

GUJARAT TECHNOLOGICAL UNIVERSITY
PDDC - SEMESTER-I • EXAMINATION – SUMMER • 2014

Subject Code: X11102**Date: 17-06-2014****Subject Name: Elements of Mechanical and Structural Engineering****Time: 02:30 pm - 05:00 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** (a) State and Describe classification of I.C.Engines. **07**
(b) Define the following terms with unit: **07**
(i) Force (ii) Heat (iii) Specific heat (iv) Work (v) Temperature
(vi) Pressure (vii) Efficiency
- Q.2** (a) Describe in detail Carnot cycle on p-v and T-s diagram. **07**
(b) Explain the working of Vapour Compression Refrigeration system. **07**

OR

- (b) Petrol engine with compression ratio of 5 has a brake thermal efficiency which is 45 percent of ideal air standard efficiency. The calorific value of fuel used is 32,000 KJ/Kg. Calculate the fuel consumption in Kg/hr if the engine delivers 25 Kw. **07**
- Q.3** (a) An engine operating on Diesel cycle has maximum pressure and temperature of 50 bar and 1800° C. Pressure and temperature at the beginning of compression are 1.5 bar and 35° C. Determine air standard efficiency of the cycle. Take $\gamma = 1.4$ for air. **07**
(b) What is prime mover? Explain its types. **07**

OR

- Q.3** (a) Derive formula for the elongation of tapered circular bar under the action of axial load. **07**
(b) Three steel pillars of equal length 150 mm and cross section area of 1200 mm² support a rigid platform of 240 kN. Take $E_s = 2 \times 10^5$ N/mm² & find stress developed in each pillar. **07**
- Q.4** (a) Derive relation between shear force, bending moment and rate of loading. **07**
(b) Define the following terms **07**
i) Stress ii) Strain iii) Hardness iv) Toughness v) Factor of Safety vi) Proof resilience
vii) Modulus of resilience

OR

- Q.4** (a) Differentiate between ductile and brittle materials. What are significant behaviors of these materials under tensile loading? **07**
(b) Derive an expression of stiffness of a hollow shaft under torsion. **07**
- Q.5** (a) Draw S.F & B.M diagram for a beam loaded as shown in fig.1 **07**
(b) A circular rod of 15 mm diameter and 500 mm long is subjected to a tensile force 70 kN. The modulus of elasticity for steel may be taken as 200 kN/mm². Find stress, strain and elongation of the bar due to applied load. **07**

OR

- Q.5 (a)** An Aluminum rod of 30 mm diameter and 1.2 m long is subjected to rise in temperature by 40°C . **07**
Calculate: i) natural expansion ii) if natural expansion is prevented, the stress developed in the bar iii) axial force in the bar. Take $E = 70\text{ GPa}$, Coefficient of thermal expansion $\alpha = 18 \times 10^{-6}$ per $^{\circ}\text{C}$.
- (b)** Derive an expression of stiffness of a shaft under torsion. **07**

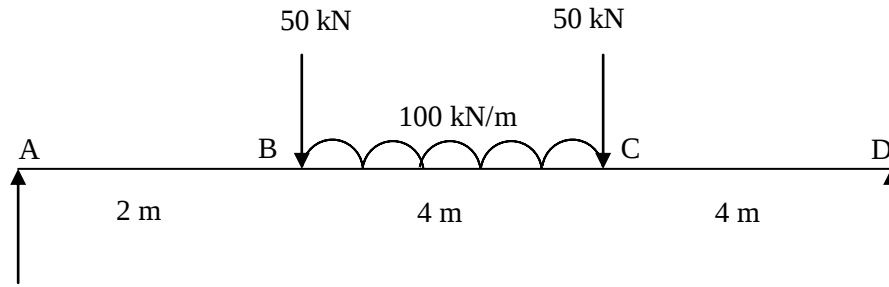


Fig. 1
