GANPAT UNIVERSITY
B.TECH SEM. IIND (CE/IT/EC/BM) ENGINEERING
CBCS REGULAR EXAMINATION MAY/JUNE - 2013
2ME101 ELEMENTS OF MECHANICAL ENGINEERING

TIME: - 3 HOURS   **TOTAL MARKS-70**

INSTRUCTIONS: (1) All questions are compulsory.
(2) Assume suitable data if necessary.
(3) Figure to the right indicates full marks.
(4) Scientific calculator and steam table is allowed.

SECTION - I

Que.-1 a 0.5 kg of air at a pressure of 1.7 bar occupies 0.3 m³ and from this condition is compressed to 16 bar according to the law $PV^{1.25}$ = C. Calculate: (i) The change in internal energy of the air (ii) The workdone on or by the air. (iii) The heat received or rejected by the air.
Take Cp = 1.005 kJ/kg K and Cv = 0.714 kJ/kg K.   **05**

b Define prime movers. Describe the sources used by prime movers. **04**

c Define heat and work. What are the different sign used for heat and work in practice. **03**

OR

Que.-1 a Derive characteristic equation of perfect gas. **04**

b Derive the following equations for Constant volume process with P-V diagram:
(i) Heat transfer (ii) Change in enthalpy. **04**

c 2000 m³ of water is to be delivered in 30 minutes to a vertical distance of 30 m. Determine the power required. Neglect friction and other losses. **04**

Que.-2 a 1 kg of air is taken through (i) Otto cycle (ii) Diesel cycle. Initially air is at 290 K and 1 bar. The compression ratio for both cycles is 12 and heat addition is 1900 kJ in each cycle. Calculate the efficiency for the both cycles. **06**

b Explain the working and construction of the Throttling calorimeter. **05**

OR

Que.-2 a Find the internal energy of 1 kg of steam at a pressure of 15 bar when: **06**
(i) The steam superheated with temperature of 400°C.
(ii) The steam is wet with dryness fraction 0.9.
Take Cps = 2.1 kJ/kg K.

b Derive an expression of air standard efficiency for Otto cycle with P-V diagram. **05**

Que.-3 **Attempt Any Three.** **12**
a Draw a neat sketch of water tube boiler with all details. List the all mountings and accessories used in this boiler.
b Classify the boiler in details.
c Differentiate between the following:
(i) Gas and Vapour   (ii) Open system and Closed system.
d Enlist the various Liquid fuels. Write the merits and demerits over solid fuels.

SECTION - II

Que.-4 **a** Explain the working of four stroke CI engine.   **06**

      b The following readings were taken during the test on a single cylinder four stroke oil   **06**
engine:
Cylinder diameter is 270 mm, stroke length is 380 mm, mean effective pressure is 6
bar, engine speed 250 rpm, Net load on brake 1000 N, effective mean diameter of
brake 1.5 m, fuel used 10 kg/hr, C.V. of fuel is 44000 kJ/kg.
Calculate: (i) Brake power (ii) Indicated power (iii) Mechanical efficiency (iv)
Indicated thermal efficiency.

OR

Que.-4 **a** Give the difference between Two stroke and Four stroke engine.   **04**

      b Write the function of following components: **04**
(i) Piston   (ii) Crank shaft   (iii) Carburetor   (iv) Flywheel

      c A two stroke internal combustion engine has stroke length of 160 mm and cylinder   **04**
bore 100 mm. Its mean effective pressure is 5.8 bar and speed of the engine is 1050
rpm. Determine brake power of the engine. Assume mechanical efficiency as 82%.

Que.-5 **a** Air is to be compressed in a single stage reciprocating compressor from 1.013 bar   **06**
and 15°C to 7 bar. Calculate the indicated power required for a free delivery of 0.3
m^3/min. When the compression process is:
(i) Isentropic (ii) Reversible isothermal (iii) Polytropic with n = 1.25. Neglect
clearance.

      b Explain the working and construction of Hartnell governor.   **05**

OR

Que.-5 **a** Derive an expression of workdone of single cylinder reciprocating air compressor   **06**
without considering the clearance volume.

      b Classify centrifugal pump. Describe the volute type centrifugal pump.   **05**

Que.-6 **Attempt Any Three.**   **12**

      a Give the difference between Individual drive and Group drive.

      b Explain the Vapour Compression Refrigeration Cycle with diagram.

      c Give the details classification of Air Compressor.

      d Enlist the types of Couplings. Explain any one with a neat sketch.

END OF PAPER