Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code:3132504 Date:29-11-2024

Subject Name: Basic and Applied 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 table is permitted.**

			Marks
Q.1	**(a)**	How does homogeneous system differ from heterogeneous system?	**03**
	(b)	Define: (i) Critical Point, (ii) Triple Point (iii) Thermodynamic Equilibrium	**04**
	(c)	Apply first law of thermodynamics to steady flow process and derive steady flow energy equation.	**07**
Q.2	**(a)**	Discuss Concept of PMM1 and PMM2.	**03**
	(b)	Explain 1st law of thermodynamics for a closed system undergoes a change of state.	**04**
	(c)	State and prove Carnot theorem for heat engine. Also write statements of Carnot theorem in context of refrigerator and pump.	**07**
		OR	
	(c)	A centrifugal air compressor delivers 12kg of air per min. The inlet and outlet conditions are C_1=12m/sec, P_1=1 bar, V_1= 0.5 m^3/kg and C_2=90m/sec, P_2=8 bar, V_2=0.14m^3/kg. The increase in enthalpy of air passing through compressor is 150 Kj/kg. The heat loss to the surroundings is 700 Kj/min. Calculate (i) Motor power required to drive the compressor (ii) Ratio of inlet to output pipe diameter. Assume that inlet and discharge lines are at same level.	**07**
Q.3	**(a)**	Explain the principle of increase of entropy.	**03**
	(b)	What are characteristic of entropy? Prove that entropy is property of the system.	**04**
	(c)	Show the equivalence of Clausius and Kelvin-Plank statement of second law of thermodynamics.	**07**
		OR	
Q.3	**(a)**	State the comparison of Carnot & Rankine cycles.	**03**
	(b)	An air standard Otto cycle has a compression ratio of 8. At the start of the compression process, the temperature is 26°C and the pressure is 1 bar. If the maximum temperature of the cycle is 1080°C. Calculate (i) The heat supplied per kg of air, (ii) The thermal efficiency of the cycle.	**04**
	(c)	Determine expression for air standard efficiency of Otto cycle with neat sketch of P-V and T-S diagram.	**07**
Q.4	**(a)**	With neat sketch state process in open cycle gas turbine power plant (Brayton Cycle).	**03**
	(b)	Determine expression for efficiency of Rankine cycle with neat sketch of their main components, P -V and T-S diagram.	**04**
	(c)	An engine working on diesel cycle has cylinder bore of 190 mm and piston stroke of 230 mm. The clearance volume is 290cm^3. The fuel injection takes place at constant pressure for 6% of the stroke. Determine the air standard cycle efficiency.	**07**

OR

Q.4	**(a)**	Draw the schematic, p-h and T-S diagrams for simple vapour compression cycle.	**03**
	(b)	State and explain factors effecting the performance of simple VCR system.	**04**
	(c)	Describe with neat sketch for Bell – Coleman (Joule cycle) for air refrigeration and derive its COP equation.	**07**
Q.5	**(a)**	Write comparison for Otto, Diesel and Dual cycle.	**03**
	(b)	Illustrate working of reaction turbine with neat sketch.	**04**
	(c)	State methods of governing of steam turbine and explain any one with neat sketch.	**07**

OR

Q.5	**(a)**	Define the following: (i) Mean effective pressure, (ii) Brake thermal efficiency, (iii) Relative efficiency.	**03**
	(b)	Illustrate working of impulse turbine with neat sketch.	**04**
	(c)	List out methods of steam turbine compounding and explain any one with neat sketch in detail.	**07**

****