PVP 14

Code: ME3T2

II B.Tech - I Semester–Regular/Supplementary Examinations
November 2016

BASIC THERMODYNAMICS
(MECHANICAL ENGINEERING)

Data books are allowed in examination.

Duration: 3 hours Max. Marks: 70

PART – A

Answer ***all*** the questions. All questions carry equal marks

11x 2 = 22 M

1.

a) Determine the pressure at a point in the flow system if the flow energy is 100 kJ and specific volume 2.5 m^3/kg.
b) How the inexact differential is converted into exact differential?
c) Write the Clausius - Clapeyron equation.
d) Determine the exit velocity from a nozzle with the enthalpy drop 500 kJ/kg with an initial velocity 10 m/sec.
e) Determine the final temperature of air at 1 bar and 300 K compresses to final pressure 10 bar adiabatically.
f) Define Carnot's theorem.
g) Mention the value of latent heat of vaporization at critical point of a pure substance.

h) Define Dalton's law of partial pressure in terms of mole fraction.

i) Assuming it an ideal gas, determine the characteristic gas constant of Carbondioxide.

j) Compare thermal efficiency of Otto cycle and Diesel cycle for same maximum pressure and same heat rejection.

k) Name thermodynamic process occurred in Lenoir cycle.

PART – B

Answer any ***THREE*** questions. All questions carry equal marks.

3 x 16 = 48 M

2.

a) Explain thermodynamic equilibrium. 8 M

b) A fluid at a pressure of 3 bar and with specific volume of $0.18 m^3/kg$ is contained in a cylinder behind a piston. The fluid expands reversibly to a pressure of 0.6 bar according to the law $p=k/v^2$, where k is a constant. Calculate the work done by the fluid on the system. 8 M

3.

a) Discuss the first law of thermodynamics applied to a non-flow system undergoing cycle and change of state. 8 M

b) A stream of gases at 7.5 bar, 750 0C and 140 m/sec is passed through a turbine of a jet engine. The steam comes out of the turbine at 2 bar, 550 0C and 280 m/sec. The

process may be assumed adiabatic. The enthalpies at the entry and exit of the turbine are 950 kJ/kg and 650 kJ/kg of gas respectively. Determine the capacity of the turbine if the gas flow is 300 kg/min. 8 M

4.

a) Prove the equivalence of Kelvin Planck and Clausius Statements of second law of thermodynamics. 8 M

b) A closed system contains 2 kg of air and during an adiabatic process, there occurs change in its pressure from 500 kPa to 100 kPa and its temperature from 350 K to 320 K. If volume doubles during the process find the change in available energy. 8 M

5.

a) Draw the phase equilibrium diagram for a pure substance on p-T coordinates. Explain, in brief. 8 M

b) One kg of Carbon dioxide has a volume of 0.003 m^3 and a pressure of 100 atm. Compute the temperature by (i) Perfect gas equation (ii) Vandar wall's equation if constants a and b are 362850 $Nm^4/kg\ mole^2$ and 0.0423 m^3/kg mole respectively. 8 M

6.

a) An air standard Otto cycle has a compression ratio of 7. At the start of the compression, pressure and temperature are 1 bar and 27 ^{0}C. If the maximum temperature of the cycle is 727 ^{0}C, calculate:

i) Heat supplied

ii) Net work
iii)Thermal efficiency. 8 M

b) Derive the expression for thermal efficiency of Ericson cycle on regeneration. 8 M