

Roll No.

Total Pages : 2

BT-3/D-12

8322

THERMODYNAMICS

Paper-ME-201E

Time Allowed : 3 Hours]

[Maximum Marks : 100

Note : Attempt five questions in all, selecting at least one question from each Unit. Use of steam table is allowed.

UNIT-I

- 1. (a) What is thermodynamic definition of Heat and Work? With an example explain, how we differentiate between the two. 10
- (b) A mass of gas is compressed in a quasi-static process from 80 KPa, 0.2 m³ to 0.4 MPa, 0.02 m³. Assuming that pressure and volume are related by $pv^n = \text{constant}$, find the work done by the gas system. 10
- 2. In a steady flow apparatus, 135KJ of work is done by each kg of fluid. The specific volume of the fluid, pressure and velocity at the inlet are 0.37 m³/kg, 600 KPa and 16 m/s. The inlet is 32 m above the floor, and discharge pipe is at the floor. Discharge conditions are 0.62 m³/kg, 100 KPa, and 270 m/s. The total heat loss between the inlet and discharge is 9 KJ/Kg of fluid. In flowing through this apparatus does the specific internal energy increase or decrease and by how much? 20

UNIT-II

- 3. A heat engine is used to drive a heat pump. The heat transfer from the heat engine and from the heat pump is used to heat the water circulating through the radiators of a building. The

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efficiency of the heat engine is 27% and COP of Pump is 4. Evaluate the ratio of the heat flowing through the circulating water to the heat being transferred to the heat engine. 20

- 4. (a) What is a Heat Pump ? How does it differ from a Refrigerator ? 5
- (b) Write Kelvin-Planck statement of the second law of Thermodynamics and prove its equivalence with Clausius statement. 15

UNIT-III

- 5. A system has heat capacity at constant volume $C_v = AT^2$, where $A = .042 \text{ J/K}^2$. The system is originally at 200 K and a thermal reservoir at 100K is available. What is the maximum amount of work that can be recovered as the system is cooled down to the temperature of the reservoir ? 20
- 6. What is Clausius inequality ? Derive the mathematical expression for it and hence introduce the term irreversibility. 20

UNIT-IV

- 7. What is use of Thermodynamic relations ? Derive Maxwell's Thermodynamic relation and hence establish any one Tds relation 3,10,7
- 8. (a) How do we calculate dryness fraction of steam by using 'separating and throttling calorimeter' ? 5
- (b) A Carnot cycle works on steam between the pressure limits of 7 MPa and 7 KPa. Determine (i) Thermal efficiency of the cycle, (ii) Work done during expansion and (iii) Compression processes. 15

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