

GUJARAT TECHNOLOGICAL UNIVERSITY**BE- SEMESTER-IV EXAMINATION – WINTER 2025****Subject Code:3142004****Date:20-11-2025****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.

MARKS

- Q.1**
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|-----|--|-----------|
| (a) | List the types of thermodynamic systems and give one example of each. | 03 |
| (b) | Explain concept of Quasi-static process with necessary figure. | 04 |
| (c) | What do you mean by pure substance? Discuss vapor- liquid solid phase in a pure substance. | 07 |

- Q.2**
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|-----|---|-----------|
| (a) | State the first law of thermodynamics and state limitations. | 03 |
| (b) | Distinguish between energy of non-flow system and flow system. | 04 |
| (c) | A turbine, operating under steady flow condition, receives 4500 kg of steam per hour. The steam enters at a velocity of 2800 m/min, an elevation of 5.5m and a specific enthalpy of 2800 kJ/kg. It leaves the turbine at a velocity of 5600 m/min, an elevation of 1.5m and specific enthalpy of 2300 kJ/kg. Heat losses from the turbine to the surrounding amount to 16,000 KJ/hr. determine the power output of the turbine. | 07 |

OR

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|-----|--|-----------|
| (c) | State the Steady Flow Energy Equation and apply this equation for Nozzle and Boiler. | 07 |
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- Q.3**
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|-----|---|-----------|
| (a) | Define the terms: (1) System (2) Process (3) State | 03 |
| (b) | With examples explain intensive and extensive properties. | 04 |
| (c) | Write difference between heat and work. Show that heat is a path function and not a property. | 07 |

OR

- Q.3**
- | | | |
|-----|---|-----------|
| (a) | Explain the terms PMM – I and PMM – II. | 03 |
| (b) | Prove that Entropy is a property of the system. | 04 |
| (c) | Write down Kelvin-Planck's and Clausius' statements for Second Law of thermodynamics. Prove equivalence between them. | 07 |

- Q.4**
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|-----|---|-----------|
| (a) | Carnot cycle is practically impossible. Justify the statement. | 03 |
| (b) | Explain various operations of an Brayton cycle. Also represent it on a T-s and p-V diagrams. | 04 |
| (c) | Draw Rankine Cycle on P-v, T-s and h-s diagrams and derive an expression for its thermal efficiency with and without pump work. | 07 |

OR

- Q.4**
- | | | |
|-----|---|-----------|
| (a) | Sketch the p - v and T -s diagram for dual cycle. | 03 |
|-----|---|-----------|

- (b) Determine the air standard efficiency of otto cycle from the following data: Bore of the cylinder=14 cm, stroke length=13 cm, clearance volume=290 cm³. **04**
- (c) Draw the diesel cycle on p-v and T-s diagram. Also derive expression for air standard efficiency with usual notations for the cycle. **07**
- Q.5** (a) State and explain Avogadro's law. **03**
- (b) Write Van der Waals equation and mention significance of constants 'a' and 'b'. **04**
- (c) Explain adiabatic mixing of perfect gases. **07**
- OR**
- Q.5** (a) State and explain the Gibbs-Dalton law of partial pressures. **03**
- (b) Explain the law of corresponding states. **04**
- (c) Prove that all reversible engines operating between two constant temperature thermal reservoirs are equally efficient. **07**
