Seat No.: _____   Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY
BE- SEMESTER 1st / 2nd EXAMINATION (OLD SYLLABUS) – SUMMER - 2017

Subject Code: 110006   **Date: 31/05/2017**

Subject Name: Elements of Mechanical Engineering

Time: 2:30 PM to 05:00 PM   **Total Marks: 70**

Instructions:
1. **Attempt any five questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Use of Steam table is permitted.**

Q.1	**(a)**	State Zeroth law, First law and Second law of thermodynamics.	**03**
	(b)	With usual notations prove that $C_p – C_v = R$.	**04**
	(c)	Explain the construction and working of Babcock and Wilcox boiler with neat sketch.	**07**
Q.2	**(a)**	Briefly classify the fuels. Define H.C.V and L.C.V.	**03**
	(b)	Compare the following : 1) S.I. engine with C.I. engine. 2) 2-stroke with 4-stroke I.C. engine	**04**
	(c)	A cylinder contains $0.5 \, m^3$ of a gas at a pressure of 1 bar and 90^0C. The gas is compressed to a volume of $0.15 m^3$. The final pressure is 5 bar. Calculate: (i) the mass of gas (ii) value of index 'n' for compression (iii) the increase in internal energy. Take $\gamma = 1.4$ and $R = 294.2 \, J/kgK$.	**07**
Q.3	**(a)**	Differentiate clearly between governor and flywheel.	**03**
	(b)	Derive the equation of thermal efficiency of Carnot Cycle. Why it cannot be used in practice? Discuss.	**04**
	(c)	3 kg of steam at pressure of 10 bar exists in the following conditions. Calculate its enthalpy in each of the following cases: (i) steam with dryness fraction = 0.91 (ii) steam at temperature 200^0C (iii) Dry and Saturated steam.	**07**
Q.4	**(a)**	Write down the working of Fusible plug, Blow-off cock and Pressure gauge.	**03**
	(b)	Explain the working of Separating and throttling Calorimeter.	**04**
	(c)	A two cylinder four stroke petrol engine has swept volume of $1.1 \times 10^{-3} \, m^3$. It runs at 950 rpm and consumes 2.2 kg of petrol per hour having C.V. of 43000 kJ/kg. The mean effective pressure in both cylinders is 7.5 bars. Determine indicated thermal efficiency and relative efficiency if clearance volume is 15% of swept volume.	**07**
Q.5	**(a)**	Explain Double Acting Reciprocating pump.	**03**
	(b)	Explain the working of vapour compression refrigeration system.	**04**
	(c)	With usual notations derive an expression for work done for single stage single acting reciprocating air compressor by considering clearance volume.	**07**
Q.6	**(a)**	Define: (i) Refrigerating effect (ii) Priming (iii) COP	**03**
	(b)	Define steam boiler. Compare Fire tube boiler with Water tube boiler.	**04**

(c) A petrol engine has swept volume of 500 cm^3 and clearance volume of 55 cm^3. **07** At suction, pressure and temperature is 1 bar and 30^0C respectively and maximum temperature in the cycle is 1450^0C. Calculate air standard efficiency and mean effective pressure of the cycle. Take γ = 1.41, R = 0.287 kJ/kgK

Q.7 **(a)** Define: (i) Creep (ii) Toughness (iii) Fatigue **03**
(b) Explain Internal expanding shoe brake with neat sketch. **04**
(c) ClassifyMechanical drives. Explain in brief: (i) Cross belt drive (ii) Helical gear **07**

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