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.
- Make suitable assumptions wherever necessary. 2.
- 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 0.2 (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 07 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. An engine operating on Diesel cycle has maximum pressure and temperature of 50 bar 07 0.3 (a) 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. (b) What is prime mover? Explain its types. 07 OR Derive formula for the elongation of tapered circular bar under the action of 07 0.3 (a) axial load. Three steel pillars of equal length 150 mm and cross section area of 1200 mm2 support 07 **(b)** a rigid platform of 240 kN. Take $Es = 2 \times 10^5 \text{ N/mm}^2$ & find stress developed in each pillar. (a) Derive relation between shear force, bending moment and rate of loading. 07 0.4 Define the following terms **(b)** 07 i) Stress ii) Strain iii) Hardness iv) Toughness v) Factor of Safety vi) Proof resilience vii) Modulus of resilience OR Differentiate between ductile and brittle materials. What are significant behaviors of **Q.4** 07 (a) these materials under tensile loading? Derive an expression of stiffness of a hollow shaft under torsion. 07 **(b)** 0.5 (a) Draw S.F & B.M diagram for a beam loded as shown in fig.1 07 A circular rod of 15 mm diameter and 500 mm long is subjected to a tensile force 70 07 **(b)**
 - 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.

- Q.5 (a) An Aluminum rod of 30 mm diameter and 1.2 m long is subjected to rise in temperature by 40° C. 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 GPa, Coefficient of thermal expansion $\alpha = 18 \times 10^{-6}$ per °C.
 - (b) Derive an expression of stiffness of a shaft under torsion.



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