Code No: 53017 **R09**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech II Year I Semester Examinations, November - 2015

THERMODYNAMICS

(Common to ME, AE, AME)

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

Answer any five questions

All questions carry equal marks

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1.a) State and explain first law of thermodynamics in different ways.

b) Prove that Internal energy is a property of the system and does not depend on path followed. [6+9]

2.a) Write short notes regarding constant pressure gas thermometer and explain with suitable diagram.

b) In a cyclic process, the heat interactions are -108 kJ, + 44 kJ, 136 kJ and -32kJ. Find the net work done during cyclic process. [6+9]

3.a) What is Clausius Inequality? Explain the Principle of Increase of Entropy for an adiabatic system.

b) 1 kg of steam at 5 bar and 200^{0}C in a closed system is first mixed adiabatically with 1 kg of saturated water at 5 bar. The mixture is then cooled at constant volume by heat loss to atmosphere at 300 K till its final state is 1 bar, 0.55 dry. Calculate the irreversibility and change in entropy. [7+8]

4.a) Explain the real gas behavior using Vander Waal's Equation of State. What are modifications done to Ideal Gas Equation of State?

b) 0.5 kg of Helium and 0.5 kg of Nitrogen are mixed at 20^{0}C and at a total pressure of 100 kPa. Find the
i) The mole fractions of the components
ii) The partial pressures of the constituent gases
iii) Volume of the mixture
iv) The specific heats of the Mixture. [7+8]

5. A perfect gas mixture consists of 2 kg N_2 and 6 kg CO_2 at a pressure 5 bar and temperature of 270^{0}C. Calculate:
a) Mole fraction of each constituent
b) Equivalent molecular weight of the mixture
c) Equivalent gas constant of the mixture
d) Partial pressure and partial volumes
e) Volume and density of the mixture. [15]

6.a) With the help of P-V and T-S diagrams, Derive an expression for thermal efficiency of an dual cycle.

b) In a gas turbine plant with air at the inlet of the compressor is at 0.1 MPa, 30^{0}C. The pressure ratio is 6 and the maximum temperature in the cycle is 900^{0}C. Find the cycle efficiency and net work. If the pressure ratio is increased to 10, for the same maximum temperature, calculate the cycle efficiency and the network. [6+9]

7.a) Derive an expression for COP for an vapour compression refrigeration system.

b) What are the merits and demerits of an air refrigeration system? Explain and also discuss their practical applications. [9+6]

8.a) Draw the schematic diagram of vapour compression system and derive its COP.

b) A Brayton cycle works between the temperature limits of 25^0C and 1250^0C, with a pressure ratio of 6. Then calculate thermal efficiency, work ratio and specific gas constant. [7+8]

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