1. (25%)

(a) Sketch a classical vapor-compression-refrigeration cycle.(3%)
(b) Plot the T-s and P-h diagrams , where T is the temperature, s is the entropy, P is the pressure and h is the enthalpy. (4%)
(c) Define the coefficient of performance of this cycle in terms of the enthalpy. (3%)
(d) Sketch a ammonia absorption refrigeration cycle and discuss its advantages compared with the vapor-compression-refrigeration cycle. (15%)

2. (25%)
An ideal gas with constant specific heat expands through an adiabatic turbine. Show that the irreversibility of the process can be expressed in terms of the following:specific heat (C_p), specific heat ratio (k), ambient temperature (T_∞), turbine efficiency (η) and pressure ratio (P_1 / P_2) across the turbine, where P_1 and P_2 are the inlet and outlet pressure, respectively.

3. (25%)

Define and decribe the following

(a) Inversion Line

(b) Fugacity

(c) Reversible useful work

(d) Mean Effective Pressure

(e) Adiabatic Flame Temperature

4. (25%)

The gas which obeys the equation of state

$$Pv = RT$$

Find the following values

(a) $\left(\frac{\partial h}{\partial v}\right)_T$

(b) $\left(\frac{\partial C_P}{\partial P}\right)_T$

(c) $\left(\frac{\partial C_v}{\partial P}\right)_T$

(d) $\left(\frac{\partial C_p}{\partial v}\right)_T$