Code: 9A01302

R09

B. Tech II Year I Semester (R09) Supplementary Examinations, May 2013

STRENGTH OF MATERIALS - I

(Civil Engineering)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions

All questions carry equal marks

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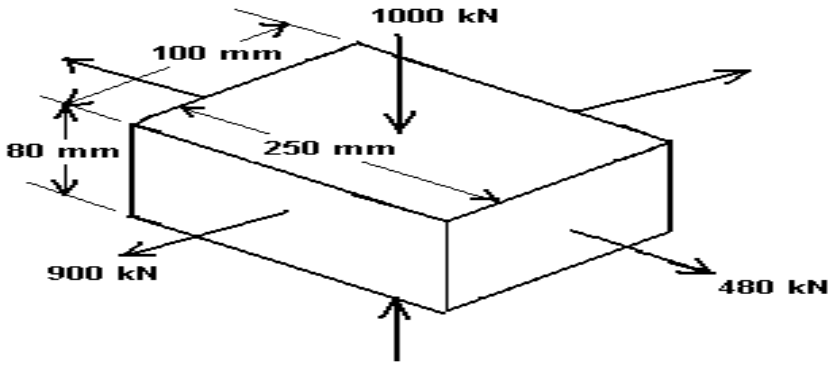
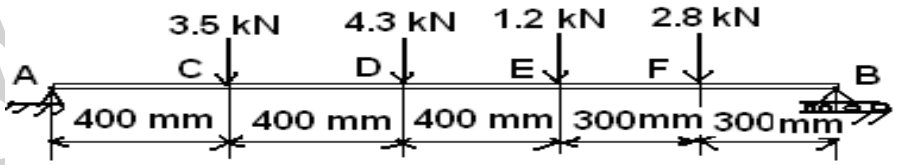
1 A rectangular block 250 x 100 x 80 mm is subjected to axial loads as shown in figure. Assuming Poisson's ratio as 0.25, find the strains in the direction of each force. Find the modulus of rigidity, bulk modulus of the material and change in volume of the block. Take $E_s = 2.0 \times 10^5$ N/mm^2.



Figure

2 (a) Define beam. Sketch three different types of beams indicating name of beam.

(b) Draw the shearing force and bending moment diagrams for the beam shown in figure.



3 (a) Define section modulus. Write the units for section modulus. Derive the section modulus for hollow circular cross section.

(b) A timber beam 120 mm wide and 200 mm deep is simply supported over a span of 4 m. The beam carries a UDL of 2.8 kN/m over the entire length. Find the maximum bending stress induced. Plot the bending stress distribution at the quarter span cross section of the beam.

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4 A simply supported beam carries a uniformly distributed load of intensity 30 N/mm over the entire span of 2 m. The cross section of beam is a T-section having flange 125 x 25 mm and web 175 x 25 mm. Calculate the maximum shear stress for the section subjected to maximum shear force. Also draw the shear stress distribution.

5 A beam of length 5 m and of uniform rectangular section is supported at its ends and carries uniformly distributed load over the entire length. Calculate the depth of the section if the maximum permissible bending stress is 8 N/mm^2 and central deflection is not exceed 10 mm. Take the value of E = 1.2 x 10^4 N/mm^2.

6 Three beams, each 4 meters long, placed side by side are freely supported at the ends and carry a central load of W. The two outside beams are 75 mm wide and 150 mm deep while the central one is 150 mm wide and 75 mm deep. If the stress in any beam is not to exceed 22.5 N/mm^2. Evaluate W and the load carried by each beam.

7 In order to determine the principal stresses at a point in a structural member two strain gauges are fixed. Their directions being 30º to the known directions of the principal stresses. The measured strains in these two directions are +450 and -32 micro-strain respectively. If E = 210 GPa and v = 0.3. Find the magnitude of the principal stresses.

8 In a two-dimensional stress system, the direct stresses on two mutually perpendicular planes are 120 MN/m^2 and σ MN/m^2. These planes also carry a shear stress of 40 MN/m^2. If factor of safety on elastic limit is 3, then find:
(i) The value of σ when shear strain energy is minimum and
(ii) The elastic limit of the material in simple tension.

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