Seat No.: _____ *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY

B.E. Sem-II [All Branch] examination June 2009

Subject code: 110006

Subject Name: Elements of Mechanical Engineering

Date: 15/06/2009 **Time: 10:30am-1:00pm**

Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Use of steam table is permissible.**

Q: 1 **(a)** What is Prime mover? How are they classified? **[03]**

(b) With usual notations prove that Cp – Cv = R. **[04]**

(c) A gas whose pressure, volume, and temperatures are 2.75 bar, 0.09m^3 and 185°C respectively has the state changed at constant pressure until its temperature becomes 15°C. Calculate **[07]**

(i) Heat Transferred.

(ii) Work Done during the process.

Take R= 0.29 KJ/Kg K , and Cp = 1.005 KJ/Kg K.

Q: 2 **(a) Define the following terms :** **[03]**

(i) Indicated thermal efficiency.

(ii) Compression ratio.

(iii) Scavenging.

(b) Prove that dryness fraction + wetness fraction = 1. **[04]**

(c) The following readings were taken during the test on a single cylinder four stroke, Oil engine : **[07]**

Cylinder diameter	= 270 mm
Stroke Length	= 380 mm
Mean effective pressure	= 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	= 44400 KJ/Kg

Calculate:- (i) Brake Power.

(ii) Indicated Power.

(iii) Mechanical Efficiency.

(iv) Indicated Thermal Efficiency.

OR

(c) A six cylinder 4 Stroke IC Engine is to develop 89.5 KW indicated power at 800 rpm. The stroke to bore ratio is 1.25 : 1. Assuming mechanical efficiency of 80% and brake mean effective pressure of 5 bar. Determine the diameter and stroke Of the Engine. **[07]**

Q: 3 **(a)** Explain the essential elements of a Heat Engine. **[03]**

(b) Show that the efficiency of Otto cycle is a function of Compression Ratio only. **[04]**

(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. **[07]**

(i) The Compression Ratio.
(ii) Efficiency.
(iii) Max & Min Pressures.

Take Cv = 0.718 KJ/Kg K & $\gamma = 1.4$ for air.

OR

Q: 3 **(a)** Define the following terms in connection with boiler. **[03]**

(i) Mountings.
(ii) Actual Evaporation.
(iii) Boiler Efficiency.

(b) Explain with neat sketch the constructional details and working of the Ramsbottom type spring loaded Safety Valve. **[04]**

(c) A Steam Generator evaporates 18000 Kg/Hr of steam at 12 bar Pressure and steam is 97% dry. Feed water temperature = 105 °C. Coal is fired at the rate of 2050 Kg/Hr. C.V. of Coal is 27400 KJ/Kg. Calculate. **[07]**

(i) Heat Supplied per Hour.
(ii) Thermal Efficiency.
(iii) Actual Evaporation.

Q: 4 **(a)** What is the function of Governor? Classify the Governing methods used in I.C. engines and describe quantity method of Governing. **[03]**

(b) Prove that the work done per Kg of air in Reciprocating Air Compressor neglecting clearance volume is given by **[04]**

$$W = RT_1 \, n / (n-1) \, [(Rp)^{(n-1)/n} - 1] \text{, Where Rp = Pressure Ratio.}$$

(c) Air is to be Compressed in a single stage reciprocating compressor from 1.013 bar and 15°C to 7 bar. Calculate the indicated power required for a free air delivery of 0.3 m^3 / min when the compression process is. **[07]**

(i) Isentropic (ii) Reversible Isothermal
(iii) Polytropic with n= 1.25 . What will be the delivery temperature in each case ? Neglect clearance.

OR

Q: 4 **(a)** Why air conditioning is required in air craft ? **[03]**

(b) With neat sketch describe the working of simple vapour compression refrigeration Cycle. (Drawing p-h and T-Ø chart) **[04]**

(c) State the different types of centrifugal pumps. Describe diffuser type of centrifugal pump. **[07]**

Q: 5 **(a)** What is function of Coupling? Name only various types of couplings. Explain Oldham coupling. **[04]**

(b) Write short note on Helical gear. **[04]**

(c) What are bearings? How are they classified? Explain Thrust Bearing. **[06]**

OR

Q: 5 **(a)** **Write short notes on :** **[06]**

(i) CNG
(ii) Composite materials.

(b) State and explain Zeroth law of Thermodynamics. **[04]**

(c) Enlist physical properties of Engineering materials **[04]**

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