Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV(New) EXAMINATION – SUMMER 2016

Subject Code:2140106 Date:06/06/2016

Subject Name:Basic Engineering Thermodynamics

Time:10:30 AM to 01:00 PM Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

			MARKS
Q.1		**Short Questions**	**14**
	1	Define State.	
	2	Write the statement of Zeroth law of thermodynamics.	
	3	How would you define PMM1?	
	4	Work is high grade energy and heat is low grade energy. Justify.	
	5	How Steady flow process differs from Unsteady flow process?	
	6	According to 1st law of thermodynamics, "Heat flows from hot end to cold end and cold end to hot end without any external sources." True or False?	
	7	Define Entropy.	
	8	Write Clausius and Kelvin-Plank statement of second law of thermodynamics.	
	9	Define Cycle.	
	10	Write four Processes of Brayton Cycle.	
	11	The efficiency of the dual cycle for the same compression ratio is _____ than Diesel cycle.	
	12	In diesel cycle, heat is added at _____.	
	13	A device which violates second law of thermodynamics is known as _____.	
	14	A system having single phase is known as _____.	
Q.2	**(a)**	Compare Microscopic and Macroscopic approach.	**03**
	(b)	A gas undergoes a quasi-static non flow process according to p=7V-8 bar, where V is volume in m^3 and p is pressure in bar. Calculate the work done when the volume changes from 2 to 3 m^3.	**04**
	(c)	What is System? How would you classify system?	**07**
		OR	
	(c)	Derive Steady Flow Energy Equation (SFEE).	**07**
Q.3	**(a)**	Prove that Energy is a property of a system.	**03**
	(b)	Air at 12ºC and 85 kPa enters the diffuser of Jet engine steadily at an inlet velocity of 220 m/s. The inlet area of diffuser is 0.38 m^2. The air leaves at a negligible velocity compared to inlet velocity. Calculate I. Mass flow rate of air II. The temperature of air leaving the diffuser	**04**
	(c)	Fluid enters a nozzle with a velocity of 50 m/s and initial enthalpy is 3000 kJ/kg. The enthalpy of fluid at the exit of nozzle is 2700 kJ/kg. Assume that the no heat	**07**

interaction between nozzle and surroundings. Apply SFEE to Calculate:

I. Velocity of fluid at the exit of nozzle
II. The mass flow rate when inlet area is 0.1 m^2 and specific volume at inlet is 0.2 m^3/kg.
III. The exit area of nozzle when the specific volume at the nozzle exit is 0.5 m^3/kg

OR

Q.3	**(a)**	Compare Kelvin-Plank and Clausius statement of second law of thermodynamics.	**03**
	(b)	A heat pump used to heat the house in the winter. A house requires 50 kJ/s heat for heating in winter which is delivered by heat pump from outside air. Work required to operate the heat pump is 8 kW. Calculate Coefficient of performance of heat pump and heat abstracted from outside.	**04**
	(c)	Prove the equivalence between Kelvin-Plank and Clausius statements.	**07**
Q.4	**(a)**	What do you understand by Vapour power cycles.?	**03**
	(b)	With neat sketch show comparison Carnot and Rankine cycle.	**04**
	(c)	Determine the cycle efficiency and steam consumption in kg/kWh for carnot cycle using steam between pressure of 35 bar dry saturated and 0.07 bar. Also find pump work required.	**07**

OR

Q.4	**(a)**	What do you mean by High grade energy and low grade energy?	**03**
	(b)	Explain Available energy and unavailable energy.	**04**
	(c)	Determine the cycle efficiency and steam consumption in kg/kWh for Rankine cycle using steam between pressure of 35 bar dry saturated and 0.07 bar. Also find pump work required.	**07**
Q.5	**(a)**	What do you mean by gas power cycles?	**03**
	(b)	Draw p-v and T-s diagrams for Otto Cycle.	**04**
	(c)	Engine working on Otto Cycle intakes air at pressure 1 bar, Temperature 27 ºC. Air is compressed adiabatically with a compression ratio of 7 and then heat is added at constant volume till temperature rises to 200K . Find air standard efficiency, pressure of air at end of compression, Heat addition during process and mean effective pressure of cycle. Take C_v=0.718 kJ/kg and γ=1.4.	**07**

OR

Q.5	**(a)**	State and explain Avogadro's law.	**03**
	(b)	State and explain Gibbs-Dalton's law.	**04**
	(c)	With neat sketch explain Diesel Cycle.	**07**