Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC Sem-I June-July Examination 2011

Subject code: X11902 Subject Name: Engineering Thermodynamics

Date: 08/07/11 Total Marks: 70 Time: 10:30am to 1:00pm

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Use of properties tables and charts is permissible.**

Q.1	**(a)**	Explain the term thermodynamic equilibrium with illustrations.	**07**
	(b)	Define following terms: 1. Closed system 2. Open system 3. Isolated system 4. Control Volume.	**07**
Q.2	**(a)**	Derive an expression to find the efficiency of Diesel Cycle.	**07**
	(b)	Compare Otto cycle, Diesel cycle and dual cycle considering 1.maximum pressure and same heat supplied and 2. maximum pressure and equal highest temperature.	**07**
		OR	
	(b)	Prove that work is a path function.	**07**
Q.3	**(a)**	Explain the terms available energy, unavailable energy and dead state.	**07**
	(b)	Derive an expression for availability of steady flow open system.	**07**
		OR	
Q.3	**(a)**	State and derive Maxell's equation from basics.	**07**
	(b)	Air expands in a turbine from 6 bar, 540^0 C to 1.01325 bar, 310^0 C. In expansion process 15 kJ/kg of heat is rejected to the surroundings at 1.01325 bar, 20^0 C. Assuming no change in K.E. and P.E., determine per kg of air, 1. decrease in availability 2. irreversibility in process 3. effectiveness of process. Take C_p =1.005 kJ/kg.K.	**07**
Q.4	**(a)**	Define first law of thermodynamics and internal energy of the system. Prove that internal energy is property of the system.	**07**
	(b)	2 m^3 gas is compressed to 0.4 m^3 at a constant pressure 100 kPa. During the process 35 kJ of heat is rejected from gas. Calculate change in internal energy of gas.	**07**
		OR	
Q.4	**(a)**	Derive an expression for energy equation for steady flow process.	**07**
	(b)	Steam enters an insulated nozzle at 7 bar and 215^0 C with velocity of 60 m/s. It leaves at pressure of 1.5 bar and velocity of 500 m/s. Determine the final enthalpy of system.	**07**
Q.5	**(a)**	Prove the equivalence of Clausius and Kelvin-Plank statement of second low of thermodynamics.	**07**
	(b)	5 kg of water at 98 ^{0} C is mixed with 8 kg of water at 20 ^{0} C in an insulated system. Calculate the change of entropy due to mixing process.	**07**
		OR	
Q.5	**(a)**	State and prove Carnot's theorem.	**07**
	(b)	3 kg of N_2 at 160^0 C and 0.3 m^3 at constant pressure then expanded isothermally to volume of 0.6 m^3. Find total change in entropy during the processes. Take C_v =0.750 kJ/kg. K, R= 0.298 kJ/kg.K.	**07**

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