Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

B.E. Sem- 1st Regular Examination January 2011

Subject code: 110006
Subject Name: Elements of Mechanical Engineering

Date: 08/ 01 /2011 **Time: 10.30 am - 01.00 pm**
Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 Answer the following questions in brief. (Any seven) **14**

1 Define the terms (i) specific heat of a substance (ii) brake thermal efficiency

2 What is the difference between mountings and accessories of a boiler ?

3 Define (i) dry saturated steam (ii) enthalpy of superheated steam

4 The two specific heats of air are $C_p = 1.005$ kJ/kg-K and $C_v = 0.718$ kJ/kg-K. Find gas constant for air in the unit J/kg-K.

5 What are the functions of (i) injector in diesel engine and (ii) carburetor in petrol engine ?

6 How a governor differs from a flywheel as a speed controlling device ?

7 What are the uses of compressed air ?

8 What is priming ? Why is it required for a centrifugal pump ?

9 Explain in brief the properties (i) elasticity and (ii) hardness of the material.

Q.2 **(a)** Select the most appropriate answer for each question. **07**

(1) Unit of mechanical power is _____
(a) Joule (b) Watt (c) Pascal (d) Newton

(2) _____ is a high pressure boiler.
(a) Cochran (b) Lancashire (c) Babcock and Wilcox (d) Benson

(3) Dryness fraction of wet steam is _____
(a) greater than 1 (b) =1 (c) less than 1 (d) 0

(4) In SI system, value of universal gas constant is _____
(a) 8.314 kJ/kg mole-K (b) 8.314 kJ/kg-K (c) 8314 kJ/kg-K (d) 8314 kJ/kg mole-K

(5) Travel of piston from one dead centre to other dead centre is termed as _____
(a) stroke length (b) swept volume (c) clearance volume (d) compression ratio

(6) In a rotary compressor, maximum delivery pressure may be around _____
(a) 1000 bar (b) 100 bar (c) 2 bar (d) 10 bar

(7) 1 bar = _____ N/m^2
(a) 10^3 (b) 10^5 (c) 10^{-3} (d) 10^{-5}

(b) How prime movers are classified ? Explain different sources of energy used by them. **07**

OR

(b) Which are common solid fuels ?Write in brief about each of them Define calorific value of fuel. **07**

Q.3 **(a)** Explain with neat sketch construction and working of a cochran boiler. **07**

(b) What is a superheated steam ? How much heat is added to convert 3 kg of water at 30 ^oC into steam at 8 bar and 210 ^oC ? Take specific heat of superheated steam as 2.1 kJ/kg-K and that of water as 4.186 kJ/kg-K **07**

OR

Q.3 **(a)** Define adiabatic process. Derive the relation between P, V and T for this process. Also derive the expression for work done and change in internal energy for this process. **07**

(b) Explain working of Rankine cycle with P-V diagram. Derive the formula for efficiency of Rankine cycle. **07**

Q.4	**(a)**	Explain with neat sketch working of 4-stroke diesel engine	**07**
	(b)	A four cylinder 4-stroke petrol engine develops 200 kW brake power at 2500 rpm. Stroke to bore ratio is 1.2. If mean effective pressure is 10 bar and mechanical efficiency is 81%, calculate bore and stroke of the engine. Also calculate indicated thermal efficiency and brake thermal efficiency if 65 kg/hr of petrol is consumed having calorific value of 42000 kJ/kg	**07**

OR

Q.4	**(a)**	Explain with neat sketch vapor compression refrigeration cycle. What is C. O. P. ?	**07**
	(b)	What is air compressor ? Air is to be compressed through a pressure ratio of 10 from a pressure of 1 bar in a single stage air compressor. Free air delivery is 3 m^3 /min. Swept volume = 14 litres. Index of compression is 1.3. Neglect clearance volume. Calculate (1) power required in kW (2) Rotational speed of the compressor	**07**
Q.5	**(a)**	What is the function of a pump ? Explain with neat sketch, working of centrifugal pump.	**07**
	(b)	Write note on the following engineering materials: (i) mild steel (ii) plywood (iii) fireclay	**07**

OR

Q.5	**(a)**	Explain (i) muff coupling (ii) single plate clutch (iii) band brake	**07**
	(b)	Explain in brief (i) worm gears (ii) rack and pinion (iii) crossed belt drive	**07**

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