,\mu K$ **07**

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