Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– 1st / 2nd • EXAMINATION – WINTER 2013

Subject Code: 110006 Date: 21-12-2013

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.**

Q.1 (a) Explain with a neat sketch the babcock and Wilcox water tube boiler. Show path of the gases and water in it. **5**

(b) Explain, with suitable diagram, working principle of disc clutch and band brake. **5**

(c) Define ferrous and non ferrous materials with their properties and suitable application. **4**

Q.2 (a) Discuss working of diesel four stroke cycle engine with help of schematic diagram. **5**

(b) How much heat is to be added to convert 4 kg of water at 20º C in to steam at 8 bar and 200º C. Take C_p of superheated steam as 2.1 KJ/kg and specific heat of water as 4.187 KJ/kg K. **5**

(c) Define following terms **4**

(i) Absolute pressure and Atmospheric pressure

(ii) Enthalpy and Energy

Q.3 (a) Explain with a neat sketch the working of a vapour compression refrigerator. **5**

(b) In an engine working on Otto cycle, air has a pressure of 1 bar and temperature 30º C at the entry. Air is compressed with a compression ratio of 6. The heat is added at constant volume until the temperature rises to 1500º C. Determine (i) air standard efficiency (ii) pressure and temperature at the end of compression (iii) heat supplied. **5**

Take C_v = 0.718 kJ/Kg K, R = 0.287 kJ/Kg K.

(c) What are LPG and CNG? **4**

Q.4 (a) Enlist various types of pulleys used for power drives. Explain any two with neat sketch and their application. **5**

(b) A single stage, single acting compressor has a bore of 170 mm and stroke of 260 mm. it runs at 130 rpm. The suction pressure is 1 bar and delivery pressure is 9 bar. Find the indicated power if compression (i) follows the law $pv^{1.25}$ = constant and (ii) is isothermal. Also find isothermal efficiency. Assume there is no clearance volume. **5**

(c) Draw a neat sketch of cochran boiler with all labels. **4**

Q.5 (a) What is the function of pump? Classify the pumps. Explain with sketch the working of single acting piston pump. **5**

(b) Air enters a compressor at 0.2 Mpa and 30º C having a volume of 2 m^3/kg is compressed to 1 Mpa isothermally. Calculate (i) work down (ii) change in I.E. (iii) Heat transferred **5**

(c) Differentiate between C.I and S.I. engine. **4**

Q.6 (a) Derive an equation for work done in case of single stage single acting reciprocating air compressor neglecting clearance. **5**

(b) What do you understand by mechanical and thermal efficiency? A steam plant uses 3 tonne of coal/hr. The steam is fed to turbine the output of which is 4 MW. The calorific value of the coal is 30 MJ/Kg. calculate the thermal efficiency of the plant. **5**

(c) Define following mechanical Properties. **4**

(i) Hardness (ii) Toughness (iii) Ductility (iv) Elasticity.

Q.7 (a) Derive the expression pV/ T = constant with the help of Boyle's law and charle's law. **5**

(b) What is governor? What are the various types of governors? Explain watt governor with neat sketch. **5**

(c) Explain working principle of air conditioning **4**

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