Code No: 43141/43142 **R07** **Set No - 1**

II B.Tech I Semester Regular Examinations,Nov/Dec 2009
THERMODYNAMICS
Common to Mechanical Engineering, Aeronautical Engineering, Automobile Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Explain a heat engine cycle performed by a steady flow system with line diagram.
   (b) Show by second law that the dissipation of electrical work into internal energy or heat is irreversible. [8+8]

2. (a) Energy is a point function. Explain and prove.
   (b) Prove that heat and work are path functions. [8+8]

3. (a) What are adiabatic and diathermic walls?
   (b) The flow energy of 0.124 m^3/min of a fluid crossing a boundary to a system is 18 KW. Find the pressure at this point. [6+10]

4. A gas refrigerating system using air as a refrigerant is to work between -11^oC and 26^oC using an ideal reversed Brayton cycle of pressure ratio 6 and minimum pressure l atm, and to maintain a load of 11 tonnes. Find
   (a) the COP
   (b) the air flow rate in kg / s
   (c) the volume flow rate entering the compressor in m^3/s and
   (d) the maximum and minimum temperatures of the cycle. [16]

5. For air conditioning a room in winter, atmospheric air at 6 ^oC and relative humidity 22% is first heated in a heating coil. It is then passed through a spray water till the relative humidity becomes 90%. The humidified air is again heated sensibly to the conditioned state in the room at 21.5^oC and 32% relative humidity. If the atmospheric pressure is 1 bar, determine per kg of dry air
   (a) the amount of heat required during the process, and
   (b) the amount of water evaporated in the spray water unit respectively. Compute also the humidifying efficiency of the spray water unit. Plot the process on the psychrometric chart. [16]

6. (a) Explain the significance of Vander walls equation and its limitations
   (b) A tank of volume 1.3 m^3 is filled with argon at 6 bar and 260^oC. If the gas within the tank changes its state isentropically when it flows from the tank until the pressure drops to the atmospheric pressure of 1 bar, determine the mass of the gas that has left the tank during the process. [6+10]

7. A dual combustion cycle operates with a volumetric compression ratio $r_k = 12$, and with a cut-off ratio 1.615. The maximum pressure is given by $P_{max} = 54\ P_1$ where P_1 is the pressure before compression. Assuming indices of compression and expansion of 1.35, show that the m.e.p. of the cycle $P_m = 10\ P_1$ Hence evaluate
   (a) temperatures at cardinal points with $T_1 = 335$ K, and
   (b) cycle efficiency. [16]

8. (a) What is normal boiling point and explain its significance.
   (b) Steam flows in a pipe line at 1.5 Mpa. After expanding to 0.1 Mpa in throttling calorimeter, the temperature is found to be 120^0 C. Find the quality of steam in the pipe line. What is the maximum moisture at 1.5 Mpa that can be determined with this set-up it at least 5^0c of super heat is required after throttling for accurate readings? [6+10]

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