B.Tech. / B.E. Mechanical Engineering (Model Curriculum) Semester-III

ME201 / PCC-ME201 - Thermodynamics

P. Pages : 2 **GUG/W/23/14058**

Time : Three Hours * 7 6 4 5 * Max. Marks : 80

Notes :
1. All questions carry equal marks.
2. Due credit will be given to neatness and adequate dimensions.
3. Assume suitable data wherever necessary.
4. Diagrams and Chemical equation should be given wherever necessary.
5. Illustrate your answers wherever necessary with the help of neat sketches.
6. Use of slide rule, Logarithmic tables, Steam tables, Mollier's chart, Drawing instruments, Thermodynamic tables for moist air, Psychrometric charts and Refrigeration charts is permitted.
7. Attempt Qu.1 or Qu.2, Qu.3 or Qu.4, Qu.5 or Qu.6, Qu.7 or Qu.8, Qu.9 or Qu.10.

1. a) What do you mean by microscopic and macroscopic approach of studying thermodynamics? Explain difference between them. **8**

b) What do you mean by thermodynamic work? Discuss displacement work. **8**

OR

2. a) In a piston cylinder arrangement the pressure is inversely proportional to the square of the volume. The initial pressure is 10 bar in the cylinder and the initial volume is 0.1 m^3. The volume is now changed so that the final pressure is 2 bar. Find the work done in Kilojoule. **8**

b) Write short notes on. **8**

i) Avogadro’s Hypothesis.

ii) Universal Gas constant.

3. a) Prove that energy is property of system. **8**

b) Explain first law of thermodynamics as discussed in Joule’s experiment. **8**

OR

4. a) A closed system undergoes a reversible process at constant pressure process of 3.5 bar and its volume changes from 0.15m3 to 0.06m3.25 kJ of heat is rejected by the system during the process. Determine the change in internal energy of system. **8**

b) What do you mean by perpetual motion machine of the first kind? Explain in detail with example. **8**

5. a) Derive steady flow energy equation for a steady flow device. **8**

b) Apply steady flow energy equation to. **8**

i) Nozzle ii) Compressor.

OR

6. a) At the inlet to a convergent-divergent nozzle the enthalpy of the fluid passing is 3000kJ/kg and the velocity is 60 m/s. At the discharge end the enthalpy is 2757 kJ/kg. The nozzle is horizontal and heat loss during flow is negligible. Find **8**

i) Velocity of fluid at exit of nozzle.

ii) If the inlet area is 0.1 m^2 and specific volume at inlet is 0.187 m^3/kg, find the mass flow rate of fluid and

iii) If the specific volume at outlet is 0.498 m^3/kg, find the area at exit of nozzle.

b) What do you mean by flow work? How it can be calculated? **8**

7. a) What are limitations of first law of thermodynamics? How second law of thermodynamics complement it? **8**

b) Write short notes on. **8**

i) Heat engine b) Refrigerator.

OR

8. a) A heat engine operates on a Carnot cycle between source and sink temperatures of 337ºC and 57ºC respectively. If the heat engine receives 400 kJ of heat flow from source, find the efficiency, net work done and heat rejected to sink. **8**

b) Write short notes on. **8**

i) Statements of second law of thermodynamics.

ii) Carnot cycle.

9. a) Describe Mollier Chart in detail. How it can be used to obtain properties of steam. **8**

b) How dryness fraction can be measured with separating calorimeter? **8**

OR

10. a) Describe critical point and triple point of water with T-s diagram. **8**

b) With suitable expressions and diagram, discuss enthalpy changes during formation of steam. **8**

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