Code No: G2102/R13

M. Tech. I Semester Supplementary Examinations, December-2016

ADVANCED THERMODYNAMICS

(Thermal Engineering)

Time: 3 hours **Max. Marks: 60**

Answer any FIVE Questions
All Questions Carry Equal Marks

1. a Establish the inequality of Clausius.
   b Two kg of air at 500 kPa, 80^0C expands adiabatically in a closed system until its volume is doubled and its temperature becomes equal to that of surroundings which is at 100 kPa, 5^0C. For this process determine i) maximum work, ii) change in availability, iii)irreversibility. For air, take C_V =0.718 kJ/kg K, u=C_V*T where C_V is constant, and pV=mRT where p is pressure in kPa, V is volume in m^3, m is mass in kg, R = 0.287 kJ/kg K, and T is temperature in K.

2. a Derive the first and second Tds equations. From them derive the expression for difference in specific heat capacities.
   b An ideal gas cycle is represented by a rectangle on p-V diagram. If p_1 and p_2 are the lower and higher pressures; and V_1 and V_2 are the smaller and larger volumes respectively, then i) calculate the work done per cycle, ii)indicate which parts of the cycle involve heat flow into the gas,
   iii) show that $\eta = \dfrac{(\gamma - 1)}{\dfrac{(\gamma\, p_2)}{(p_2 - p_1)} + \dfrac{(V_1)}{(V_2 - V_1)}}$ if heat capacities are constant.

3. a Derive the expression for Joule Thomson coefficient of a gas obeying the van der walls equation of state and determine the equation of the inversion curve.
   b What is psychrometry? Discuss about psychrometric process of adiabatic mixing of two streams.

4. a Discuss about chemical potential and phase equilibrium.
   b Explain Heat of reaction and adiabatic flame temperature.

5. a With a neat sketch explain the working of Binary vapour cycle.
   b Explain the working of combined cycle power plant. Write its advantages.

6. a With a neat sketch explain the working of a simple cogeneration plant. Write its advantages and applications.
   b What are Phenomenological laws? Discuss its applicability.

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7. a What is direct energy conversion system? Write its advantages, limitations and applications when compared with conventional energy system.
   b Explain the working of a fuel cell and a photovoltaic cell.

8. a Discuss about generalized compressibility chart.
   b Explain Sensible heating and cooling psychrometric processes.
   c Explain Availability and unavailability.

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