C 15641

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Name...................

Reg. No...................

FOURTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, JUNE 2011

ME 09 406/PTME 09 405—THERMODYNAMICS

(2009 admissions)

Time : Three Hours

Maximum : 70 Marks

Part A

Answer all the questions.
Each question carries 2 marks.

1. State First law of thermodynamics.
2. State Carnot's theorem.
3. State the Avogadro's law and state its significance.
4. Draw the generalized compressibility chart.
5. Define dew point temperature.

$(5 \times 2 = 10 \text{ marks})$

Part B

Answer any four questions.
Each question carries 5 marks.

1. State the Zeroth law of thermodynamics. Explain how it forms the basis for temperature measurement.
2. Explain the significance of entropy.
3. Show how a reversible heat engine operates as a reversible refrigerator.
4. Define Available energy, Availability and Irreversibility.
5. Explain Third law of thermodynamics.
6. Deduce Clapeyron equation.

$(4 \times 5 = 20 \text{ marks})$

Part C

Answer any four questions.
Each question carries 10 marks.

1. A closed system undergoes a thermodynamic cycle consisting of four separate and distinct processes. The heat and work transferred in each process are as tabulated below :

Process	Heat transfer in Q kJ/min.	Work transfer in w kJ/min.
1—2	20,000	0
2—3	– 10,000	30,000
3—4	0	20,000
4—1	15,000	– 25,000

Turn over

Show that the data is consistent with the first law of thermodynamics. Also evaluate the network output in kW and the change in internal energy.

2. The properties of a certain fluid are related as follows $u = 196 + 0.178\ t$ and $pv = 0.287\ (t + 273)$, where u is specific internal energy (kJ/kg.), t is in °C, p is pressure (kN/m.^{2}) and v specific volume. For this fluid find C_v and C_p.

3. Prove that irreversibility is created (entropy generated) whenever heat transfer with finite temperature difference occurs.

4. Define Helmholtz function and Gibbs function and hence deduce the two Maxwell's relations.

5. What is the triple point ? Find the specific volume, enthalpy and internal energy of wet steam at 18 bar dryness fraction 0.9.

6. A mixture of hydrogen and oxygen is in the ratio of 2 to 1 by volume determine the mass of hydrogen required and volume of the container per kg. of oxygen if the temperature and pressure of the mixture are to be 100 kPa and 300 kPa respectively.

7. A moist air has a dry bulb temperature of 300° C. and relative humidity of 60 %. The total pressure is 100 kPa. Determine the partial pressure of the water vapour, humidity ratio and the dew point temperature.

8. Dry bulb and wet bulb temperature of moist air are found to 30° C. and 21°C. respectively. From the psychometric chart obtain :

    (a)   Relative humidity.   (b)   Humidity ratio.

    (c)   Specific enthalpy.   (d)   Dew point temperature.

    (e)   Specific volume of the mixture.

$$(4 \times 10 = 40\text{ marks})$$