Seat No.: _____ Enrolment No.

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV (OLD) EXAMINATION – WINTER 2018

Subject Code:141903 **Date: 28/11/2018**

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.**
4. **Use of mollier chart and steam tables is permitted**

Q.1	(a)	Draw the Diesel cycle on p-v and T-s diagram. Also derive expression for air standard efficiency with usual notations for the cycle.	07
	(b)	Write the steady flow energy equations from first principles. Deduce the SFEE for 1) boiler 2) compressor	07
Q.2	(a)	0.2m3 of an ideal gas at a pressure of 2 MPa and 600K is expanded isothermally to 5 times the initial volume. It is then cooled to 300K at constant volume and then compressed back polytropically to its initial state. Determine the net work done and heat transfer during the cycle.	07
	(b)	Define entropy. With usual notations prove that $\Phi\delta Q/T <= 0$	07
		OR	
	(b)	Show that COP of a heat pump is greater than COP of refrigerator by unity	07
Q.3	(a)	A lump of 800 kg of steel at 1250K is to be cooled to 500K. If it is desired to use the steel as source of energy, calculate the available and unavailable energies. Take specific heat of steel as 0.5 kJ/kg K and ambient temperature 300K	07
	(b)	Explain Rankine cycle with P-V and T-S diagram.	07
		OR	
Q.3	(a)	It is proposed to design a refrigeration plant for a food store which is to be maintained at -5˚C. The ambient temperature is 25˚C and the estimated heat transfer from the store is at the rate of 5 KW. If the system operates on reversed Carnot heat engine cycle, determine the performance index and the minimum power required to operate the refrigeration plant.	07
	(b)	Explain Binary vapour cycle with P-V and T-S diagram.	07
Q.4	(a)	Derive Maxwell's equations and state their importance in thermodynamics.	07
	(b)	An air standard Otto cycle is designed to operate with the following data: Maximum cycle pressure and temperature: 5MPa and 2250K Minimum cycle pressure and temperature: 0.1 MPa and 300 K. Determine the net work output per unit mass of working fluid and the thermal efficiency	07
		OR	
Q.4	(a)	Explain: 1. Coefficient of volume expansion. 2. Isothermal compressibility. 3. Adiabatic compressibility.	07
	(b)	Prove that all reversible engines working between two constant temperature reservoirs have the same efficiency.	07

Q.5 (a) Explain briefly the following terms 07
(1) Thermodynamic system (2) Stochiometric air (3) exothermic reaction
(4) triple point (5) Enthalpy of formation (6) adiabatic flame temperature
(7) Control Volume

(b) Describe the phase change process of water using a -V diagram. 07

OR

Q.5 (a) Explain the following terms: Helm-Holtz, Clausius- Clapeyron equation, Joule-Thomson coefficient. 07

(b) Prove that 'Energy' is a point function of a system undergoing change of state. 07

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