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GUJARAT TECHNOLOGICAL UNIVERSITY PDDC - SEMESTER-I EXAMINATION – WINTER 2015

Subject Code: X11902 Da		et Code: X11902 Date:30/12/2015	ate:30/12/2015	
Sı Ti In:	ibjec me: struct	et Name: Engineering Thermodynamics 10:30am to 01:00pm Total Marks: 7 ions: 1. Attempt any five questions. 2. Make suitable assumptions wherever necessary. 3. Figures to the right indicate full marks.	0	
Q.1	(a)	Distinguish between: 1) Open system and closed system; 2) Path function and point function	07	
	(b)	Derive steady flow energy equation for condenser and nozzle.	07	
Q.2	(a)	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	
	(b)	Explain Clausius inequality.	07	
Q.3	(a) (b)	Derive equation of air standard efficiency of diesel cycle. In an air standard otto cycle, the maximum and minimum temperatures are 1600° C and 20° C. the heat cycle. The heat supplied per kg of air is 900 kJ. Determine the compression ratio and cycle efficiency. Take Cv = 0.718 kJ/kg and $\gamma = 1.4$	07 07	
Q.4	(a)	State and prove Carnot theorem.	07	
	(b)	A steam turbine operates under steady flow conditions. It receives 4500 kg/hr steam from boiler. The steam enters the turbine at enthalpy of 2800 kJ/kg, a velocity of 2800 m/min and elevation of 5.5 m. The steam leaves the turbine at enthalpy of 2300 kJ/kg, a velocity of 5600 m/min and elevation of 1.5 m. Due to radiation, heat losses from turbine to the surroundings amounts to 16,000 kJ/hr. Calculate the power output of the turbine.	07	
Q.5	(a)	Explain the terms Reversibility and Irreversibility.	07	
	(b)	In oil-water heat exchanger, oil is cooled from 90° to 35° C. The water enters heat exchanger at 15° C. Mass flow rate of oil and water are 20 kg/s and 50 kg/s respectively. The specific heat of oil and water are 1.8 kJ/kg K and 4.18 kJ/kg K respectively. The surrounding temperature is 12° C. Calculate: (1) Change of availability of oil and water and (2) Effectiveness.	07	
Q.6	(a)	Explain the Dalton's law and Gibbs - Dalton's law for mixture of gases.	07	
	(b)	A vessel of volume 0.4 m ³ consists of 0.45 kg of CO and 1 kg of Air at 15^{0} C. Calculate (1) The partial pressure of each constituent and (2) Total pressure in the vessel. The air contains 23.3 % O ₂ and 76.6 % N ₂ by mass. Take the molecular mass of CO, O ₂ , N ₂ as 28, 32 and 28 kg/kg mole respectively. Take Universal Gas constant, R = 8.3143 kJ/kg mol k	07	
Q.7	(a)	Enlist methods to determine the calorific value of solid and liquid fuels and explain any one of them with neat sketch.	07	
	(b)	How fuels are classified. Give comparison of solid fuel and liquid fuel.	07	