

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- Ist /IInd SEMESTER-EXAMINATION – MAY/JUNE - 2012

Subject code: 110006

Date: 30/05/2012

Subject Name: Elements of Mechanical Engineering

Time: 10:30 am – 01:00 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 calculator and steam table is permissible.
5. Each question carry equal marks

- Q.1** (a) State whether the following statements are **true or false** : **4**
- (1) Fusible plug is used to protect the boiler against overheating caused due to the low water level.
- (2) A system with mass transfer along with energy transfer across its boundary is called an open system.
- (3) Prime mover is a device which converts natural energy into mechanical energy.
- (4) Spark plug is used in diesel engine.
- (b) What is boiler? Compare fire tube boiler with water tube boiler. **3**
- (c) Explain construction and working of Lancashire boiler. **7**
- Q.2** (a) Define the term 'Refrigeration'. Explain Vapour compression refrigerator. **4**
- (b) What are basic gas processes? How are they shown graphically on p-v diagram? **3**
- (c) 0.3m³ of air of mass 1 kg at an initial pressure of 5.5 bar expands to a final volume of 0.5m³ If the expansion is according to the law $pv^{1.3} = C$, Find the work done, the change in internal energy and heat received or rejected during the process. **7**
- Take $C_v = 0.708$ kJ/kg K and $R = 0.287$ kJ/kg K for air.
- Q.3** (a) How much heat is needed to convert 4 kg of water at 20⁰C into steam at 8 bar and 200⁰C. Take C_p of superheated steam as 2.1 kJ/kg K and specific heat of water as 4.187 kJ/kg K. **4**
- (b) Define the following terms: **3**
- (a) Wet steam (b) Degree of superheat (c) Saturation temperature
- (c) What do you mean by Dryness fraction? Describe Combined calorimeter with a neat sketch. **7**
- Q.4** (a) Explain Double acting reciprocating pump with a neat sketch. **4**
- (b) The efficiency of an Otto cycle depends upon its compression ratio- prove it. **3**
- (c) In air standard Otto cycle the maximum and minimum temperatures are 1673 K and 288 K. The heat supplied per kg of air is 800 kJ. Calculate : (1) the compression ratio (2) Efficiency (3) Maximum and minimum pressures. **7**
- Take $C_v = 0.718$ kJ/kg K and $\gamma = 1.4$

- Q.5** (a) Give comparison of belt drive, Chain drive and gear drive. **4**
 (b) Briefly Classify air compressors. Write the uses of compressed air **3**
 (c) A single stage air compressor is required to compress 72 m^3 of air per minute from 15°C and 1 bar to 8 bar pressure. **7**
 Find the temperature at the end of the compression, work done, power and heat rejected during each of the following processes :
 (i) Isothermal compression
 (ii) Polytropic compression following the law $pV^{1.25} = C$.
 Neglect Clearance.
- Q. 6** (a) A two stroke cycle internal combustion engine has a piston diameter of 110 mm and a stroke length of 140 mm. The mep exerted on the head of the piston is 600 kN/m^2 . If it runs at a speed of 1000 r.p.m. Find the indicated power developed. **4**
 (b) Give difference between Two stroke and Four stroke I.C. Engine **3**
 (c) Explain working of Four stroke petrol engine with neat diagram. **7**
- Q.7** **3**
 (a) Distinguish between a coupling and a clutch. **3**
 (b) List the various Liquid fuels. State its merits over solid fuels. **3**
 (c) Explain the following : **8**
 (1) State the important properties of engineering materials.
 (2) What are the different methods of I.C. engine governing? Explain the difference between the quality method and the quantity method of governing.
