SE Civil III CBGS
SOM

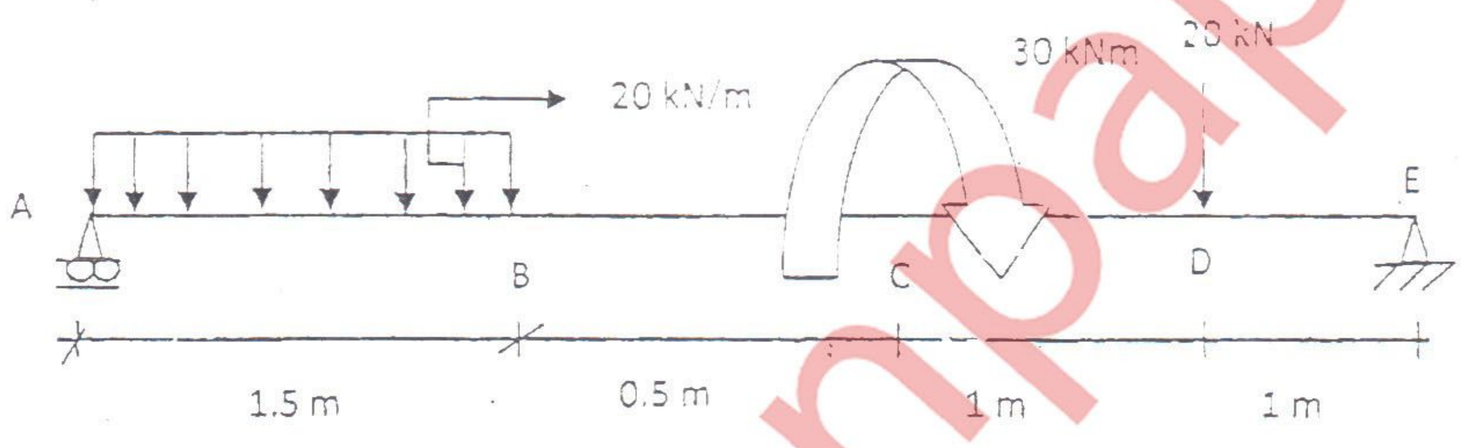
QP Code : **14590**

(3 Hours) [ Total Marks : 80

**N. B. :** (1) Question No. 1 is **compulsory**.
(2) Attempt any **three** out of the remaining **five** questions.
(3) Assume suitable data if not given.

1. Attempt any **four** :– **20**
   (a) Write the assumptions made in the theory of simple bending.
   (b) Establish the relationship between shear force, bending moment and rate of loading.
   (c) Write a note on Mohr's Circle of stresses.
   (d) Establish relationship between young modulus of elasticity, modulus of rigidity and bulk modulus.
   (e) A cylindrical shell is subjected to an internal fluid pressure, find an expression for change in diameter and change in length of cylinder..

2. (a) Draw a shear force diagram and bending moment diagram for a beam as shown in figures below. **10**




   (b) Explain concept of contra flexure in bending and procedure to locate it. **5**
   (c) Explain how to determine the young modulus of elasticity for mild steel and tor steel. **5**

3. (a) A steel rod of 3 cm diameter and 5 m long is connected to two grips and the rod is maintained at a temperature of 95 °C. determine the stress and pull exerted when the temperature falls to 30 °C, if: **8**
      (i) The ends do not yield, and
      (ii) The ends yield by 0.12 cm, Take $E = 2\times10^5$ MN/mm$^2$ and $\alpha = 12 \times 10^{-6}$ /°C.
   (b) Distinguish between: **6**
      (i) Stress and strain
      (ii) Force and stress, and
      (iii) Tensile stress and compressive stress.
   (c) Explain with Mohr's Circle method, the procedure for determining the magnitude and direction of shear stress and normal stress on a inclined plane in a member subjected to axial stress of a in horizontal direction. Also find maximum shear stress and its location. **6**

