PVP 12

Code: ME3T2, AE3T6

II B.Tech - I Semester – Regular Examinations - December 2014

BASIC THERMODYNAMICS
(Common for ME, AE)

Duration: 3 hours Marks: 5x14=70

Answer any FIVE questions. All questions carry equal marks

1. a) What do you understand by path function and point function? What are exact and inexact differentials? 7 M

   b) To a closed system, 150 kJ of heat is supplied. If the initial volume is 0.6 m^3 and pressure of the system changes as $P = 8 - 4V$, where P is pressure in bar and V is in m^3, determine the final volume and the pressure of the system. 7 M

2. a) Derive the general steady flow energy equation for a flow process and deduce the expression for unit mass flow rate for throttling process. 7 M

   b) A centrifugal pump delivers 2730 kg of water per minute from a initial pressure of 0.784 bar to a final pressure of 2.746 bar. The suction is 2m below the centre of the pump and the delivery is 5m above the centre of the pump. Find the power required to run the pump. 7 M

3. a) An inventor claims that his petrol engine operating between the temperatures 2000°C and 600°C will produce 1 H.P. hr consuming 0.12 kg of petrol of 46,043.8 kJ/kg calorific value. Check the validity of his claim. 7 M

b) 1 kg of air is compressed polytropically from a pressure of 1 bar and temperature of 300K to a pressure of 7 bar and 373K. Determine the irreversibility and reversibility measure assuming a sink temperature of 298K. 7 M

4. a) Draw the phase equilibrium diagram on p-v coordinates for a pure substance which shrinks in volume on melting and then for a substance which expands in volume on melting. Indicate there on the relevant constant property lines. 7 M

b) Steam is heated to raise its temperature to 150°C, evaluate the pressure, increase in enthalpy, increase in internal energy, increase in entropy of steam and heat transfer. Evaluate also the pressure at which steam becomes saturated. 7 M

5. a) Derive an expression for work done during polytropic process for a non flow system and further prove that the heat transfer for the same system. 7 M

b) Air at 15°C and 1 bar is compressed isentropically to 6 bar. Determine the final temperature and work done. If the air is now cooled to 15°C at constant pressure, find the heat exchange and the work done. 7 M

6. a) Why do specific heat of an ideal gas depends only on atomic structure of the gas? And show that for an ideal gas internal energy depends only on its temperature. 7 M

b) 5 grams of water vapor per kg of atmospheric air is removed and temperature of air after removing water vapor becomes 25°C DBT. Calculate the following

i) Relative humidity

ii) Dew point temperature

7 M

7. a) Derive an expression for air standard efficiency of a diesel Cycle. 7 M

b) The compression ratio of an Otto cycle is 8 at the beginning of compression process the pressure is 1 bar and the temperature is 300K. The heat transfer to the air per cycle is 1900 kJ/kg of air. Calculate

i) Pressure and temperature at various salient points

ii) Air standard efficiency.

7 M

8. a) In a Rankine cycle the steam at the inlet to the turbine is saturated at a pressure of 30 bar and exhaust pressure is 0.25 bar. Determine

i) pump work

ii) turbine power

iii) Rankine efficiency

iv) dryness fraction.

Assume flow rate as 10 kg/s. 7 M

b) Explain with relevant sketches working of a simple vapor compression refrigeration system. 7 M