R15/R13

Code No: 123AB/113AB

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year I Semester Examinations, March - 2021
THERMODYNAMICS
(R15 – Common to ME, AE; R13 – Common to ME, AE, MSNT)

Time: 3 hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks
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1.a) What do you mean by thermodynamic equilibrium? How does it differ from thermal equilibrium? Explain.
b) Prove that the work transfer is a path function. [7+8]

2.a) What is meant by a system? Explain the different types of systems with suitable examples.
b) To a closed system, 150 kJ of work is supplied. The initial volume is 0.6 m^3 and pressure of the system changes as p = 8- 4V, where p is in bar and V in m^3. Determine the final volume and pressure of the system and also heat transfer. [7+8]

3) Air flows steadily at the rate of 0.4 kg/s through an air compressor, entering at 6 m/s with a pressure of 1 bar and specific volume of 0.85 m^3/kg , and leaving at 4.5 m/s with a pressure of 6.9 bar and a specific volume of 0.16 m^3/kg. The internal energy of air leaving is 88 kJ/kg greater than that of air entering. Cooling water in a jacket surrounding the cylinder absorbs heat from the air at the rate of 59W. Calculate the power required to drive the compressor and the inlet and outlet cross sectional areas. [15]

4.a) What is the physical significance of the two constants that appear in the Vander Waal's Equation of state? Explain.
b) A reversible adiabatic process begins at P_1= 10 bar, T_1= 300^{0}C and ends with P_2=1 bar. Find the specific volume and the work done per kg of fluid if (i) the fluid is air and (ii) the fluid is steam. [7+8]

5.a) Describe the phase-change process of water using a T-υ diagram.
b) 10 kg of air is heated in a rigid vessel from 20 ^{0}C to 100^{0}C. If the ratio of specific heat is 1.4 estimate the values of C_p and C_v, change in internal energy, and enthalpy. [7+8]

6.a) Explain Daltons law of partial pressures for non reactive mixtures.
b) Air at 20^{0}C, 40% RH is mixed adiabatically with air at 40 ^{0}C, 40% RH in the ratio of 1 kg of former with 2 kg of the latter (on dry basis). Find the final condition of air. [7+8]

7.a) Compare otto, diesel and dual cycles for the same max pressure and temperature.
b) An engine works on a diesel cycle with an inlet pressure and temperature of 1 bar and 17^{0}C. The pressure at the end of the adiabatic compression is 35 bar. The ratio of expansion, i.e. after constant pressure heat addition is 5. Calculate the heat addition, heat rejection and efficiency of the cycle. Assume r = 1.4, C_p=1.005 kJ/kgK C_v=0.717 kJ/kgK. [7+8]

8.a) Explain the working principle of Bell-Coleman cycle used for air refrigeration with p-v and T-s diagrams .

b) Explain the effect of superheat and sub-cooling on the vapour compression refrigeration system. [7+8]

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