PARUL UNIVERSITY
FACULTY OF ENGINEERING & TECHNOLOGY
B.Tech. Winter 2022 - 23 Examination

Semester: 3   Date: 08/10/2022
Subject Code: 203113201   Time: 02:00 pm to 04:30 pm
Subject Name: Engineering Thermodynamics   Total Marks: 60

Instructions:
1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

Q.1 Objective Type Questions (All are compulsory) (Each of one mark)   **(15)**
1. State: zeroth law of thermodynamics.
2. In an irreversible process, there is a
   (a) loss of heat
   (b) no loss of heat
   (c) gain of heat
   (d) No gain of heat.
3. Dryness fraction of steam is defined as ratio of _____.
4. What is a pure substance?
5. The unit of energy in SI units is
   (a) Joule (J)
   (b) Joule metre (Jm)
   (c) Watt (W)
   (d) Joule/metre (J/m).
6. A control volume refers to
   (a) a fixed region in space
   (b) a specified mass
   (c) an isolated system
   (d) a reversible process only
   (e) a closed system.
7. Define 'Available energy'
8. Second law of thermodynamics defines entropy. TRUE or FALSE
9. Gibb's function is expressed as _____.
10. In an extensive property of a thermodynamic system
   (a) extensive heat is transferred
   (b) extensive work is done
   (c) extensive energy is utilized
   (d) all of the above
11. Write 3 intensive property names.
12. In a Carnot engine, when the working substance gives heat to the sink, the temperature of the sink increases. TRUE or FALSE
13. Choose the correct answer:
   (a) Critical point involves equilibrium of solid and vapour phases
    (b) Critical point involves equilibrium of solid and liquid phases
   (c) Critical point involves equilibrium of solid, liquid and vapour phases
   (d) Triple point involves equilibrium of solid, liquid and vapour phases.
14. Write the general equation for superheated steam _____.
15. Write Kelvin-Planck statement for Second law of thermodynamics:

Q.2 Answer the following questions. (Attempt any three)   **(15)**
A) Explain: Thermodynamic systems with diagram.
B) A gas contained in a cylinder is compressed, the work required for compression being 6000 kJ. During the process, heat interaction of 3000 kJ causes surroundings to be heated. Find out the changes in internal energy of the gas?
C) Write difference between microscopic and macroscopic concept.
D) A steam turbine receives steam steadily at 10 bar with a enthalpy of 3500 kJ/kg and discharges at 1 bar with an enthalpy of 2800 kJ/kg. The work output is 270 kJ/kg. The changes in kinetic and potential energies are negligible. Find the heat transfer from the turbine casing to the surrounding.

Q.3 A) Prove: "Energy is a point function of the thermodynamic system." **(07)**

A) Explain 1st law of thermodynamics with the help of Joule's experiment. **(08)**

OR

B) Explain the inequality of Clausius for Entropy, **(08)**

Q.4 A) A system receives 50 kJ of heat while expanding with volume change of 0.14 m3 against an atmosphere of 1.2 × 105 N/m2. A mass of 90 kg in the surroundings is also lifted through a distance of 5.5 metres. **(07)**

(i) Find the change in energy of the system.

(ii) The system is returned to its initial volume by an adiabatic process which requires 110 kJ of work. Find the change in energy of the system.

(iii) For the combined processes of (i) and (ii) determine the change in energy of the system.

OR

A) Discuss: Thermodynamic Equilibrium. **(07)**

B) Enlist Ideal Gas laws. Explain any two in details. **(08)**