Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–III (NEW) EXAMINATION – SUMMER 2024

Subject Code:3131905 Date:29-06-2024

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**
5. **Use of steam tables and Mollier diagrams is allowable.**

			Marks
Q.1	**(a)**	Define the terms: 1. Process 2. Cycle 3. Isolated system	**03**
	(b)	Explain in brief:1. Thermodynamic equilibrium 2. Zeroth law of thermodynamics	**04**
	(c)	Derive the steady flow energy equation for (1) Steam Nozzle (2) Centrifugal Pump	**07**
Q.2	**(a)**	What do you mean by PMM-1 and PMM-2 ?	**03**
	(b)	Differentiate between the Heat Pump and Refrigerator.	**04**
	(c)	A stream of gases at 750 kPa, 750°C and 140 m/s is passed through a gas turbine of a jet engine. The stream comes out of the turbine at 200 kPa, 550°C and 280 m/s. The enthalpies of gas at the entry and exit of the turbine are 950 kJ/kg and 650 kJ/kg of gas respectively. Determine the capacity of the turbine if the gas flow is 5 kg/s. Assume the process is adiabatic.	**07**
		OR	
	(c)	Determine the least rate of heat rejection per kW net output of the cyclic heat engine which operates between a source temperature of 1000°C and a sink temperature of 40°C.	**07**
Q.3	**(a)**	State the limitations of the Carnot Cycle.	**03**
	(b)	The air standard efficiency of an Otto cycle is 60% and γ = 1.4. Calculate the compression ratio.	**04**
	(c)	Derive the air standard efficiency equation of Otto cycle with usual notations.	**07**
		OR	
Q.3	**(a)**	Explain the terms: Brake thermal efficiency and Relative efficiency of the engine.	**03**
	(b)	An oil engine working on the dual combustion cycle has a compression ratio of 14 and the explosion ratio obtained from an indicator card is 1.4. If the cut-off occurs at 6 per cent of the stroke, find the ideal efficiency. Take γ for air = 1.4.	**04**
	(c)	Derive the air standard efficiency equation of Diesel cycle with usual notations.	**07**
Q.4	**(a)**	Explain in brief the term: EXERGY.	**03**
	(b)	Explain with neat schematic diagram the Reheat Rankine cycle.	**04**
	(c)	In a Rankine cycle, the steam at inlet to turbine is saturated at a pressure of 35 bar and the exhaust pressure is 0.2 bar. Determine: (i) The pump work, (ii) The turbine work, (iii) The Rankine efficiency, (iv) The condenser heat flow,(v) The dryness at the end of expansion. Assume the mass flow rate of steam equals to 9.5 kg/s.	**07**
		OR	

Q.4	**(a)**	Explain in brief the terms: Available energy and Unavailable energy.	**03**
	(b)	Draw the Simple Brayton cycle on p-v and T-s diagrams.	**04**
	(c)	Explain with neat schematic diagram the Simple Vapour Compression Refrigeration (VCR) cycle. Also draw P-h and T-s diagrams for it.	**07**
Q.5	**(a)**	Define the terms: Reversibility and Irreversibility.	**03**
	(b)	With usual notations prove that $\Phi\delta Q/T <= 0$.	**04**
	(c)	Describe the terms: (i) Enthalpy of formation, (ii) Enthalpy of reaction, (iii) Adiabatic flame temperature	**07**

OR

Q.5	**(a)**	What is irreversibility? State various types of irreversibility.	**03**
	(b)	What is entropy principle? With the help of it prove that adiabatic mixing of two fluids is irreversible.	**04**
	(c)	Describe with neat diagram the bomb calorimeter.	**07**

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