JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD
B.Tech II Year I Semester Examinations, December-2014
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) What are different thermodynamic systems? Give example for each type with justification.

  b) A mass of 1 kg of air contained in a closed vessel at 1 bar, 300 K is stirred with a constant torque of 1 N-m at a speed of 1000 RPM till the volume doubles at constant pressure. The initial and final temperatures were found to be the same. If 10 kJ of heat is absorbed during the experiment, calculate its duration.

2.a) What are the advantages of gases over liquids as a thermometric substances?

  b) During one cycle, the working fluid in an engine engages in two work interactions: 15 kJ to the fluid and 44 kJ from the fluid, and three heat interactions, two of which are 75 kJ of the fluid, and 40 kJ from the fluid. Evaluate the magnitude and direction of the third heat transfer.

3.a) Show the equivalence of Clausius and Kelvin statement of second law.

  b) A heat engine receives heat at the rate of 1500 kJ/min. and gives an output of 8.2 KW. Determine
  i) the thermal efficiency
  ii) the rate of heat rejection.

4.a) Explain T-S diagram for a pure substance.

  b) Find the dryness fraction, specific volume and internal energy of steam at 7 bar and enthalpy 2550 kJ/kg.

5.a) A gaseous mixture consists of 1 kg of oxygen and 2 kg of nitrogen at a pressure of 150 kPa and a temperature of 20^0C. Determine the changes in internal energy, enthalpy and entropy when the mixture is heated to a temperature of 100^0C,
  i) at constant volume and
  ii) at constant pressure.

  b) Relative merits of Ideal gas equation of state and the Vander Waal's equation of state.

6.a) What is the significance of Psychrometric chart? Represent the following processes on Psychrometric chart:
  i) Sensible heating
  ii) Adiabatic dehumidification an
  iii) Latent heat removal.

  b) The moist air enters the heater-humidifier unit at 5^0C, 100kPa, 50% RH. The flow rate of dry air is 0.1 kg/s. Liquid water at 10^0C is sprayed into the mixture at the rate of 0.002 kg/s. The mixture leaves the unit at 30^0C, 10 kPa. Calculate the relative humidity at the outlet and the rate of heat transfer.

7.a) Derive an expression for air standard efficiency of Ericsson cycle.

b) An Ericsson cycle operating with an ideal regenerator works between 1100 K and 288 K. The pressure at the beginning of isothermal compression is 1.013 bar. Determine:
i) The compressor and turbine work per kg of air
ii) The cycle efficiency.

8.a) Describe a simple Vapour Compression cycle giving clearly its flow diagram.

b) State merits and demerits of Vapour Compression system over air refrigeration system.

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