Code No: RT21033 **R13** SET - 1

**II B. Tech I Semester Supplementary Examinations, October/November - 2019**
**THERMODYNAMICS**
(Com. to ME, AE, AME)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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## PART –A

1. a) What is quasi static process? Explain. (3M)
   b) Explain the significance of Vander wall`s equation and its limitations. (4M)
   c) What is meant by PMM2 and why it is not possible? (3M)
   d) Why do the isotherms on Mollier diagram become horizontal in the superheated region at low pressures? (4M)
   e) Why is there no temperature change when an ideal gas is throttled? (4M)
   f) Why is Carnot cycle not practicable for a steam power plant? (4M)

## PART -B

2. a) State Zeroth law of thermodynamics and its significance. (6M)
   b) A cylinder contains 1kg of a certain fluid at an initial pressure of 20 bar. The fluid is allowed to expand reversibly behind a piston according to a law $PV^2$=constant until the volume is doubled. The fluid is then cooled reversibly at constant pressure until the piston regains its original position; heat is then supplied reversibly with the piston firmly locked in position until the pressure rises to the original value of 20 bars. Calculate the net work done by the fluid, for an initial volume of 0.05 $m^3$. (10M)

3. a) One kg of $CO_2$ has a volume of 0.003 $m^3$ and a pressure of 100 atm. Compute the temperature by i) perfect gas equation ii) Vander walls equation. (8M)
   b) What will be the velocity of a fluid leaving the nozzle, if the velocity of approach is very small? (8M)

4. a) Define entropy and show that it is a property of the system. (6M)
   b) Each of three identical bodies satisfies the equation U=CT, where C is the heat capacity of each of the bodies. Their initial temperatures are 200K, 250K and 540K. If C=8.4 kJ/K, determine the maximum amount of work that can be extracted in a process in which these bodies are brought to a final common temperature. (10M)
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5. a) Explain the principle of operation of a separating and throttling calorimeter. (6M)

   b) One kg of steam at 20 bar exists in the following conditions (i) 0.9 dry (ii) dry and saturated (iii) at a temperature of $250^0$C find its enthalpy, specific volume, density, internal energy and entropy in each case. Assume $C_P$ for superheated steam 2.01 kJ/kg K. (10M)

6. a) What is a polytropic process? What are the relations among $p, v$ *and* $T$ of an ideal gas in a polytropic process? (6M)

   b) A room of dimensions 5m x 3m x 3m contains an air water vapour mixture at 1 bar, $30^0$C and 70% relative humidity. Calculate (i) mass of air (ii) mass of water vapour (iii) degree of saturation. The universal gas constant is 8.3143 kJ/kg–mol-K and molecular mass of air and water vapour is 29 and 18 respectively. (10M)

7. a) Explain the working of otto cycle and derive the expression for thermal efficiency. (6M)

   b) An engine operating on the air standard Otto cycle. The conditions at the start of the compression are $27^0$C and 100 kPa. The heat added is 1840 kJ/kg. The compression ratio is 8. Determine the temperature and pressure at each point in the cycle, the thermal efficiency and the mean effective pressure. (10M)