



- Notes :
1. All questions carry marks as indicated.
 2. Solve Question 1 OR Questions No. 2.
 3. Solve Question 3 OR Questions No. 4.
 4. Solve Question 5 OR Questions No. 6.
 5. Solve Question 7 OR Questions No. 8.
 6. Illustrate your answers whenever necessary with the help of neat sketches.
 7. Use of non programmable calculator is permitted.

1. A steel bar 2.4 m long has a circular cross section of diameter $d_1 = 20$ mm over one half & its length and diameter $d_2 = 12$ mm over the other half (fig. 1). The modulus of elasticity $E = 205$ GPa. **20**
- a) How much will the bar elongate under a tensile load $P = 22$ kN ?
 - b) If the same volume of material is made into a bar of constant dia- d and length 2.4 m what will be the elongation under the same load ?

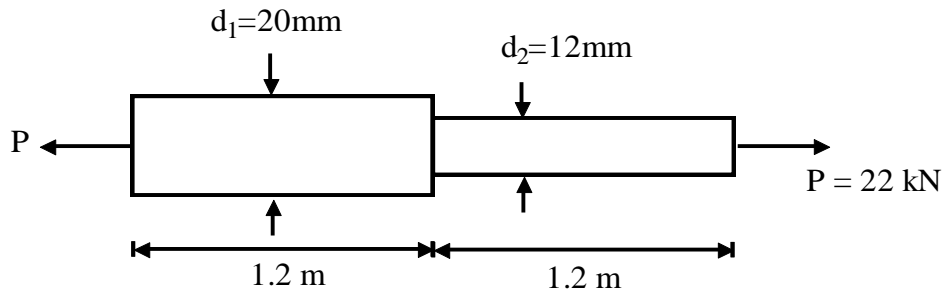


Fig. 1

2. A thin strip of steel of length $L = 0.9$ m and thickness $t = 10$ mm is bent by coupler. M_o . **20**
The deflection at the midpoint of the strip (measured from a line joining its end points) is found to be 7.5 mm. Determine the longitudinal normal strain ϵ at the top surface of the strip.

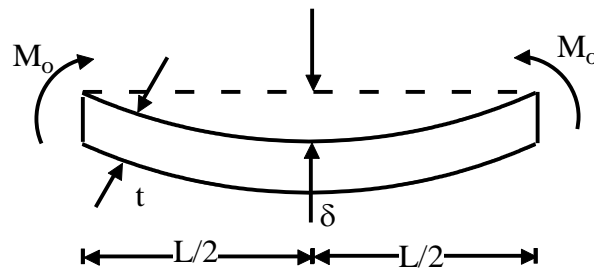
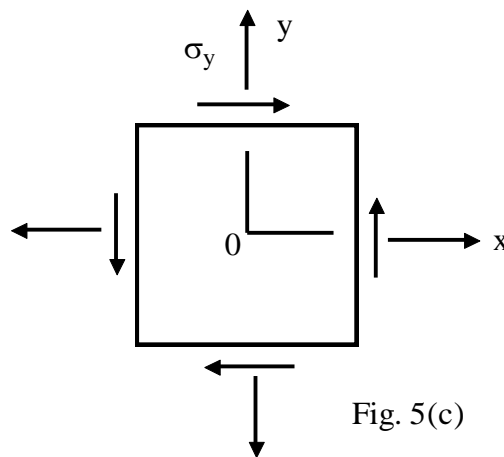


Fig. 2

- a) What is compatibility equation. State & explain its significance. **6**
- b) Derive the general differential equation of equilibrium in polar co-ordinate system. **14**

4. a) Derive the expression of stress in rotating circular disk. 12
- b) Carry out stress analysis of cylinder subjected to internal & external pressure condition. Identify few practical situations. 8
5. a) What is curved beam ? Explain in brief pure bending in curved beam. 7
- b) Explain the effect of elliptical hole on the stress distribution in the plate subjected to uniform tension. 7
- c) Using Mohr's circle determine the stresses acting on an element at an angle θ from the x axis. Show these stresses on a sketch of an element oriented at an angle θ (θ +ve clockwise) 6
- $\sigma_x = 31 \text{ MPa}$, $\sigma_y = 97 \text{ MPa}$
 $\tau_{xy} = -21 \text{ MPa}$ $\theta = -55^\circ$



6. a) Explain how isochromatic and isoclinic fringes are produced when stressed model is placed in plane polariscope. 12
- b) What do you mean by plane circularly and elliptically polarized light ? How they can be produced. 8
7. a) Explain stress optic law for normal incidence of light. 6
- b) Explain the techniques to separate principle stresses ? Explain shear difference method in details. 7
- c) Explain the procedure for calibration of photoelastic sheet. 7
8. Write short notes **any four**. 20
- i) Applications of experimental stress analysis.
- ii) Modern techniques of stress analysis.
- iii) Method of stress freezing.
- iv) Brittle coating method.
- v) Strain gauges & their application.
