Enrollment No./Seat No.:

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering - SEMESTER - III EXAMINATION - WINTER 2025

Subject Code: BE03000201 **Date: 15-12-2025**

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
Q.1	**(a)**	What is PMM1? Why is it impossible?	**03**
	(b)	A system rejects 120 kJ of heat and 80 kJ of work is done on it. Calculate change in internal energy.	**04**
	(c)	Explain diesel cycle with P–V and T–S diagrams and derive expression for efficiency.	**07**
Q.2	**(a)**	Identify whether pressure, volume, and temperature are intensive or extensive properties with justification.	**03**
	(b)	Interpret the principle of increase of entropy in isolated systems.	**04**
	(c)	A mass of 2 kg of water is heated from 30°C to 80°C at a pressure of 1 bar. Calculate the change in entropy. (Cp = 4.18 kJ/kg·K)	**07**
		OR	
	(c)	Analyze the Clausius theorem and explain its significance in determining entropy change for reversible cycles.	**07**
Q.3	**(a)**	State the two main practical reasons why the Carnot cycle is not used in steam power plants.	**03**
	(b)	What is a thermodynamic system? Explain open, closed, and isolated systems briefly.	**04**
	(c)	State the Gouy-Stodola theorem. How is it used to quantify irreversibility?	**07**
		OR	
	(a)	An engine operates on a Dual cycle with a compression ratio of 16, a pressure ratio of 1.5 during the constant volume heat addition, and a cut-off ratio of 2 during the constant pressure heat addition. Given the ratio of specific heats for air is 1.4, calculate the air-standard thermal efficiency of this Dual cycle.	**03**
	(b)	What is the Zeroth Law of Thermodynamics? How does it lead to the concept of temperature?	**04**
	(c)	Define exergy and derive the expression for exergy associated with heat transfer from a source at temperature T to surroundings at T0.	**07**
Q.4	**(a)**	Explain First Law for a closed system undergoing change of state.	**03**

	(b)	What is a throttling process? Explain how it is analyzed using the first law of thermodynamics.	**04**
	(c)	Steam enters a nozzle at 1 MPa, 300°C with velocity 50 m/s and leaves at 0.2 MPa with velocity 300 m/s. Assuming no heat loss, calculate exit enthalpy. (From Superheated Steam Tables at P=1 MPa and T=300° C, h=3051.2 kJ/kg)	**07**

OR

	(a)	Describe the Clausius statement and its equivalence to the Kelvin-Planck statement.	**03**
	(b)	Interpret Carnot's theorem and its significance in thermodynamics.	**04**
	(c)	Prove that no engine can be more efficient than a reversible engine operating between the same temperature limits.	**07**
Q.5	**(a)**	Define Mean Effective Pressure (MEP) and explain its significance in relation to engine performance.	**03**
	(b)	For an Otto cycle with compression ratio 8, calculate air standard efficiency. ($\gamma = 1.4$)	**04**
	(c)	Draw a T-s diagram and explain how reheating improves the Rankine cycle efficiency.	**07**

OR

	(a)	Explain the main function of a feed water heater (FWH) in a regenerative cycle.	**03**
	(b)	Define brake thermal efficiency and relative efficiency and explain their difference with examples.	**04**
	(c)	A Diesel Engine has a compression ratio of 15 and heat addition at constant pressure take place 6% of stroke. Find the air standard efficiency of the engine. Take Y for air as 1.4.	**07**

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