

2122
B.E. (Mechanical Engineering)
Third Semester
MEC-301: Thermodynamics

Time allowed: 3 Hours

Max. Marks: 50

NOTE: Attempt five questions in all, including Question No. 1 which is compulsory and selecting two questions from each Unit.

x-x-x

1. a Name the different irreversible non-flow processes
- b State and explain zeroth law of thermodynamics
- c What are the limitations of First Law of Thermodynamics?
- d Define steady flow process.
- e What is perpetual motion machine of second kind?
- f Distinguish between saturated liquid and saturated vapors.
- g What do you understand by triple point?
- h Draw the Rankine cycle on T-s diagram using dry saturated steam.
- i What is the difference between working substance and pure substance?
- j What is flow energy? Do fluids at rest possess any flow energy?

(10x1)

UNIT - I

2. a Determine the power required to accelerate a 900-kg car from rest to a velocity of 80 km/h in 20 s on a level road. 3
- b What forms of energy can cross the boundaries of a closed system. Explain. 4
- c Define and explain pump and turbine efficiencies 3
3. a Write a note on Mollier chart. 5
- b A vessel of 0.3 m³ capacity contains 1.5 kg mixture of water and steam in equilibrium at a pressure of 5 bar. Calculate: (a) the volume and mass of liquid; and (b) the volume and mass of vapour. 5
4. a A rigid container equipped with a stirring device contains 2.5 kg of motor oil. Determine the rate of specific energy increase when heat is transferred to the oil at a rate of 1 W, and 1.5 W of power is applied to the stirring device. 5
- b What is the significance of specific heat at constant pressure and specific heat at constant volume in energy analysis of closed system? 5

UNIT - II

5. a The electric heating systems used in many houses consist of a simple duct with resistance heaters. Air is heated as it flows over resistance wires. Consider a 15-kW electric heating system. Air enters the heating section at 100 kPa and 17°C with a volume flow rate of 150 m³/min. If heat is lost from the air in the duct to the surroundings at a rate of 200 W, determine the exit temperature of air. 4
- b Start from basic, obtain the expression for the energy equation of a steady flow open system applicable to turbine. 6

(2)

- 6 a What is a Carnot cycle? Represent it on p-v and T-s diagrams and derive an expression for the efficiency of a Carnot cycle. 5
- b A refrigerating machine works on a reversed Carnot cycle. It consumes 6 KW and the refrigerating effect is 1000 kJ/min. The sink temperature is -40°C . Determine: 5
1. Source temperature; and 2. C.O.P. of the refrigerating machine.
- 7 a Steam expands to 0.34 bar in a Rankine cycle from 50 bar and 400°C .. For a mass flow rate of 150 kg /s of steam, determine (a) the power developed; (b) the thermal efficiency; and (c) specific steam consumption. 7
3
- b Draw Schematic steam power plant and T-s diagram with one open feed water heater.

x-x-x