Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– III (New) EXAMINATION – WINTER 2019

Subject Code: 3130109 Date: 30/11/2019

Subject Name: Thermodynamics for Aeronautical Engineering

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.**

Q.1	**(a)**	Difference between extensive property and intensive property.	**03**
	(b)	Give the comparisons of microscopic and macroscopic point of view of Thermodynamics.	**04**
	(c)	Derive an expression for efficiency of Diesel cycle in terms of the compression ratio r, cut-off ρ and γ.	**07**
Q.2	**(a)**	Write steady flow energy equation in case of boiler, turbine and condenser	**03**
	(b)	Prove that "Energy is a property of a system".	**04**
	(c)	In a gas turbine unit, the gas flow through the turbine is 15 Kg/Sec. and the Power developed by the turbine is 12000 KW. The enthalpies of gases at inlet and Outlet are 1260 KJ/Kg and 400 KJ/Kg respectively, and the velocity of gases at the Inlet and outlet are 50 m/s and 110 m/s respectively. Calculate (i) The rate at which Heat is rejected to the turbine, and (ii) The area of the inlet pipe given that the Specific volume of gases at inlet is 0.45 m^3/kg.	**07**
		OR	
	(c)	Derive equation for (i) filling the tank and (ii) emptying the tank	**07**
Q.3	**(a)**	Identify the reasons for the impracticality of Carnot cycle	**03**
	(b)	State and explain the Perpetual motion machines of Second Kind	**04**
	(c)	State Kelvin-Plank Statement of Second Law of thermodynamics and show that violation of Kelvin-Plank statement leading to violation of Clausius statement.	**07**
		OR	
Q.3	**(a)**	Write the equation for entropy change of reversible and irreversible process and cycles with usual notations.	**03**
	(b)	Explain: Entropy principle.	**04**
	(c)	Two Carnot engines work in series between the source and sink temperatures of 550 K and 350 K. If both engines develop equal power determine the intermediate temperature.	**07**
Q.4	**(a)**	Draw the T-s diagram of ideal Rankine vapour power cycle showing name of component for each process and write the energy equation for each component neglecting kinetic and potential energy	**03**
	(b)	Compare Otto, Diesel and Dual cycle for i) Same compression ratio and heat supplied ii) Same Max. Pressure and temperature	**04**

	(c)	A steam turbine power plant operating on ideal Rankine cycle, receives steam at 20bar, 300^0C at the rate of 3 Kg/S and it exhausts at 0.1bar. Calculate the followings: i) Net power output ii) Steam rate iii) Heat rejection in condenser in KW iv) Rankine Cycle efficiency.	**07**

OR

Q.4	**(a)**	Write comparison of Carnot and Rankine cycle.	**03**
	(b)	Derive an air-standard efficiency expression for Brayton cycle in terms of r_p and γ	**04**
	(c)	In an IC Engine working with the Otto cycle, the cylinder diameter is 250 mm and a stroke is 375mm. If the clearance volume is 0.00263 m^3, and the initial pressure and temperature are 1bar and 50^0C, calculate the air standard efficiency and mean effective pressure of the cycle. The maximum cycle pressure is limited to 25bar.	**07**
Q.5	**(a)**	Give causes of irreversibility in detail.	**03**
	(b)	Draw the brayton cycle diagram with ideal regeration, reheating and intercooling. Also draw the T-s diagram.	**04**
	(c)	Derive Maxwell relations and various TdS equations.	**07**

OR

Q.5	**(a)**	Explain in short: Exergy	**03**
	(b)	Define and Explain Helmholtz & Gib's function	**04**
	(c)	Write down Jet engine components. Derive expression for component efficiency of any one component	**07**

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