

**GUJARAT TECHNOLOGICAL UNIVERSITY****PDDC - SEMESTER-I • EXAMINATION – WINTER 2013****Subject Code: X11102****Date: 24-12-2013****Subject Name: Elements of Mechanical and Structural Engineering****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** (a) Explain different types of beam, support and loading with sketch. **07**  
(b) An engine operating on Diesel cycle has maximum pressure and temperature of 45 bar and 1500° C. Pressure and temperature at the beginning of compression are 1 bar and 27°C. Determine air standard efficiency of the cycle. Take  $\gamma = 1.4$  for air. **07**

- Q.2** (a) Explain Linear, shear, lateral, thermal and volumetric strain. **07**  
(b) Differentiate between ductile and brittle materials. What are significant behaviors of these materials under tensile loading? **07**

**OR**

- (b) Explain Carnot cycle on p-v and T-s diagram. **07**

- Q.3** (a) Explain the working of Four stroke Petrol engine with neat sketch. **07**  
(b) Derive the equation of work required in single stage reciprocating air compressor without clearance. **07**

**OR**

- Q.3** (a) Explain the working of Vapour Compression Refrigeration system. **07**  
(b) Explain advantages of multistage in reciprocating air compressor. Write applications of compressed air. **07**

- Q.4** (a) Explain the difference between: **07**  
(i) Positive Displacement pump and roto-dynamic pump.  
(ii) Single acting pump and Double acting pump  
(b) Explain with a neat sketch split air conditioner and state their advantages. **07**

**OR**

- Q.4** (a) Explain Linear, shear, lateral, thermal and volumetric strain. **07**  
(b) A steel bar 3.5 m long and 2000 mm<sup>2</sup> in area hangs vertically, which is securely fixed on its lower end. If a weight of 10 kN falls on the collar from a height of 8 mm, determine the stress developed in the bar. What will be the strain energy stored in the bar? Take E as 200 GPa. Explain Linear, shear, lateral, thermal and volumetric strain. **07**

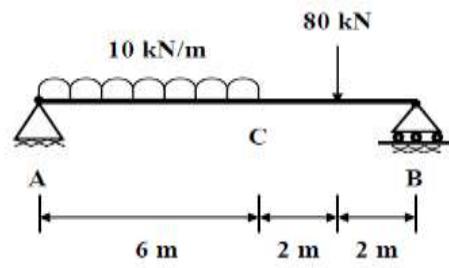
- Q.5** (a) An Aluminum rod of 25 mm diameter and 1.7 m long is subjected to rise in temperature by 35° C. Calculate i) natural expansion ii) if natural expansion is prevented, the stress developed in the bar iii) axial force in the bar. Take E = 70 GPa, Coefficient of thermal expansion  $\alpha = 18 \times 10^{-6}$  per °C. **07**  
(b) For torsion of a circular shaft, derive the equation  $T/I_p = \tau/R = C\theta/L$  with usual notations. **07**

**OR**

- Q.5** (a) Derive relation between shear force, bending moment and rate of loading. **07**

- (b) Find reactions about support A and B for the simply supported beam as shown in figure below.

07



\*\*\*\*\*