

**GUJARAT TECHNOLOGICAL UNIVERSITY****B.E. Sem-I & II Remedial Examination Nov/ Dec. 2010****Subject code: 110006****Subject Name: Elements of Mechanical Engineering****Date: 03 /12/2010****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** Attempt the Following:
- (a) Define the following terms: Prime mover, Boundary, Latent Heat, Temperature, First law of thermodynamics **05**
- (b) List advantages and disadvantages of gear drive **04**
- (c) An artificial satellite has a mass of 600 Kg and is moving towards moon. Calculate its kinetic and potential energies in (MJ) relative to earth when it is 50 Km from launching and moving at 2500 Km/hr. Take acceleration of earth's gravitational field as  $790 \text{ cm/s}^2$ . **05**
- Q.2** Answer the following.
- (a) With neat sketch explain construction and working of window air-conditioner. **08**
- (b) State three Engineering application of following materials, **06**
- i) Diamond ii) Composite materials.
- Q.3** Attempt the following:
- (a) With neat sketch explain construction and working of throttling calorimeter. **04**
- (b) One Kg of gas at  $100 \text{ kN/m}^2$  and  $17^\circ \text{C}$  is compressed isothermally to a pressure of  $2500 \text{ kN/m}^2$  in a cylinder. The characteristic equation of the gas is given by the equation  $PV = 260 T / \text{Kg}$  where T is in degree Kelvin. Find out **06**
- (i) The final temperature ii) Final Volume iii) compression ratio  
iv) change in enthalpy v) work done on the gas.
- (c) Explain prospects of following alternative fuels **04**
- i) Compressed natural gas ii) Hydrogen gas
- OR**
- Q.3** (a) What amount of heat would be required to produce 5 kg of steam at a pressure of 5 bar and temperature of  $250^\circ \text{C}$  from water at  $30^\circ \text{C}$ , take  $C_{ps}=2.1 \text{ KJ/Kg K}$ . **06**
- (b) Prove that  $PV^\gamma = C$ , for an adiabatic process. **04**
- (c) Differentiate between the following, **04**
- i) Lignite and bituminous coal ii) Higher C.V and lower C.V of fuel
- Q.4** (a) Prove that efficiency of Carnot Engine working between temperature limits  $T_1$  and  $T_2$  is given by the expression **05**
- $$\eta = \frac{T_1 - T_2}{T_1}$$
- (b) Draw neat and labeled sketches of following **04**
- i) Economizer ii) Babcock Wilcox Boiler
- (c) During a test on a single cylinder four stroke engine having compression ratio of 6, following data is recorded. **05**
- Bore = 10cm, Stroke = 12.5 cm, imep = 2.6 bar, dead load on dynamometer = 60N, spring balance reading = 19 N, Effective radius of flywheel = 40cm, fuel consumption = 1Kg/hr. Calorific value of fuel is 42, 000 KJ/ Kg, speed = 2000RPM, Determine its indicated power, brake power, mechanical, over all efficiency, air standard and relative efficiency.

**OR**

- Q.4** (a) An air standard diesel cycle has compression ratio of 16. The pressure and temperature at the beginning of compression stroke is 1 bar and 20 °C. The maximum temperature is 1431 °C. Determine the thermal efficiency and mean effective pressure for this cycle. **05**
- (b) What are high pressure boilers? State their advantages. **05**
- (c) Explain how I.C Engines are classified. **04**
- Q.5** (a) State different methods of governing I.C engines and explain any one. **04**
- (b) Explain following terms associated with pumps **06**  
i) Priming in Pumps    ii) Head    iii) Air chamber
- (c) A single stage reciprocating air compressor is required to compress 1Kg of air from 1 bar to 5 bar. Initial temperature of air is 27 °C. Calculate work required for isothermal, and poly tropic compression with  $n=1.25$  **04**

**OR**

- Q.5** (a) a) Differentiate between the following **06**  
i) Brake and Clutch  
ii) Governor and flywheel
- (b) State uses of compressed air and explain how compressors are classified. **04**
- (c) What do you understand by gear train? Discuss various types of gear train. **04**

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