

GUJARAT TECHNOLOGICAL UNIVERSITY**M.E –Ist SEMESTER–EXAMINATION – JULY- 2012****Subject code: 711101N****Date: 05/07/2012****Subject Name: Advanced Thermodynamics and Heat Transfer****Time: 2:30 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.
4. Usual notations are used

Q.1 (a) Define (i) compressibility factor (ii) reduced co-ordinates. Explain with neat sketch **07**
general compressibility chart.

(b) Explain in detail different types of Phase Equilibrium diagram on p-T surface, **07**
h-s surfaces, and T-s surfaces

Q.2 (a) Differentiate clearly between the following:

(i) Diathermal wall and adiabatic wall,

(ii) Isolated and closed systems and

(b) Establish the equivalence of Kelvin-Plank and Clausius statements. **07**

OR

(b) Derive the two $T.ds$ equations as stated below: **07**

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

Q.3 (a) Establish the general differential equation in Cylindrical co-ordinates for 3-D unsteady **07**
heat conduction..

(b) The temperature distribution across a wall, 1 m thick at a certain instant of time is given **07**
as: $T(x) = 900 - 300x - 50x^2$, Where T is in degree Celsius and x is in meters

The uniform heat generation of 1000 W/m^3 is present in wall of area 10 m^2 having the
properties $\rho = 1600 \text{ kg/m}^3$, $k = 40 \text{ W/m.K}$ and $C = 4 \text{ kJ/kg.K}$

1. Determine the rate of heat transfer entering the wall ($x = 0$).and leaving the wall
($x = 1 \text{ m}$)

2. Determine the rate change of internal energy of the wall

OR

Q.3 (a) What is lumped capacity? What are the assumptions for lumped capacity analysis? **07**

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

Q.4 (a) What do you understand by high grade energy and low grade energy? Explain it with **07**
examples.

(b) What do you understand by entropy transfer? Why is entropy transfer associated with **07**
heat transfer and not with work transfer?

OR

Q.4 (a) What is Reynold analogy? Describe the relation between fluid friction and heat transfer. **07**

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

Q.5 (a) State and explain Stefan Boltzmann law. Derive an expression for total emissive power **07**
of a blackbody.

(b) Explain Kirchhoff's law. **07**

OR

Q.5 (a) What is Wien's displacement law? Derive an expression for its relation. **07**

(b) State and explain Lambert's cosine law of radiation.. **07**
