Code No: R21032 **R10** SET - 1

II B. Tech I Semester Supplementary Examinations, Dec - 2015
THERMODYNAMICS
(Com. to ME, AE, AME, MM)

Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions
All Questions carry **Equal** Marks
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1. a) A pump discharges liquid into a drum at the rate of 0.0032 m^3/s. The drum, 1.50 m in diameter and 4.20 m in length, can hold 3000 kg of the liquid. Find the density of the liquid and mass flow rate of liquid handled by the pump?
   b) What is the concept of continuum? How will you define density and pressure using this concept? (10M+5M)

2. a) A mass of 8 kg gas expands within a flexible container so that p-v relationship is of the form $pv^{1.4}$ = const. The initial pressure is 1000 Kpa and the initial volume is 1 m^3. The final pressure is 5 Kpa. If specific internal energy of gas decreases by 40 kJ/kg. Find the heat transfer in magnitude and direction?
   b) Define the specific heats at constant volume and at constant pressure? (10M+5M)

3. a) Define the term 'Irreversible processes' and 'Reversible process'. Give an example of each.
   b) In a Carnot cycle the maximum pressure and temperature are limited to 18 bar and 410^0C. The volume ratio of isentropic compression is 6 and isothermal expansion is 1.5, assume the volume of the air at the beginning of isothermal expansion as 0.18m^3. show the cycle on p-V and T-s diagrams and determine i) the pressure and temperature at main points ii) thermal efficiency of the cycle (10M+5M)

4. Consider a steam power plant operating on the ideal Rankine cycle. Steam enters the turbine at 3 MPa and 623 K and is condensed in the condenser at a pressure of 10 kPa. Determine (i) the thermal efficiency of this power plant, (ii) the thermal efficiency if steam is superheated to 873 K instead of 623 K, and (iii) the thermal efficiency if the boiler pressure is raised to 15 MPa while the turbine inlet temperature is maintained at 873 K. (15M)

5. a) Derive the Clausius Clapeyron equation and Vander Waal's equations.
   b) A tank contains 0.2m^3 of gas mixture composed of 4 kg of Nitrogen, 1 kg of oxygen and 0.5 kg of carbon-dioxide. If the temperature is 20^0C, determine the total pressure, gas constant and molar mass of the mixture. (7M+8M)
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6. a) Draw the psychrometric chart and show any two psychometric processes on it.
   b) A sample of moist air at 1 atm and 25^0C has a moisture content of 0.01% by volume. Determine the humidity ratio, the partial pressure of water vapor, the degree of saturation, the relative humidity and the dew point temperature. (7M+8M)

7. In air standard diesel cycle, the compression ratio is 15.Compression ratio begins at 0.1 Mpa, 40^oC.The heat added is 1.675MJ/kg. Find:
   i) The maximum temperature of the cycle,
   ii) The work done per kg of air,
   iii) The cycle efficiency,
   iv) The temperature at the end of the isentropic expansion,
   v) The cut-off ratio,
   vi) The maximum pressure of the cycle, and
   vii) The m.e.p. of the cycle. (15M)

8. An R-12 plant is to cool milk from 30^0C to 1^0C involving a refrigeration capacity of 10 tone. Cooling water for the condenser is available at 25^0C and 5^0C rise in its temperature is allowable. Determine the suitable condensing and evaporating temperatures, providing a minimum of 5^0C differential, and calculate the theoretical power required in kW and the cooling water requirement in kg/s. Also, find the percentage of flash gas at the end of the throttling. Assume a 2^0C sub cooling in the liquid refrigerant leaving the condenser. (15M)