Register No.: ..... Name: .....

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FOURTH SEMESTER B.TECH DEGREE EXAMINATION (R,S), MAY 2024
MECHANICAL ENGINEERING
(2020 SCHEME)

Course Code : 20MET202

Course Name: Engineering Thermodynamics

Max. Marks : 100 **Duration: 3 Hours**

Use of Steam Tables and Thermodynamic Charts may be permitted

PART A

(Answer all questions. Each question carries 3 marks)

1. Differentiate between control volume approach and system approach.
2. Why thermodynamic properties are considered to be point functions ?
3. Explain about free expansion work.
4. List the limitations of first law of thermodynamics.
5. Write a short note on Absolute thermodynamic temperature scale.
6. Define the term “Exergy”
7. What are reduced properties?
8. Write Van der Waals equation of state.
9. Explain about Gibbs Free energy.
10. Define the terms Mole fraction and Mass fraction.

PART B

(Answer one full question from each module, each question carries 14 marks)

MODULE I

11. a) Explain how Microscopic approach is different from Macroscopic approach in thermodynamics. (4)
    b) With neat sketches explain about the following thermometers. (10)
    (i) Electrical resistance thermometer (ii) Thermocouple

OR

12. a) What is a Thermometric property? Identify the thermometric property of a Mercury thermometer. (8)
    b) Explain the Quasi-static process with neat diagrams. (6)

MODULE II

13. a) Prove that energy is a property of a system. (6)
    b) With neat sketches explain Joule’s experiment. (8)

OR

14. a) List the applications of Steady Flow Energy Equation. (4)

b) In a steady flow apparatus, 120kJ of work is done by each kg of fluid. The specific volume of the fluid, pressure, and velocity at the inlet are 0.37m^3/kg, 600kpa, 16 m/s. The inlet is 32 m above the floor, and the discharge pipe is at floor level. The discharge conditions are 0.62m^3 /kg,100kPa, and 270m/s. The total heat loss between inlet and discharge 9 kJ/kg of fluid. In flowing through this apparatus, does the specific internal energy increase or decrease, and by how much? (10)

MODULE III

15. a) State and prove Carnot's theorem and its corollaries. (10)

b) Explain why PMM2 is not possible. (4)

OR

16. a) Prove the equivalence of the two statements of second law of thermodynamics. (10)

b) State the Third law of thermodynamics. (4)

MODULE IV

17. a) Derive Ideal gas equation of state and explain how it differs from Vander Waal's equation of state? (8)

b) Draw the phase diagram for a pure substance on h-s plot with relevant constant property line. (6)

OR

18. a) Derive law of corresponding state. What is compressibility factor? (10)

b) Differentiate between universal gas constant and characteristic gas constant. (4)

MODULE V

19. a) Write down the first and second TdS equations, and derive the expression for the difference in heat capacities Cp and Cv. (10)

b) Differentiate between Gravimetric and Volumetric analysis. (4)

OR

20. a) Derive Maxwell's relations from relevant equations of the form dz=Mdx+Ndy and derive Clausius Clapeyron equation from Maxwell's relations. (10)

b) State and explain Amagat's law of partial volume of gas mixture. (4)

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