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

PCC-ME201 - Thermodynamics

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

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Time : Three Hours Max. Marks : 80

Notes :
1. Solve Q. 1 or Q. 2, Q. 3 or Q. 4, Q. 5 or Q. 6, Q. 7 or Q. 8, Q. 9 or Q. 10.
2. All questions carry equal marks.
3. Due credit will be given to neatness and adequate dimensions.
4. Assume suitable data wherever necessary.
5. Diagrams and Chemical equation should be given wherever necessary.
6. Illustrate your answers wherever necessary with the help of neat sketches.
7. 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.
8. Discuss the reaction, mechanism wherever necessary.

1. a) Write short notes on: **8**
i) Process and cycle
ii) Thermodynamic equilibrium.

b) What is system? Explain different types of systems? **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 $0.1m^3$. The volume is changed so that the final pressure is 2 bar. Find the work done in kJ. **8**

b) Derive the expression for displacement work in polytropic process. **8**

3. a) Explain first law of thermodynamics as applied to a closed system undergoing a change of state. **8**

b) Explain heat transfer in **8**
i) Isobaric process
ii) Isothermal process in detail.

OR

4. a) The energy in Joule of closed system can be expressed as $E = 100 + 50T + 0.04T^2$. The heat in Joule absorbed is given by Q = 5000 + 20T. The temperature in these relations is in Kelvin. Calculate the work done during the process, when the temperature rises from 500 K TO 1000K. **8**

b) Explain first law of thermodynamics for a cyclic process with reference to Joules experiment. **8**

5. a) Write short notes on **8**
i) Control volume
ii) Energy conservation principle

b) Apply steady flow energy equation to **8**
i) Nozzle
ii) Compressor

OR

6. a) A fluid flows through the system with 5 kg/s. The enthalpy, velocity and height of the system are 4000 kJ/kg, 50 m/s and 40m respectively. At the exit these quantities are 4100kJ/kg, 20 m/s and zero metres. The heat transferred to the system 200 kJ/s. Determine the power capacity of the system. **8**

b) What are steady flow process conditions? Explain total energy of closed and open system. **8**

7. a) What do you mean by refrigerator? Explain in detail. **8**

b) Explain Clausius inequality in detail. **8**

OR

8. a) Explain working of Carnot engine in detail. Derive the expression for thermal efficiency of Carnot Engine. **8**

b) A cyclic heat engine operates between a source temperature of 800ºC and sink temperature of 30ºC. What is the least rate of heat rejection per KW net output of the engine. **8**

9. a) Draw schematic of Temperature entropy plot for water? Explain it. **8**

b) How dryness fraction of steam can be measured with separating calorimeter? Elaborate with neat sketch. **8**

OR

10. a) Find the internal energy of 1 kg of steam at a pressure of 10 bar, when the condition of steam is i) wet with a dryness fraction of 0.85 ii) Dry and saturated iii) superheated the degree of superheat being 50ºC. The specific heat of superheated steam at constant pressure is 2.01 kJ/KG. K. **8**

b) Write short notes on **8**
i) Triple point of water
ii) Mollier chart.

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