**Code No: 183CG** **R22**

**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 Vader 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 = 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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