*Seat No.: _____* *Enrolment No._____*

# GUJARAT TECHNOLOGICAL UNIVERSITY

**B.E. Sem-I Remedial Examination 2010**

## Subject code: 110006

## Subject Name: Elements of Mechanical Engineering

**Date: 06 / 04 / 2010** **Time: 12.00 Noon – 02.30 pm**

**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 permitted**

**Q.1** **(a)** What are different types of coal? State their properties. **04**

**(b)** Enlist properties of copper? State their applications **03**

**(c)** A cylindrical vessel of 1 m diameter and 4 m length has hydrogen gas at pressure of 100 k Pa and 27° C. Determine the amount of heat to be supplied so as to increase pressure to 125 k Pa. for hydrogen take **07**
Cp= 14.307 k J/ Kg K , Cv=10.183 k J/ Kg K

**Q.2** **(a)** With neat sketch explain construction and working of throttling calorimeter **04**

**(b)** Sate the following Charles Law, Boyles Law, Characteristic gas equation **03**

**(c)** In an Otto Cycle, air at 15 ° C and 1 bar is compressed adiabatically until the pressure is 15 bar. Heat is added at constant volume until pressure rises to 40 bar. Calculate (i) Air standard efficiency (ii) compression ratio and (iii) mean effective pressure for cycle **07**
Assume Cv= 0.718 k J/ Kg K
R= 8.134 k J/ k mole K.

**OR**

**(c)** $0.15m^3$ of air at pressure of 900 kPa and 300 ° C is expanded at constant pressure to 3 times its initial volume. It is expanded polytropically following the law $PV^{1.5}$ =C and finally compressed back to initial state isothermally. **07**
Calculate heat received, heat rejected, efficiency of cycle.

**Q.3** **(a)** With neat sketch explain construction and working of pressure gauge. **03**

**(b)** What are high pressure boilers? State their advantages and disadvantages of high pressure boilers. **04**

**(c)** During testing of single cylinder two stroke petrol engine following data is obtained, Brake torque 640 NM, Cylinder diameter 21cm, speed 350 rpm, stroke 28cm, mep 5.6 bar, oil consumption 8.16 Kg/hr, C.V. 42705 Kj/Kg . Determine **07**
Mechanical efficiency Indicated thermal Efficiency
Brake thermal efficiency Brake specific fuel consumption

**OR**

**Q.3** **(a)** Draw neat and labeled diagram of following **03**
(i) Cochran boiler

(ii) Fusible Plug

**(b)** With neat sketch explain working of four stroke petrol engine. **04**

**(c)** A steam generator evaporates 1800 kg / hr of steam at 12 bar pressure and steam is 97 ٪dry. Feed water temperature is 105 °C coal is fired at rate of 2050 kg/hr CV of coal is 27,400 KJ/ kg. Calculate heat supplied / hr, Thermal efficiency, Equivalent evaporation. **07**

**Q.4** **(a)** How are air compressors classified? **03**

**(b)** Write short note on fly wheel. **04**

**(c)** With neat sketch explain construction and working of gear pump and screw pump. **07**

**OR**

**Q.4** **(a)** State methods of governing IC Engines and describe any one. **03**

**(b)** Compare centrifugal pump and reciprocating pump. **04**

**(c)** A single stage reciprocating air compressor is required to compress 1 kg of air from 1 bar to 5 bar . Initial temperature of air is 27 °C. Calculate work for isothermal , isentropic and polytrophic compression for n= 1.25 **07**

**Q.5** **(a)** What is function of clutch in an automobile? List different types of clutches used in automobiles **03**

**(b)** What are refrigerants? State their desirable characteristics of refrigerants. **04**

**(c)** Draw neat and labeled sketches of following **07**

(i) open belt drive
(ii) quarter twist drive
(iii) fast and loose pulley drive
(iv) stepped pulley drive

**OR**

**Q.5** **(a)** What is function of coupling? Explain any one type of coupling used to connect two shafts. **03**

**(b)** Compare belt and gear drive. **04**

**(c)** Draw line diagram of vapour compression refrigeration cycle and represent on P-h and T-S diagram and state function of individual components of vapour compression refrigeration system. **07**