Code No: 113AB

R13

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year I Semester Examinations, March - 2017
THERMODYNAMICS
(Common to ME, AE, AME, MSNT)

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

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit.
Each question carries 10 marks and may have a, b, c as sub questions.

PART- A

(25 Marks)

1.a) What is open system? Give suitable examples. [2]
b) What is path function? Explain. [3]
c) What is PMM of second kind? [2]
d) Write the two statements of second law of thermodynamics. [3]
e) What is dryness fraction? Explain. [2]
f) What do you mean by throttling? Which property remains constant during throttling? [3]
g) Define dry bulb temperature and wet bulb temperature. [2]
h) What is thermodynamic wet bulb temperature? Explain. [3]
i) Draw layout of Bell- Coleman cycle and indicate various components on it. [2]
j) Draw p-v and T-s plots for Atkinson cycle. [3]

PART-B

(50 Marks)

2. Explain the working of constant pressure gas thermometer with the help of a neat sketch. [10]

OR

3.a) Prove that internal energy is a property of the system.
b) Discuss in detail about quasi static process. [5+5]

4.a) Prove the equivalence of Kevin Plank and Clausius statements.
b) Derive Clausius inequality and explain the significance. [5+5]

OR

5.a) What do mean by thermodynamic potentials? Explain.
b) A cyclic heat engine operates between a source temperature of 1000 ^{0}C and a sink temperature of 40^0 C. Find the least rate of heat rejection per kW net output of the engine. [5+5]

6.a) Explain free expansion process.
b) Find internal energy of 1 kg of steam at 20 bar when
i) It is superheated, its temperature being 400 ^{0}C;
ii) it is wet, its dryness being 0.9 [5+5]

OR

7.a) 1 kg of air at a pressure of 8 bar and a temperature of 100 ^{0}C undergoes a reversible polytrophic process following the law $pv^{1.2} = constant$. If the final pressure is 1.8 bar determine:
i) The final specific volume, temperature and increase in entropy;
ii) The work done and heat transfer
Assume R= 0.287 kJ/kg K and γ=1.4.

b) Repeat (a) assuming the process to be irreversible and adiabatic between end states. [5+5]

8.a) Explain the method of evaluation of internal energy of gaseous mixture.

b) A vessel of 0.35 m^3 capacity contains 0.4 kg of carbon monoxide (molecular weight=28) and 1 kg of air at 20 ^{0}C. Calculate:
i) The partial pressure of each constituent
ii) The total pressure in the vessel.
The gravimetric analysis of air may be taken as 23.3% oxygen (molecular weight = 32) and 76.7% nitrogen (molecular weight = 28). [5+5]

OR

9.a) Derive the expression for enthalpy of moist air.

b) 0.004 kg of water vapour per kg of atmospheric air is removed and temperature of air after removing the water vapour becomes 20 ^{0}C. Determine:
i) Relative humidity ii) Dew point temperature.
Assume that condition of atmospheric air is 30 ^{0}C and 55% RH and pressure is 1.0132 bar. [5+5]

10. Explain Diesel cycle with the help of p-v and T-s plots. Derive the expressions for air standard efficiency and mean effective pressure. [10]

OR

11. Explain the working of Bell Coleman cycle and derive the expression for COP. [10]

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