BACHELOR OF TECHNOLOGY (C.B.C.S.) (2020 COURSE)
B.Tech.Sem - III CIVIL : : SUMMER - 2022
SUBJECT : MECHANICS OF SOLIDS

Day : Monday
Date : 30-05-2022

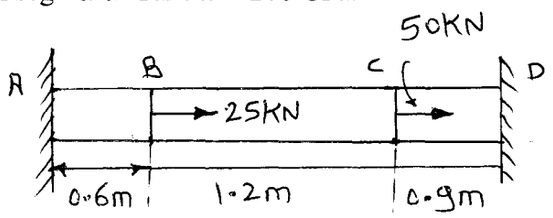
S-24362-2022

Time : 02:30 PM-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) Draw neat and labeled diagram **WHEREVER** necessary.
5) Assume suitable data if necessary.

Q.1 A homogeneous bar with cross sectional area 500 mm^2 is attached to rigid supports as shown in figure. Determine the magnitude and nature of the stress in each segment. Take E = 200 GPa. **[10]**

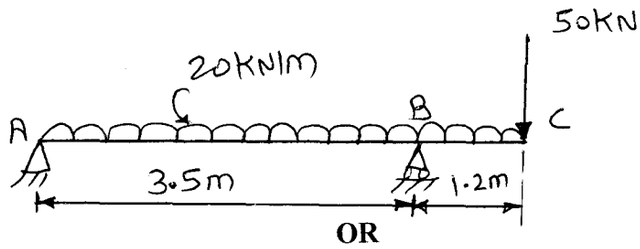


OR

Q.1 **a)** Define : **i)** Stress **ii)** Poisson's ratio. **[02]**

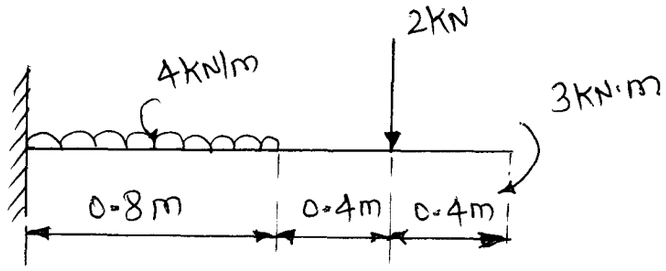
b) A cube of 150 mm side is acted upon by stresses along the three directions. 20 N/mm^2 (tensile), 10 N/mm^2 (compressive) and 15 N/mm^2 (tensile). Calculate the change in volume of cube and strain ins all three direction. Take E = 200 GPa and $\mu = 0.25$. **[08]**

Q.2 Draw shear force diagram and bending moment diagram for an overhanging beam as shown in figure. Determine maximum bending moment. Also locate point of contra-flexure if any **[10]**



OR

Q.2 Draw shear force diagram and bending moment diagram for beam shown in figure. **[10]**

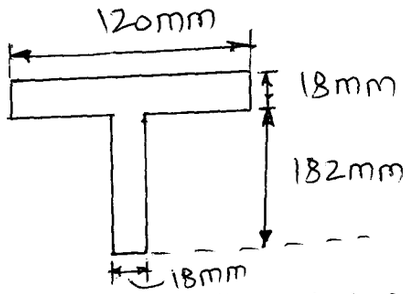


Q.3 A horizontal cantilever 6m long is fixed at A. It carries a UDL of 30 KN/m over entire span and a point load of 200 KN at the centre of beam. Calculate slope and deflection at free end and under point load in terms of flexural rigidity EI. Use Macaulay's method. **[10]**

P.T.O.

OR

Q.3 A 'T' section having top flange 120 × 18 mm and overall depth of 200 mm used as a cantilever. It is subjected to a bending moment of 300 KN/m. Calculate maximum value of bending stress developed in the section. Draw the diagram showing in distribution of bending stress over the cross section. The web thickness is 18 mm. **[10]**



Q.4 **a)** Draw the shear stress distribution diagram in the following cases: **[03]**
i) I – section **ii)** Channel section **iii)** L – section

b) A beam of rectangular cross section is 300 mm × 450 mm. It is subjected to a shear force of 30 kN. Find the shear stress at top layer and at a distance of 75 mm, 150 mm and 225 mm from top layer. Draw shear stress distribution diagram. **[07]**

OR

Q.4 **a)** State any four assumptions made in the theory of pure torsion. **[04]**

b) A solid shaft 100 mm in diameter is running at 200 rpm. If the angle of twist is 4° in a length of 4m. Calculate power is being transmitted by the shaft and maximum shear stress in the shaft? Take G = 80GPa. **[06]**

Q.5 **a)** State and explain Rankine's formula giving compressive carrying capacity of a column. **[04]**

b) Calculate the bulking load of column 60 mm wide × 30 mm thick having length of 2.5 m. It has its both end hinged. Take E = 200 GPa factor of safety = 5. Also find buckling load for above column if it's both ends are fixed. **[06]**

OR

Q.5 **a)** How can you determine the maximum and minimum stresses induced in a rectangular section due to eccentric load 'P' an eccentricity 'e'? **[06]**

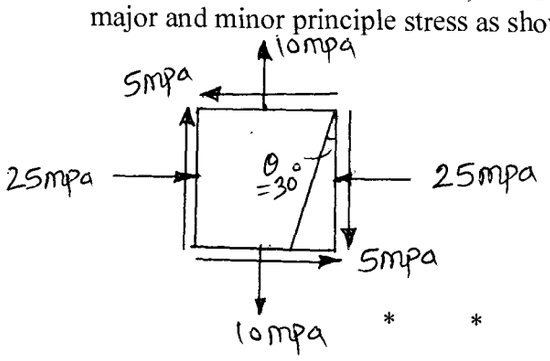
b) Calculate the limit of eccentricity of a rectangular cross section of size 1.5 m × 2 m and sketch it. **[04]**

Q.6 A point in a strained material the principle stresses are 150 MPa (tensile) and 350 MPa (compressive). Determine the intensity of normal tangential and resultant stresses on a plane inclined at 38° to the plane carrying 150 MPa stress. Use Mohr's circle method. Also find major, minor principal stress and maximum shear stress. **[10]**

OR

Q.6 **a)** Define: **i)** Principal plane **ii)** Equivalent Bending moment. **[04]**

b) At a point in a strained material, stress pattern is shown in figure. Determine major and minor principle stress as shown in figure. **[06]**



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