H.T NO.										

MLR15

Code No: A10310

MLR INSTITUTE OF TECHNOLOGY

(An Autonomous Institution)
II B.Tech I Sem Examinations- December-2016

THERMODYNAMICS
(MECH and AERO)

Time: 3 hours Max.Marks :75

Note: 1. This question paper contains two parts A and B.
2. Part A is compulsory which carries 25 marks. Answer all Questions in part A.
3. Part B consists of 5 units. Answer any one full question from each unit. Each question carries 10 Marks and may have a,b,c as sub questions.

PART-A

1. a) Define an open system Give an example. Define an isolated system [2M]
   b) Name two alternative methods by which the efficiency of a Carnot cycle can be increased [2M]
   c) Define latent Heat of vaporization [2M]
   d) State Avogadro's law. [2M]
   e) What is a thermodynamic cycle? [2M]

2. a) What is the difference between the classical and the statistical approaches to Thermodynamics? [3M]
   b) What is the relationship between COP of the heat pump and refrigerator? [3M]
   c) Explain the terms: super heat enthalpy, Degree of Super heat and Degree of sub cooling. [3M]
   d) If atmospheric air (at 101325 Pa) contains 21% oxygen and 79% nitrogen (vol %), what is the partial pressure of oxygen. [3M]
   e) Draw P-V and T-S diagram of Otto cycle and explain different processes in the cycle. [3M]

PART-B

3. a) A gas of mass 1.5 kg undergoes a quasi-static expansion which follows a relationship $p = a + bV$, where a and b are constants. The initial and final pressures are 1000 kPa and 200 kPa respectively and the corresponding volumes are 0.20 m^3 and 1.20 m^3. The specific internal energy of the gas is given by the relation

$$u = 1.5\ pv - 85\ kJ/kg$$

Where p is the kPa and v is in m^3/kg. Calculate the net heat transfer and the maximum internal energy of the gas attained during expansion. [10M]

OR

4. State and explain the first law of thermodynamics for a closed system undergoing a cycle. What is PMM1? [10M]

5. (a) State and prove Carnot's theorem [4M]
(b) A heat engine is used to drive a heat pump. The heat transfers from the heat engine and from the heat pump are used to heat the water circulating through the radiators of a building. The efficiency of the heat engine is 27% and the COP of the heat pump is 4. Evaluate the ratio of the heat transfer to the circulating water to the heat transfer to the heat engine. [6M]

OR

6. (a) Establish the equivalence of Kelvin – Plank and Clausius statements of second law of thermodynamics. [4M]
(b) A heat engine is used to drive a heat pump. The heat transfer from the heat engine and the heat pump are used to heat the water circulating through radiator of a building. If the COP of the heat pump is 4 and the efficiency of the heat engine is 0.3, how much heat is transferred to the radiator water for every kJ heat transferred to the heat engine? [6M]

7. a) Draw and explain phase equilibrium diagram for a pure substance on P-T coordinate. Also indicate different regions on the diagram. [5M]
b) Write down the Vander Waal's equation of state for real gases and how is it obtained from ideal gas equation by incorporating real gas corrections? [5M]

OR

8. In a steam power plant the condition of steam at inlet to the steam turbine is 20 bar and 300^0C and the condenser pressure is 0.1 bar. Two feed water heaters operates at optimum temperatures. Determine: (i) the quality of the steam at the turbine exhaust, (ii) network per kg of steam, and (iii) cycle efficiency. Neglect pump work. [10M]

9. An engine working on the otto cycle is supplied with air at 0.1 Mpa, 35^0C. The compression ratio is 8, heat supplied is 2100 KJ/Kg. Calculate the maximum pressure and temperature of the cycle, the cycle efficiency and the mean effective pressure. For C_p of air =1.005 KJ/Kg K, C_v = 0.718 KJ/Kg K, R= 0.287 KJ/Kg K. [10M]

OR

10. Derive an expression for the thermal efficiency of diesel cycle and draw P-V and T-S diagrams. [10M]

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