

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-III(NEW) EXAMINATION – SUMMER 2023****Subject Code:3131905****Date:28-07-2023****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	(a) Discuss the type of thermodynamic system by giving suitable example of it.	03
	(b) Explain thermodynamic equilibrium and state the Zeroth law of thermodynamics.	04
	(c) Derive the general energy equation and deduce it for steady flow energy equation.	07
Q.2	(a) Discuss the Limitation of first law of thermodynamics.	03
	(b) Explain the terms PMM – I and PMM – II with suitable diagram.	04
	(c) Give comparison between Otto, diesel, and dual cycles based on same compression ratio and heat rejection.	07
OR		
	(c) Derive equation for efficiency for Diesel Cycle.	07
Q.3	(a) Explain state and property also describe intensive and extensive property.	03
	(b) Show that the COP of a heat pump is greater than the COP of refrigerator by unity.	04
	(c) How actual Brayton cycle differs from the theoretical cycle? Explain with the help of T-S diagram.	07
OR		
Q.3	(a) Define: i) Enthalpy of formation, ii) Enthalpy of reaction, iii) Adiabatic flame temperature.	03
	(b) Write down Kelvin-Planck and Clausius statements of 2 Law of thermodynamics.	04
	(c) In a steam power station, steam flows steadily through a 0.2 m diameter pipeline from the boiler to the turbine. At the boiler end, the steam conditions are found to be $p = 4 \text{ MPa}$, $t = 400^\circ\text{C}$, $h = 3213.6 \text{ kJ/kg}$, and $v = 0.073 \text{ m}^3/\text{kg}$. At the turbine end, the conditions are found to be $p = 3.5 \text{ MPa}$, $t = 392^\circ\text{C}$, $h = 3202.6 \text{ kJ/kg}$ and $v = 0.084 \text{ m}^3/\text{kg}$. There is a heat loss of 8.5 kJ/kg from the pipeline. Calculate the steam flow rate.	07
Q.4	(a) Discuss causes of irreversibility for a thermodynamic system.	03
	(b) Explain the Clausius inequality.	04
	(c) An engine working on the otto cycle is supplied with air at 0.1 MPa , 35°C . The compression ratio is 8. Heat supplied is 2100 kJ/kg , Calculate the maximum pressure and temperature of the cycle, the cycle efficiency and mean effective pressure (for air, $C_p = 1.005$, $C_v = 0.718$ and $R = 0.287 \text{ kJ/kg K}$).	07

OR

- Q.4** (a) State first law of thermodynamics. Write the limitation of first law of thermodynamics. **03**
(b) What is the mean temperature of heat addition? Explain its significance. **04**
(c) Show that efficiency of a reversible heat engine operating between two constant temperatures is maximum. **07**

- Q.5** (a) Draw the sketch of Rankine cycle p-V, T-s and h-s diagram (consider Inlet and exit to turbine is superheated and saturated steam respectively). **03**
(b) Draw block diagram of Vapour Compression Refrigeration system. Write down all four processes only. Also show these processes on p-h diagram. **04**
(c) Steam at 20 bar, 360°C is expanded in a steam turbine to 0.08 bar. It then enters a condenser, where it is condensed to saturated liquid water. The pump feeds back the water into the boiler. Assuming ideal processes, find per kg steam the network and the cycle efficiency. **07**

OR

- Q.5** (a) Define following terms: 1) dead state 2) high grade energy 3) irreversibility. **03**
(b) Define cut-off ratio. How cut-off ratio affects the efficiency of diesel cycle? **04**
(c) Explain the availability of steady flow process. **07**
