* 3 9 6 4 *

Strength of Materials - I
(113102)

P. Pages : 4

Time : Three Hours **Max. Marks : 80**

Instructions to Candidates :
1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with blue ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Attempt any two sub questions from each unit.
5. Figures to the right indicate full marks.
6. Use of non - programmable calculator is allowed.
7. Assume suitable data, if necessary.

UNIT - I

1. a) Define following terms. **8**

i) Factor of safety ii) Poisson's ratio

iii) Composite section iv) Temperature stress.

b) Show that the elongation of a bar of tapering section having smallest diameter 'd' at one end and diameter 'D' at other end, under the action of tensile force P is given by **8**

$$\delta L = \frac{4 P \cdot L}{\Pi \; D \; d \; E}$$

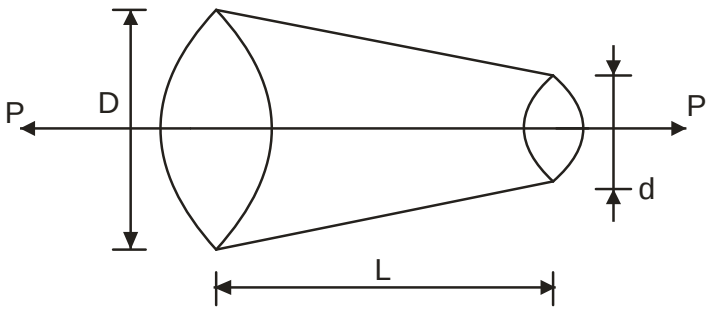

Figure 1

c) Find the stresses in the wires of the system shown in figure 2 the cross sectional area of the wires is $60mm^2$ and the temperature of system rises by 25ºC. **8**

Take E_s = 200GPa $\alpha_s = 12 \times 10^{-6} / ºC$

E_c = 110GPa $\alpha_c = 16 \times 10^{-6} / ºC$

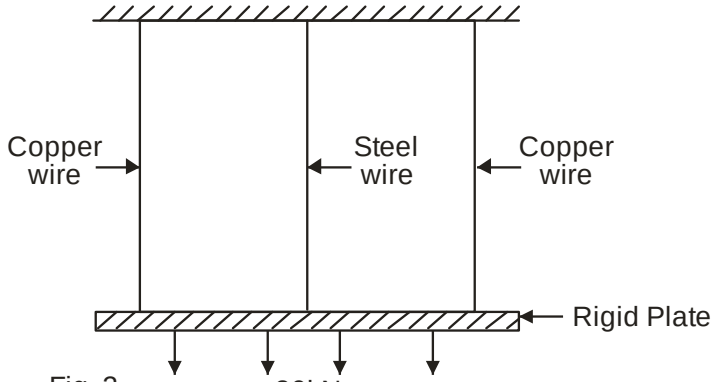

Fig. 2

UNIT - II

2. a) A member of rectangular section of length 600mm, width 80mm and thickness 20mm, is subject to normal stresses in the three direction as σ_x = 90MPa (Tensile) **8**
σ_y = 40MPa (compressive) and $\sigma_z = 0$. Calculate the strains in the three directions. Also calculate the change in three dimensions. Take poisson's ratio as 0.25, $E = 2 \times 10^5 MPa$.

b) A solid circular cone hangs from the top. Determine strain energy stored in it due to its self weight. Assume the specific weight of cone as 'r' and Modulus of elasticity as 'E'. **8**

c) A rod 12.5 mm in diameter is stretched by 3.2 mm under a steady load of 10,000N. What stress would be ..... produced in same bar due to impact load of 200 N falling through height of 75 mm. Take $E = 2.1 \times 10^5$ N/mm^2. **8**

UNIT - III

3. a) Define the shear force and Bending Moments. Also derive relationship between load intensity 'W', shear force 'F' and Bending moment 'M' **8**

b) The Tee section is shown in figure 3 given below is used as a beam simply supported over a span 6m. The beam carries udl of 7kN/m over entire span. Calculate the maximum value of tensile & compressive stresses setup in the cross section. **8**

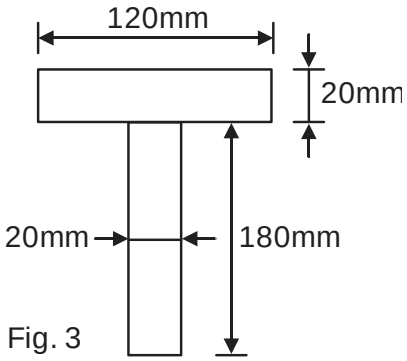

Fig. 3

c) Draw S.F.D & B.M.D. of the beam supported and loaded as shown in figure 4. **8**

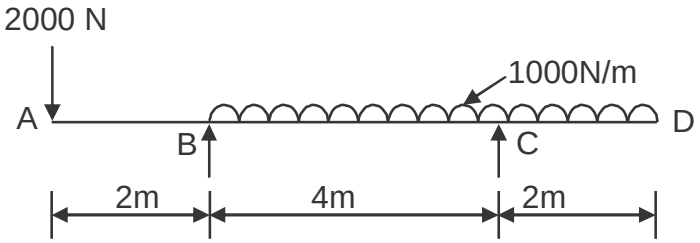

Figure 4

UNIT - IV

4. a) Derive the equation for shear stress. $\tau = \frac{SA\bar{Y}}{Ib}$ **8**

b) i) State the assumptions mode in the derivation of Torsion formula. **4**

ii) Prove that, for the rectangular cross section, maximum shear stress is 1.5 times of average shear stress i. e. $\tau_{max} = 1.5\ \tau_{ave}$ **4**

c) Determine the buckling load for a strut of flange width 100mm and overall depth 80mm. The thickness of both flange and web is 10mm. the strut is 3m long and hinged at both ends. Take $E = 200GN/m^2$. **8**

UNIT - V

5. a) A short column of rectangular cross section 80mm by 60mm carries a load of 40KN at a eccentricity of 20mm from the longer (outer) side and 35mm from the shorter (outer) side. Determine the maximum compressive and tensile stresses in the section. **8**

b) What is core of section? Derive the equation for core of a Rectangular section. Also state what is mean by Middle Third rule. **8**

c) The principle tensile stresses at a point are $100\,N/mm^2$ & $60\,N/mm^2$. Find normal, tangential and resultant stresses on a plane at 30^o with vertical plane. What is the angle of obliquity ? **8**

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