Code No: 53017

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD B. Tech II Year I Semester Examinations, November - 2015 THERMODYNAMICS

(Common to ME, AE, AME)

Time: 3 hours

100

62-64<u>3</u>

BR

1000

Max. Marks: 75

Answer any five questions All questions carry equal marks

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

12.37

- 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°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 infeversibility 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°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 N₂ and 6 kg CO₂ at a pressure 5 bar and temperature of 270°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.

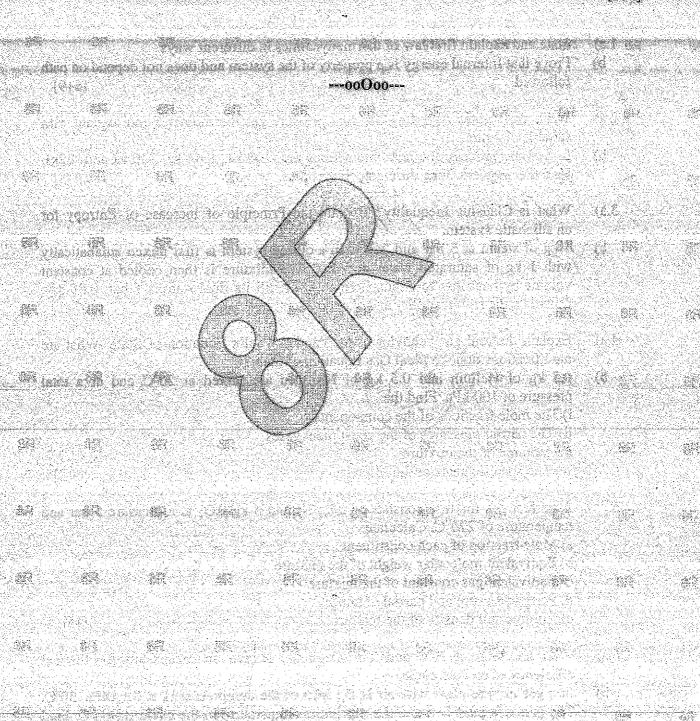
[15]

- 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°C. The pressure ratio is 6 and the maximum temperature in the cycle is 900°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.

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- 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°C and 1250°C, with a pressure ratio of 6. Then calculate thermal efficiency, work ratio and specific gas constant. [7+8]



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