

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-IV (NEW) EXAMINATION – SUMMER 2024****Subject Code:3142004****Date:01-07-2024****Subject Name: Engineering Thermodynamics****Time:10:30 AM TO 01:00 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

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| Q.1 | (a) State the first law of thermodynamics and state limitations. | 03 |
| | (b) Prove that energy is property. | 04 |
| | (c) What do you mean by pure substance? Discuss vapor- liquid-solid phase in a pure substance. | 07 |
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| Q.2 | (a) State and explain Avogadro's law. | 03 |
| | (b) Explain briefly Brayton cycle. | 04 |
| | (c) A cylinder contains 0.45m^3 of gas at $1 \times 10^5 \text{ N/m}^2$ and 80°C . The gas is compressed to a volume of 0.13 m^3 . The final pressure being $5 \times 10^5 \text{ N/m}^2$. Assume $\gamma=1.4$, $R=294.2 \text{ J/kg}^\circ\text{C}$. Calculate mass of gas index of compression n , increases in internal energy of gas, heat rejected by gas during compression. | 07 |
| OR | | |
| | (c) Write a short note on Van der Waal's equation. | 07 |
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| Q.3 | (a) Define terms: Exergy, Thermodynamic temperature scale, Heat engine. | 03 |
| | (b) Prove that Entropy is a property of the system. | 04 |
| | (c) Write difference between heat and work. Show that heat is a path function and not a property. | 07 |
| OR | | |
| Q.3 | (a) A paddle wheel used for mixing and stirring of fluid. A stirring wheel turns 500 rpm with applied torque 3 Nm. Calculate work transmitted to liquid through the paddle wheel. | 03 |
| | (b) With suitable T-S diagram explain methods of improving efficiency of Rankine cycle. | 04 |
| | (c) Explain briefly Dalton's law and Gibbs-Dalton law applied to mixture of perfect gases. | 07 |
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| Q.4 | (a) Explain different types of systems with suitable examples. | 03 |
| | (b) Explain quasi static process with example. | 04 |
| | (c) Explain adiabatic mixing of perfect gases. | 07 |
| OR | | |
| Q.4 | (a) State the assumptions made for analysis of air standard cycles. | 03 |
| | (b) A domestic refrigerator maintain a temperature of -10°C . The ambient temperature is 27°C . The heat leaks into the refrigerator at the continuous rate of 90 KJ/min . Calculate least power required to pump this heat out continuously. | 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 |

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| Q.5 | (a) Explain microscopic and macroscopic point of view. | 03 |
| | (b) Explain third law of thermodynamics. | 04 |
| | (c) Prove internal energy and enthalpy of an ideal gas are functions of temperature only. | 07 |

OR

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| Q.5 | (a) Explain steady and unsteady flow process. | 03 |
| | (b) Explain entropy and disorder. | 04 |
| | (c) State Clausius statement of second law of thermodynamics and show that violation of Clausius statement leading to violation of Kelvin-Plank statement. | 07 |
