Total No. of Questions :5] *[Total No. of Printed Pages :2*

Roll No .....

AU/IP/IEM/ME - 304

B.E. III Semester

Examination, December 2012

Thermodynamics

Time : Three Hours

Maximum Marks : 70/100

Note: *All questions are compulsory, Internal choice is given with all the questions. Steam table and Mollier charts are allowed in exam.*

1. A certain mass of gas in a closed system is undergoing polytrophic expansion in accordance with the expression $p\gamma^n$ = constant. Show that the ratio-

   $\Delta Q; \Delta u; \Delta w :: (\gamma-n); (h-1) : (\gamma-1)$

   Where ΔQ is the heat rejected

   Δu in the gain in internal energy

   Δw is the work done

   Or

   A certain mass of ideal gas is heated from 325K to 355K at a
   a) Constant volume b) Constant pressure
   For which case do you think the energy required will be greater? Explain.

2. a) Describe an imaginary process that satisfies the first law but violates the second law.
   b) Describe an imaginary process that satisfies the second law but violates the first law.
   c) Describe an imaginary process that violates both the first law and second law of thermodynamics.

   Or

   Show the following differential equations of entropy:

$$ds = C_p\left[\frac{dv}{v}\right] + C_v\left[\frac{dp}{p}\right]$$

Hence prove that for isentropic process, pv^{γ} = constant

3. Prove that a) $T_C = \frac{8a}{27^{-} Rb}$ b) $P_C = \frac{a}{27b^2}$

Where on T_C & P_C are temperature and pressure at critical points, 'a' and 'b' are van der Waal's gas constants, R = characteristic gas constant.

Or

a) What is compressibility factor 'Z'? What is the physical significance of the compressibility factor?
b) What is the physical significance of two constants that appear in the Van der Waals Equation of state.

4. A steam sample at 2mPa has a specific volume of 0.09 m^3/Kg. Determine the dryness fraction of the steam. Also calculate the specific enthalpy and specific entropy of the sample?

Or

1 ton of ice at -5^{0}C is heated to produce steam at 250^{0}C. The entire process is carried out at 1 atm. Calculate the entropy changes in all possible stages?

5. An ideal SI engines operates between two temperature limits 300K and 1700K. If operates with compression ratio of 6. The ambient air pressure in 1 atm. Assuming C_p and C_v remains constant over its operating temperature range, determine the
a) Pressure and temperature at each point in the cycle.
b) Thermal efficiency of engine
c) MEP, Assume $\gamma = 1.4$

Or

An ideal diesel engine operates within the temperature limits of 1700 K and 300K with a compression ratio of 16. Determine
a) Pressure and temperature at each point in the cycle.
b) Thermal Efficiency of Engine c) MEP
Given C_p = 1.005 KJ/Kg.K
C_v = 0.717 KJ/Kg.K and $\gamma = 1.4$

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