B. TECH. SEM - III (MECHANICAL ENGG.) (2014 COURSE)
(CBCS) : SUMMER - 2018
SUBJECT : SOLID MECHANICS

Day : **Tuesday**
Date : **22/05/2018**

S-2018-2255

Time : **02.30 PM TO 05.30 PM**
Max. Marks : 60

N.B.:

1) All questions are **COMPULSORY**.
2) Figures to the right indicate **FULL** marks.
3) Use of non-programmable **CALCULATOR** is allowed.
4) Assume suitable data if necessary.

Q.1 A tension bar 5 m long is made up of two parts, 3 m of its length has a cross sectional area of 10 cm^2 while the remaining 2 m has a cross sectional area of 20 cm^2. An axial load of 80 kN is gradually applied. Find the total strain energy produced in the bar and compare this value with that obtained in a uniform bar of the same length and having the same volume when under the same load. Take E = 2×10^5 N/mm^2. **[10]**

OR

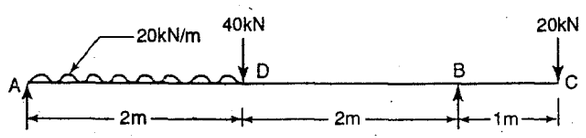
A piece of material is subjected to three mutually perpendicular tensile stresses and the strains in the three directions are in the ratio 3:4:5. If the value of Poisson's ratio is 0.2857 find the ratio of the stresses and their values when the greatest stress is 90 N/mm^2.

Q.2 Direct stresses of 120 MN/m^2 in tension and 90 MN/m^2 in compression are applied to an elastic material at a certain point on planes at right angles to another. If the maximum principal stress is not to exceed 150 MN/mm^2 in tension, to what shearing stress can the material be subjected? What is then the maximum resulting shearing stress in the material? Also find the magnitude of the other principal stress and its inclination to 120 MN/m^2 stress. **[10]**

OR

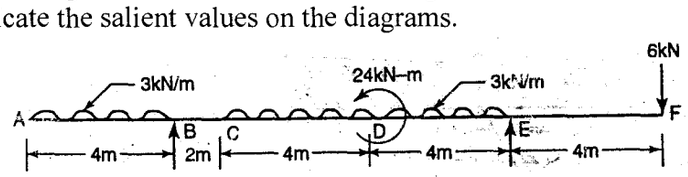
A circular shaft of diameter 50 mm is subjected to a maximum bending moment of 3×10^5 N-mm and a twisting moment of 5×10^5 N-mm. Find the factor of safety of the shaft using maximum shear stress theory. The yield stress of the shaft is not to exceed 90 N/mm^2.

Q.3 Draw shear force and bending moment diagram for the overhanging beam shown and clearly indicate point of contraflexure. **[10]**



OR

Draw the bending moment and shear force diagrams for the beam shown in figure. Indicate the salient values on the diagrams.



P.T.O.

Q.4 A hollow shaft of diameter ratio $\frac{3}{8}$ is required to transmit 600kW at 110 rpm. **[10]**

The maximum torque being 20% greater than the mean. Shear stress is not to exceed 63 N/mm^2 and the twist in a length of 3 m not to exceed 1.4 degrees. Calculate external diameter of shaft which would satisfy these conditions. Take modulus of rigidity = 84 GPa.

OR

Determine:

a) Slope at the left support

b) Deflection under the load

c) Maximum deflection of a simply supported beam of length 5 m, which is carrying a point load of 5 kN at a distance of 3 m from the left end.

Take E = 2 × 10^5 N/mm^2 and I = 1 × 10^8 mm^4.

Q.5 A CI beam of I section with top flange 15 cm × 1 cm bottom flange 20 × 2 cm, web 27 × 1 cm is supported over a span of 6 m. If permissible stress 100 MPa in compression and 25 MPa in tension, what uniformly distributed load can be safely applied on beam. **[10]**

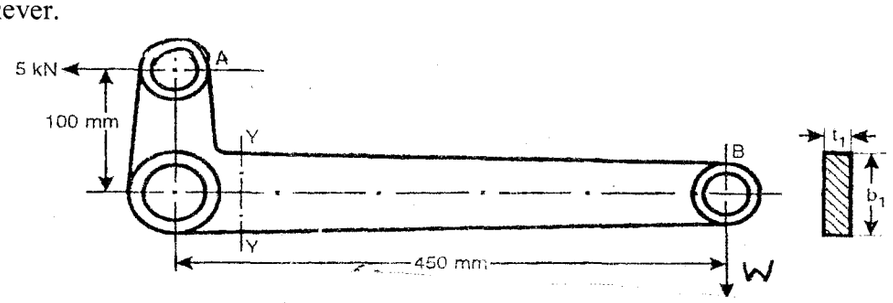
OR

A beam of span, 'L' m is simply supported at the ends, carries a central load W. The beam is I – section having overall depth of 290 mm with horizontal flange each of 150 mm × 20 mm and vertical web 250 mm × 10 mm. If the maximum shear stress is to be 45 N/mm^2 when maximum bending stress is 150 N/mm^2. Calculate the value of central applied point load W and span L. Also draw shear stress distribution for the section where shear force is maximum.

Q.6 A closed ring of mean radius of curvature 90 mm is subjected to a pull of 3 kN. The line of action of the load passes through the centre of the ring. Calculate the maximum tensile and compressive stresses in the material of the ring if the ring is circular in cross-section with diameter equal to 15 mm. **[10]**

OR

A bell crank lever is to be designed for a load of 5 kN, at the short arm end. The arm length are 100 and 450 mm. Permissible shear and tensile stresses for pin and lever are 70 and 80 MPa. Bearing pressure is 10 MPa. Assuming lever cross section as t × 3t and fulcrum pin length 1.25 times pin diameter. Design the lever.



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