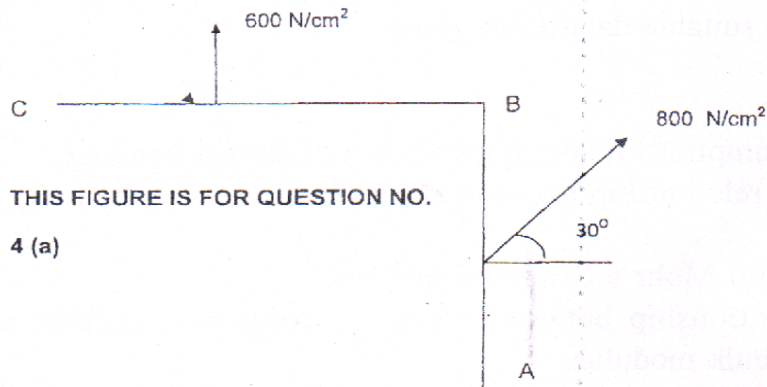


4. (a) For the state of stress at a point as shown in figure, determine:

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- (i) The resultant stress on plane BC
- (ii) The principal stresses and their directions.
- (iii) The maximum shear stresses and their planes.



(b) Calculate the instantaneous stress produced in a bar of 10 cm^2 in area and 3 m long by suddenly application of tensile load of unknown magnitude, if the extension of bar due to suddenly applied load is 1.5 mm. also determine the suddenly applied load. Take $E = 2 \times 10^5 \text{ N/mm}^2$

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(c) Define resilience, proof resilience and modulus of resilience.

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5. (a) A solid round bar 4 m long and 5 cm in diameter was found extended 4.6 mm under a tensile load of 50 kN. This bar is used as a strut with both ends hinged. Determine the buckling load for bar and also the safe load taking factor of safety as 4.

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(b) A masonry pier of 3 m x 4 m supports a vertical load of 80 kN at an eccentricity of 0.5 m along y axis and 1 m along x axis respectively.

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- (i) Find the stresses developed at each corner of the pier.
- (ii) What additional load should be placed at the centre of the pier, so that there is no tension anywhere in the pier section?
- (iii) What are the stresses at the corners with the additional load in the centre?

6. (a) A cast iron beam with dimensions as given here. [TOP FLANGE: $80 \times 20 \text{ mm}$, WEB: $20 \text{ mm} \times 200 \text{ mm}$ and BOTTOM FLANGE: $160 \text{ mm} \times 40 \text{ mm}$]. The beam is simply supported over a span of 5 meters. If the tensile stress is not to exceed 20 N/mm^2 , find the safe udl which the beam can carry. Find also the maximum compressive stress.

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(b) For a T section with dimension given here. [TOP FLANGE: $100 \times 20 \text{ mm}$, WEB: $20 \text{ mm} \times 80 \text{ mm}$]. Draw shear stress diagram if it is subjected to a shear force of 50 kN.

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(c) Find the maximum shear stress in a solid circular shaft of diameter 15 cm when the shaft transmits 150 kW power at 180 r.p.m.

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