Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– III (NEW) EXAMINATION – SUMMER 2022

Subject Code:3132504 Date:15-07-2022

Subject Name:Basic and Applied 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)**	Define following terms in thermodynamics. 1) Intensive Property 2) Extensive Property 3) Open System.	**03**
	(b)	Explain Quasi-Static Process with suitable example.	**04**
	(c)	State first law of thermodynamics for closed system undergoing a cycle and explain it with the help of joule's experiment.	**07**
Q.2	**(a)**	Define following terms in thermodynamics. 1) Internal energy 2) Steady flow process 3) Unsteady flow process	**03**
	(b)	Discuss Perpetual motion machine of second kind with neat sketch.	**04**
	(c)	In a steam power plant, feed water is supplied to the boiler with rate of 2kg/s. the initial enthalpy and velocity of feed water are 600 kJ/kg and 6 m/s. the water receives 1800 kJ/kg of heat in the boiler. Then steam passes through turbine, and the steam leaving from turbine with velocity 52 m/s and enthalpy 2050 kJ/kg. The inlet is 5 m below the exit of turbine. The heat losses from the boiler and the turbine to the surrounding are 30 kJ/kg. Calculate the power developed by the turbine.	**07**
		OR	
	(c)	Two Carnot engines work in series between the sources and sink temperatures of 550 K and 350 K. If both engines develop equal power determine the intermediate temperature.	**07**
Q.3	**(a)**	Explain Clausius statement for second law of thermodynamics with suitable example.	**03**
	(b)	Draw components and arrangement of Carnot vapour cycle and state the processes of this cycle.	**04**
	(c)	Determine expression for air standard efficiency of Diesel cycle with neat sketch of P-V and T-S diagram.	**07**
		OR	
Q.3	**(a)**	Write a short note on Entropy	**03**
	(b)	Write down and explain processes of Rankine cycle and also indicate it on P-V and T-S diagram.	**04**

	(c)	Explain Brayton cycle and Derive an expression for air-standard efficiency. $\eta = 1 - \frac{T_4 - T_1}{T_3 - T_2}$	**07**
Q.4	**(a)**	Define Refrigeration and COP of Refrigerator	**03**
	(b)	Write down and explain four processes of Reversed Carnot cycle and also indicate it on P-V and T-S diagram.	**04**
	(c)	A steam turbine power plant operating on ideal Rankine cycle, receives a steam at 30 bar, 350^o C at the rate of 2kg/s and it exhausts at 0.09 bar. Calculate the following. 1) Net power output 2) steam rate 3) heat rejection in condenser in kW 4) Rankine cycle efficiency Take, h_{fg3} = 2397.7 kJ/kg $h_4 = h_{f4} = h_{f3}$ = 183.3 kJ/kg, V_{f4} = 0.001009 h_2 = 3117.5 kJ/kg, S_{f3} = 0.622 kJ/kg K S_2 = 6.747 kJ/kg K, S_{fg3} = 7.565 kJ/kg K	**07**
		OR	
Q.4	**(a)**	Explain various parts and their functions of Vapour Compression Refrigeration system with neat sketch.	**03**
	(b)	Write down and explain processes of Bell-Coleman cycle and also indicate it on P-V and T-S diagram.	**04**
	(c)	In an air standard Otto cycle, the maximum and minimum temperatures are 1600^{o}C and 20^{o}C. The heat supplied per kg of air is 900 kJ. Determine the compression ratio, and the cycle efficiency. Take C_v = 0.718 kJ/kg K and Υ = 1.4.	**07**
Q.5	**(a)**	Explain effect of superheating of steam in Rankine cycle	**03**
	(b)	Give the conditions for maximum efficiency of impulse and reaction turbine.	**04**
	(c)	Explain with neat sketch pressure compounding of impulse turbine.	**07**
		OR	
Q.5	**(a)**	Draw P-V and T-S diagram for Dual cycle	**03**
	(b)	Give the classification of steam turbines.	**04**
	(c)	Explain with neat sketch velocity compounding of impulse turbine.	**07**

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