

Duration: 3hrs

[Max Marks:80]

- N.B. : (1) Question No 1 is Compulsory.  
 (2) Attempt any three questions out of the remaining five.  
 (3) All questions carry equal marks.  
 (4) Assume suitable data, if required and state it clearly.  
 (5) Use of steam table and Mollier Diagram is permitted.

- 1 Attempt any Five [20]
- State Zeroth law of Thermodynamics and its significance.
  - A gas undergoes a reversible non- flow process according to the relation  $p = (-3V + 15)$ . Where V is the Volume in  $m^3$  and p is the pressure in the bar. Determine the work done when the volume changes from 3 to 6  $m^3$ .
  - What is meant by thermodynamic property? Define Extensive and Intensive properties with examples.
  - Define Joule Thomson coefficient and state its significance.
  - Draw P-V & T-S diagram for Stirling cycle and Ericsson cycle.
  - Explain the effect of varying back pressure on nozzle performance.
- 2 a) Define perpetual motion Machine second kind. Write two major statements of second law of thermodynamics and explain how the concept of thermal efficiency and coefficient of performance are generated by this law. [10]
- b) 1kg of air at 1 bar and 300K is compressed adiabatically till its pressure becomes 5 times the original pressure. Subsequently it is expanded at constant pressure and finally cooled at constant volume to return to its original state. Calculate the heat and work interactions and change in internal energy for each process and for cycle.  $C_p = 1.005 \text{ KJ/kg K}$ ,  $C_v = 0.718 \text{ KJ/kg K}$  [10]
- 3 a) A refrigerator operates on a reversed Carnot cycle whose coefficient of performance is 5. The evaporator is maintained at a temperature of  $-6^\circ\text{C}$  and the power required to run the refrigerator is 3.5 kw. Determining the refrigerating effect and the condenser temperature of the refrigerator. [06]
- b) Write the Maxwell equation and Clapeyron Equation. [04]
- c) Define the terms Available energy, Un-available energy, useful work, irreversibility and Dead state. [10]
- 4 a) Explain various components of a simple steam power plant with sketch. [06]
- b) Define a) wet steam b) Superheated steam c) Dryness fraction d) Saturation temperature. [04]
- c) Write a short note on the Rankine cycle. [10]
- 5 a) What is cut off ratio? What are assumptions of air standard cycle? Derive an expression for the air standard efficiency of Otto cycle. [10]

- b) What is Difference between Otto Cycle and Diesel Cycle. [10]  
For same compression ratio compare Otto, Diesel cycle with the help of P-V and T-S Diagram.
- 6 a) Explain with sketch one dimensional Isentropic flow through ducts of varying cross-sectional area and list its applications. [10]
- b) How the Enthalpy, Specific Volume and Specific Entropy can be calculated for the wet steam with the help of Steam Table. [10]

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