

Code No: 183CG

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**B. Tech II Year I Semester Examinations, February - 2024****THERMODYNAMICS
(Mechanical Engineering)****Time: 3 Hours****Max. Marks: 60****Note:** This question paper contains two parts A and B.i) **Part- A** for 10 marks, ii) **Part - B** for 50 marks.

- Part-A is a compulsory question which consists of ten sub-questions from all units carrying equal marks.
- Part-B consists of **ten questions** (numbered from 2 to 11) **carrying 10 marks each**. From each unit, there are two questions and the student should answer one of them. Hence, the student should answer five questions from Part-B.

PART- A**(10 Marks)**

- 1.a) Define a quasi-static process. [1]
- b) Differentiate between path and point function. [1]
- c) What is PMM I in thermodynamics? [1]
- d) Define Gibbs and Helmholtz function. [1]
- e) Define dryness fraction in the context of thermodynamics. [1]
- f) What is the Clausius-Clapeyron Equation used for? [1]
- g) What is the significance of the Vander Waals Equation of State? [1]
- h) What are deviations from the perfect gas model? [1]
- i) Name two types of refrigeration cycles. [1]
- j) What is the Brayton cycle commonly used for? [1]

PART - B**(50 Marks)**

2. Elaborate on the concepts of displacement work and other forms of work in thermodynamics. Provide examples to illustrate. [10]

OR

- 3.a) Discuss the types of systems in thermodynamics. Provide real-world examples for each type.
 - b) Define thermodynamic state and property. How are they related in the context of a system? [5+5]
- 4.a) A blower handles 1 kg/s of air at 20°C and consumes a power of 15 kW. The inlet and outlet velocities of air are 100 m/s and 150 m/s respectively. Find the exit air temperature, assuming adiabatic conditions. Take c_p of air is 1.005 kJ/kg-K.
 - b) Derive a steady state energy equation for an open system. [5+5]

OR

- 5.a) In a cyclic process, heat transfers are + 14.7 kJ, - 25.2 kJ, - 3.56 kJ and + 31.5 kJ. What is the net-work for this cyclic process?
- b) Discuss entropy, the principle of entropy increase. [5+5]
6. Describe P-v, T-S and h-s phase diagrams, and explain how they aid in the analysis of thermodynamic processes. Provide examples. [10]

OR

7. A rigid vessel of volume 0.86 m^3 contains 1 kg of steam at a pressure of 2 bar. Evaluate the specific volume, temperature, dryness fraction, internal energy, enthalpy, and entropy of steam. [10]
8. An ideal gas of molecular weight 30 and $\gamma = 1.3$ occupies a volume of 1.5 m^3 at 100 kPa and 77°C . The gas is compressed according to the law $1.25 pv = \text{constant}$ to a pressure of 3 MPa. Calculate the volume and temperature at the end of compression and heating, work done, heat transferred, and the total change of entropy. [10]

OR

- 9.a) Find the molal specific heats of monatomic, diatomic, and polyatomic gases, if their specific heat ratios are respectively $5/3$, $7/5$ and $4/3$.
- b) Elaborate on Dalton's Law of partial pressure and its implications in understanding the behavior of gas mixtures. [5+5]
10. Explore the factors influencing the thermal efficiency of power cycles and how they impact overall performance. [10]

OR

11. Discuss the vapor compression cycle used in refrigeration. Describe its components and evaluate its performance, emphasizing efficiency considerations. [10]

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