

GUJARAT TECHNOLOGICAL UNIVERSITY
BE- SEMESTER 1st / 2nd EXAMINATION (OLD SYLLABUS) – winter - 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 : **04**
1) S.I. engine with C.I. engine. 2) 2-stroke with 4-stroke I.C. engine
(c) A cylinder contains 0.5 m^3 of a gas at a pressure of 1 bar and 90°C . 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 $R = 294.2 \text{ J/kgK}$. **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 10bar 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°C (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 $1.1 \times 10^{-3} \text{ m}^3$. 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°C respectively and maximum temperature in the cycle is 1450°C . Calculate air standard efficiency and mean effective pressure of the cycle. Take $\gamma = 1.41$, $R = 0.287\text{ kJ/kgK}$

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