3E1621

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B.Tech. (Sem.III) (Main/Back) Examination, 2015
Civil Engineering
3CE1 Strength of Materials-I

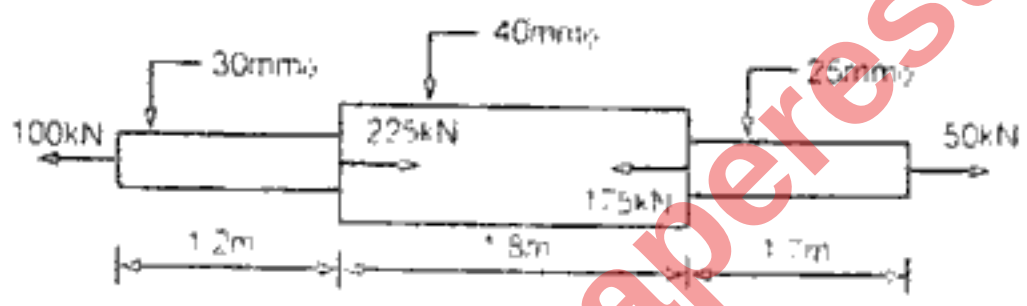
Time : 3 Hours

Total Marks : 80
Min. Passing Marks : 26

Instructions to Candidates :
Attempt any five questions, selecting one question from each unit. All questions carry equal marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.

UNIT – I

1. (a) Determine the total elongation of the stepped steel bar under loads as shown in fig. Take modulus of elasticity for steel E = 210 GPa.



(10)

(b) Determine the total elongation of a uniform bar of area A and length L hanging freely under its self weight w per unit volume. **(6)**

OR

(a) A reinforced concrete column of 450 mm square has four steel bars of 30mm diameter. It carries a load of 600 kN. Find the stresses in steel and concrete, if their modulii of elasticity are 210 GPa and 22 GPa respectively. Also calculate the adhesive force between concrete and steel. **(10)**

(b) In an axial tensile test on 15 mm diameter bar of gauge length 200mm, the load at proportionality limit is found to be 25kN and the corresponding changes in length and diameter are 0.25 mm and 0.00625 mm respectively. Determine modulus of elasticity, Poisson's ratio and the % volume change. **(6)**

UNIT – II

(a) Define principal stresses and principal planes. **(4)**

(b) In a piece of strained material, the stresses at a point are $p_1 = 25$ MPa, $p_2 = -40$MPa and $q_1 = -30$ MPa. Find the principal stresses and position of principal planes. Also find the stresses on a plane inclined at 30° with the vertical. **(12)**

OR

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(a) Define principal moment of inertia. **(4)**

(b) Determine position of centroid, centroidal moment of inertia and radii of gyration of the angle section shown in fig.

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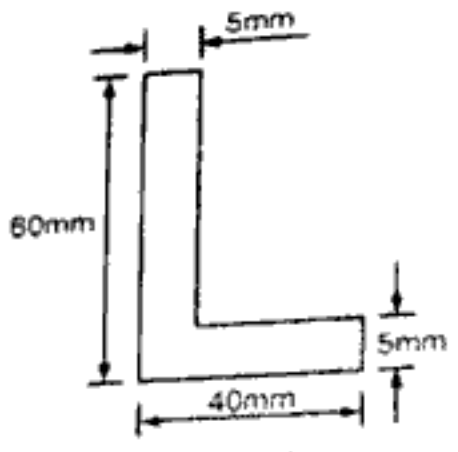

Fig.

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(12)

UNIT – III

3. (a) Write short notes on :
   (i) Effective length of a column, and
   (ii) Limitations of Euler's formula (6)

   (b) A 2 meter long solid circular column of dia 40 mm hinged at both ends is subjected to an eccentric load of 50kN. If the lateral deflection at the mid point of column is 0.8mm, find the eccentricity (e) of the load and the maximum normal stress in the column. Take E = 2.1 × 10^5 N/mm^2. (10)

OR

3. (a) A compressed air cylinder of internal dia 600 mm has a wall thickness of 3 mm. It contains air at a pressure of 1.5 MPa. Calculate the stresses in the cylinder wall. Also determine the shear stress in the cylinder. (5)

   (b) A simply supported concrete dome of radius 3.5 m is to bear its self weight of 25kN/m^2. Calculate meridional and hoop stress $\phi = 30^\circ$ and $\phi = 60^\circ$. (6)

   (c) A steel spherical shell of internal diameter 1m, has its wall thickness 5mm. An incompressible fluid is pumped in the shell till its pressure is 3MPa. Determine the stress in the wall of the shell and the changes in internal volume. Take E = 210GPa and Poisson's ratio = 0.3 (steel). (5)

UNIT – IV

4. (a) Derive the relation between load, shear force and bending moment. (4)

   (b) Draw shear force and bending moment diagrams for a simply supported beam of 8 m span shown in fig.

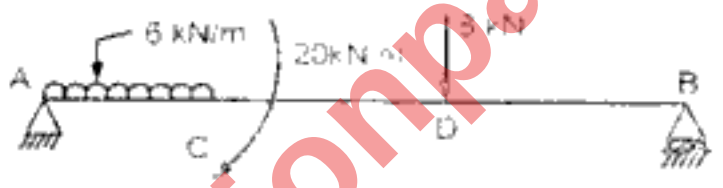

Fig (12)

OR

4. Draw shear force and bending moment diagrams for a beam shown in fig. indicating the values at important points. Find the position and magnitude of maximum bending moment and position of point of contra flexure.

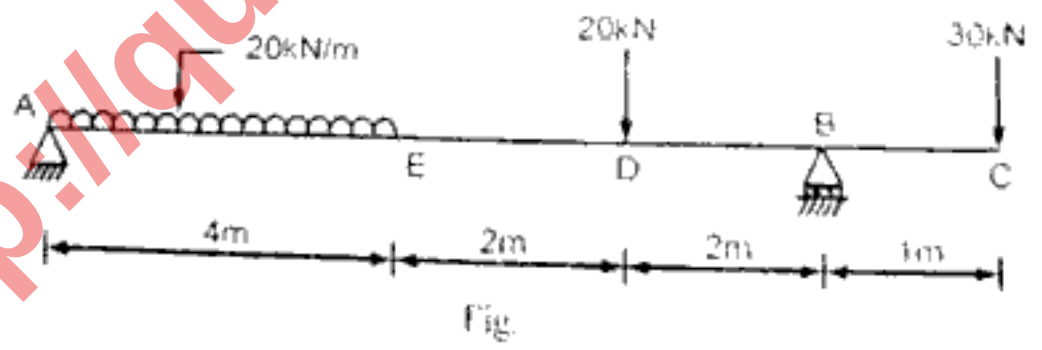

Fig. (16)

UNIT – V

5. (a) Write the assumptions made and derive the equation for simple theory of bending. (10)

   (b) A rectangular beam 200 mm wide and 300 mm deep carries an UDL of 10kN/m over a simply supported span of 6m. Determine :
   (i) The maximum stress in the beam due to bending
   (ii) The radius of curvature for the section where bending is maximum, if E = 200 GPa (6)

OR

5. (a) A flitched beam consists of 150mm × 300 mm timber section bonded with two steel plates 10 mm × 300mm, one on each side. Determine the stress in timber and steel when the beam is subjected to a bending moment of 60kN.m, if the ratio of modulus of elasticity of steel and timber is 20. (6)

   (b) Plot the shear stress distribution on a solid circular beam section and prove that the maximum shear intensity is 33% more than its average value. (10)

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