

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER-IV (NEW) EXAMINATION – WINTER 2024

Subject Code:3142004

Date:26-11-2024

Subject Name:Engineering Thermodynamics

Time:02:30 PM TO 05:00 PM

Total Marks:70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

- Q.1** (a) What do you understand by intensive and extensive properties? Give examples of both. **03**
- (b) Write the statements of Zeroth Law, First Law and Second Law. **04**
- (c) What is thermodynamic equilibrium? **07**
- Q.2** (a) Define heat engine, refrigerator and heat pump. **03**
- (b) What is a throttling process, and how does it relate to the First Law of Thermodynamics? **04**
- (c) Describe the working of a Carnot cycle. **07**
- OR**
- (c) Prove that no heat engine is more efficient than reversible heat engine. **07**
- Q.3** (a) Draw p-V diagram for Otto and Diesel cycle and mention all processes on it. **03**
- (b) Prove that entropy is property. **04**
- (c) What do you mean by 'Clausius inequality'? Explain in details. **07**
- OR**
- Q.3** (a) What is the critical state? Explain critical pressure, temperature and volume of water. **03**
- (b) A cyclic heat engine operates between a source temperature of 1000°C and a sink temperature of 40°C. Find the least rate of heat rejection per kW net output of the engine? **04**
- (c) State the law of corresponding states and define the compressibility factor and explain its significance. **07**
- Q.4** (a) The efficiency of an Otto cycle is 60% and $\gamma = 1.5$. What is the compression ratio? **03**
- (b) What are PMM1 and PMM2? Why they are impossible? **04**
- (c) Prove internal energy and enthalpy of an ideal gas are functions of temperature only. **07**
- OR**
- Q.4** (a) Explain quasi static process with example. **03**
- (b) State Boyle's and Charle's laws and derive an equation of the state for a perfect gas. **04**
- (c) In a steam power cycle, the steam supply is at 15 bar and dry and saturated. The condenser pressure is 0.4 bar. Calculate the Carnot and Rankine efficiencies of the cycle. Neglect pump work. **07**
- Q.5** (a) Explain concept of exergy. **03**
- (b) Give comparison between Rankine Cycle and Carnot Cycle **04**
- (c) State various methods to improve efficiency of Brayton cycle. With suitable diagrams, explain any two of them. **07**

OR

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| Q.5 | (a) What does Avogadro's Law state? | 03 |
| | (b) Write a short note on Van der Waal's equation. | 04 |
| | (c) Explain briefly Dalton's law and Gibbs-Dalton law applied to mixture of perfect gases. | 07 |
