Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC - SEMESTER–I- EXAMINATION – SUMMER 2016

Subject Code:X11902 **Date:04/06/2016**

Subject Name:ENGINEERING 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.**

Q.1	**(a)**	Derive general steady flow energy equation.	**07**
	(b)	Derive an expression for air standard efficiency for Otto cycle	**07**
Q.2	**(a)**	Define thermodynamic system, surrounding, system boundary, extensive properties, intensive properties, isolated system and homogeneous system.	**07**
	(b)	A stream of gases at 7.5bar, 750^0c and 140 m/s is passed through a turbine of a jet engine. The stream comes out of the turbine at 2 bar, 550^0c and 280 m/s. the process may be assumed adiabatic. 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.	**07**
		OR	
	(b)	Define pure substance. What is critical point and triple point? State the value of pressure and temperature at critical and triple point of water.	**07**
Q.3	**(a)**	Derive equation of air standard efficiency of diesel cycle.	**07**
	(b)	An engine working of ideal Otto cycle has a clearance volume of 0.03 m^3 and swept volume of 0.12 m^3 the temperature and pressure at the beginning of compression are 100^0c and 1bar respectively. If pressure at the end of heat addition is 25 bar, calculate: 1. Ideal efficiency of cycle. 2. Temperature at key points of the cycle.	**07**
		OR	
Q.3	**(a)**	Explain variables affecting efficiency of Rankine cycle	**07**
	(b)	In a steam power cycle, the steam supply is at 15 bar and dry and saturated. The condenser pressure is 0.4 bar. Calculate the Carnot and Rankine efficiencies of the cycle. Neglect pump work.	**07**
Q.4	**(a)**	State and prove the Clausious theorem.	**07**
	(b)	8 kg of air at 650 K and 5.5 bar pressure is enclosed in a closed system. If the atmosphere temperature and pressure are 300 K and 1 bar respectively, determine : (i) The availability if the system goes through the ideal work producing process. (ii) The availability and effectiveness if the air is cooled at constant pressure to atmospheric temperature without bringing it to complete dead state. Take Cv = 0.718 kJ/kg K ; Cp= 1.005 kJ/kg K.	**07**
		OR	
Q.4	**(a)**	Write short note on joule-Thomson co-efficient.	**07**
	(b)	5 kg of air at 550 K and 4 bar is enclosed in a closed system. (i) Determine the availability of the system if the surrounding pressure and temperature are 1 bar and 290 K respectively. (ii) If the air is cooled at constant pressure to the atmospheric temperature, determine the availability and effectiveness.	**07**
Q.5	**(a)**	Explain the working of Orsat apparatus with neat sketch	**07**
	(b)	Derive Maxweill's equation from basics	**07**
		OR	
Q.5	**(a)**	How fuels are classified. Give comparison of solid fuel and liquid fuel	**07**
	(b)	Derive Vander wall's equation.	**07**

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