

Code : 102214
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2012 (A)

THERMODYNAMICS—I

Time : 3 hours

Full Marks : 70

Instructions :

- (i) All questions carry equal marks.
- (ii) There are **TEN** questions in this paper.
- (iii) Attempt any **FIVE** questions.
- (iv) Use of charts and tables is allowed.

1. Explain in detail with suitable changes the use of solar energy as the source of energy used for different applications like solar refrigerator and thermal power plant.

2. Differentiate between the following :

- (a) Open, Closed and Isolated systems
- (b) Heat, Work and Internal energies
- (c) Reversible and Irreversible processes
- (d) Quasi and Non-quasi static processes

3. State the first law of thermodynamics and explain the use of this law for flow, non-flow and cyclic processes.

4. 5 kg of a gas initially at 100 kPa and 300 K is compressed adiabatically till the volume is reduced to its half volume. Find the following :

- (a) Final temperature and volume
- (b) Work transfer, heat transfer and change in internal energy

Take $C_p = 1.003 \text{ kJ/kg-K}$ and $\gamma = 1.4$ for the gas.

5. 5 kg of water at 30 °C is heated till the temperature is attained 400 °C. Find the heat required, change in internal energy, change in entropy and work transfer. Show the process on $P-V$ and $T-S$ diagrams.

6. State both laws of thermodynamics and prove that they are equivalent.

7. Find the expression of Otto cycle in terms of temperature ratio. If the initial condition of air is 100 kPa and 300 K, and the maximum temperature is 600 K, find the compression ratio and efficiency of the cycle.

8. Define DBT, DPT, WBT, relative humidity, specific humidity and enthalpy of moist air. Find the relations between properties of the moist air.

9. A steam power plant works on Rankine cycle in which condenser temperature is 30°C and boiler pressure is 1 MPa. Find the efficiency of the cycle if the cycle is simple saturation cycle. If the condenser temperature is decreased by 5°C and boiler pressure is increased by 100 kPa, how will the result be changed?
10. Write notes on the following :
- (a) Corollaries of second law of thermodynamics
 - (b) P - V - T surface of steam
