PVP 14

Code: ME3T2

II B.Tech - I Semester – Regular Examinations – December 2015

BASIC THERMODYNAMICS
(MECHANICAL ENGINEERING)

Duration: 3 hours Max. Marks: 70

PART – A

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

11x 2 = 22 M

1. a) Classify thermodynamic properties
   b) What are the causes of irreversibility?
   c) Define thermodynamic temperature.
   d) What are the limitations of first law of thermodynamics?
   e) State the Carnot's theorem.
   f) Define Availability.
   g) Define Critical point. What are the pressure and temperature at critical point.
   h) Write the Van der waals' equation and state the constants.
   i) Distinguish between Diesel and Atkinson cycle.
   j) Define Compression ratio and Mean effective pressure.
   k) Write Gibbs and Helmholtz functions.

PART – B

Answer any ***THREE*** questions. All questions carry equal marks. 3 x 16 = 48 M

2. a) Classify thermodynamic systems with an examples. 8 M

b) A spherical balloon of 1m diameter contains a gas at 200kPa and 300K. The gas inside the balloon is heated until the pressure reaches 500kPa. During the process of heating, the pressure of gas inside the balloon is proportional to the diameter of the balloon. Make the calculation for the work done by the gas inside the balloon. 8 M

3. a) Show that energy is property of a system. 7 M

b) A nozzle is a device for increasing the velocity of a steadily flowing stream. At the inlet to a certain nozzle, the enthalpy of the fluid passing is 3000 kJ/kg and the velocity is 60 m/s. At the discharge end, the enthalpy is 2762 kJ/kg. The nozzle is horizontal and there is negligible heat loss from it. 9 M

i) Find the velocity at exist of the nozzle.

ii) If the inlet area is 0.1 m^2 and the specific volume at inlet is 0.187m^3/kg, find the mass flow rate.

iii) If the specific volume at the nozzle exit is 0.498m^3/kg, find the exit area of the nozzle.

4. a) Establish the Inequality of Clausius. 8 M

b) A household refrigerator is maintained at a temperature of 2°C. Every time the door is opened, warm material is placed inside, introducing an average of 420 kJ, but making only a small change in the temperature of the refrigerator. The door is opened 20 times a day, and the refrigerator operates at 15% of the ideal COP. The cost of work is Rs. 2.50 per kWh. What is the monthly bill for this refrigerator? The atmosphere is at 30°C. 8 M

5. a) Explain Free expansion and Throttling processes. 6 M

b) A vessel of volume 0.04m^3 contains a mixture of saturated water and saturated steam at a temperature of 250°C. The mass of the liquid present is 9kg. Find pressure, the specific volume, the enthalpy, the entropy and internal energy. 10 M

6. a) Derive air standard efficiency of Brayton cycle with P-V and T-s diagrams. 8 M

b) An engine working on Otto cycle has an air standard cycle efficiency of 56% and rejects 544kJ/kg of air. The pressure and temperature of air at the beginning of compression are 0.1MPa and 60°C respectively. Compute

i) compression ratio of engine

ii) the work done/kg of air

iii) the pressure and temperature at the end of compression
iv) the maximum pressure in the cycle.

8 M