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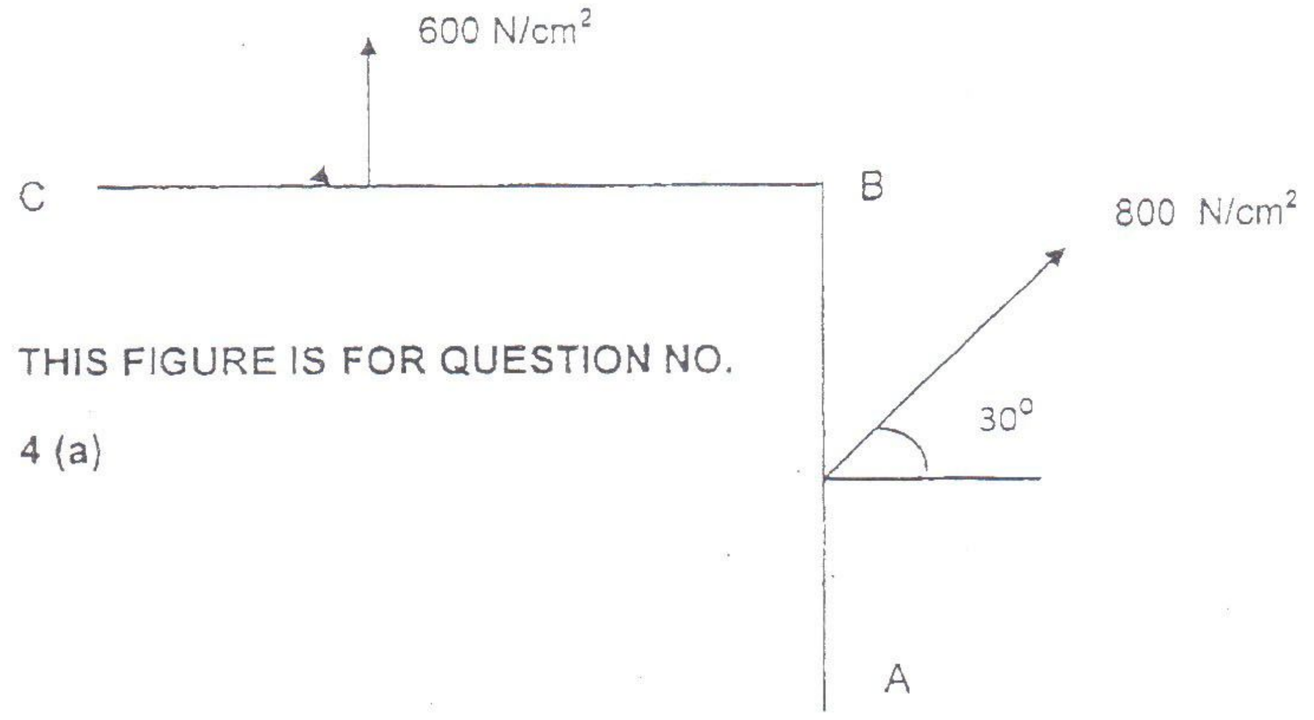
4. (a) For the state of stress at a point as shown in figure, determine: 10
(i) The resultant stress on plane BC
(ii) The principal stresses and their directions.
(iii) The maximum shear stresses and their planes.




THIS FIGURE IS FOR QUESTION NO.
4 (a)

(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 = $2\times10^5$ $N/mm^2$ 6
(c) Define resilience, proof resilience and modulus of resilience. 4

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. 10
(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. 10
(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: 80×20 mm, WEB: 20 mm x200 mm and BOTTOM FLANGE: 160 mm x 40 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. 10
(b) For a T section with dimension given here. [TOP FLANGE: 100×20 mm, WEB: 20 mm ×80 mm]. Draw shear stress diagram if it is subjected to a shear force of 50 kN. 5
(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. 5

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