B. Tech Degree III Semester Examination, December 2006

CE/SE 303 STRENGTH OF MATERIALS

(1999 Admission Onwards)

Time : 3 Hours | Maximum Marks : 100

I. (a) Establish the relationship between Young's modulus and Bulk modulus. (8)

(b) A weight of 20 tonnes is supported by three pillars, each $500mm^2$ in section. The central pillar is of steel and the other ones are of copper. The pillars are so adjusted that at a temperature of 15^0C each carries equal loads. Find the stress in each pillar at 115^0C.

Take : $E_s = 2.0 \times 10^5\ N/mm^2; E_c = 0.8 \times 10^5\ N/mm^2$

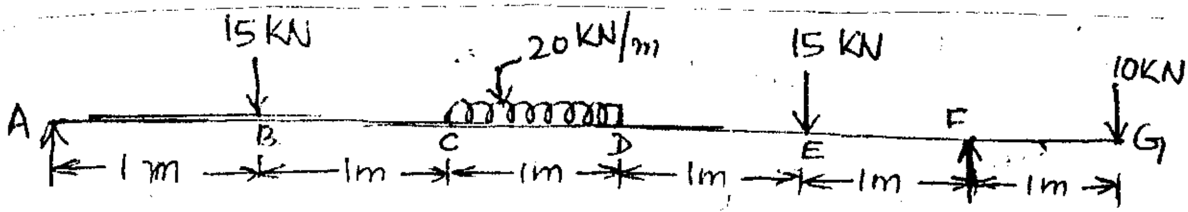
$\alpha_s = 12 \times 10^{-6} /^0c; \alpha_C = 18.5 \times 10^{-6} /^0c$ (12)

OR

II. (a) A point in a strained element consists of normal stresses of $200N/mm^2$ (Tensile) and $100N/mm^2$ (Tensile) on two mutually perpendicular planes, together with a shear stress of $50N/mm^2$. With the help of Mohr's circle, determine the principal planes and principal stresses and the stresses on an oblique plane inclined at 30^0 with the plane of $200\ N/mm^2$ tensile stress. Also find the maximum shear stress. (12)

(b) A steel rod circular in section tapers from 2cm diameter to 1cm diameter in a length of 60cm. Find how much its length will increase under a tensile force of 20KN. Given $E = 2 \times 10^5 N/mm^2$. (8)

III. (a) Draw the SFD and BMD for the beam shown in the figure and mark the salient points. Find the point of contraflexure and maximum bending moment. (12)



(b) Derive the relation between shear force, bending moment and intensity of load at a section of a beam. (8)

OR

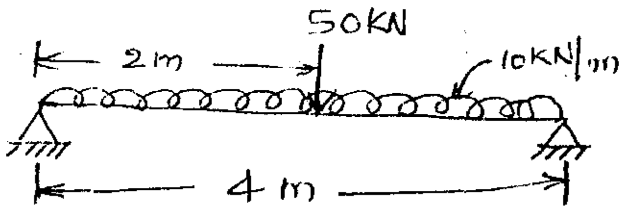
IV. (a) What is meant by pure bending? What are the assumptions made in simple theory of bending? (8)

(b) A circular pipe of external diameter 70mm and thickness 8mm is used as a simply supported beam over an effective span of 2.5m. Find the maximum concentrated load that can be applied at the centre of the span if permissible stress in tube is $150N/mm^2$. (12)

V. (a) Using Mohr's Theorem, derive an expression to find out the maximum slope and deflection of a simply supported beam of length L and uniform EI with a central point load of W. (8)

(Turn Over)

(b) A simply supported R.C rectangular beam of span 4m and cross-section 150mm × 300mm is loaded as shown below. Find the maximum slope and deflection of the beam. Take $E = 2\times10^4 N/mm^2$. (12)



OR

VI. (a) Find out the maximum slope and deflection of a cantilever of length L and uniform EI carrying a Udl of intensity w per unit run for a length of 'a' from the fixed end. (8)

(b) A cantilever of length 2m carries a uniformly distributed load of 2500N/m on its full length and a point load of 1000N at the free end. If the section is rectangular 120mm wide and 240mm deep, find the deflection and slope at the free end. Take $E = 10,000 N/mm^2$. (12)

VII. (a) Find the maximum torque that can be safely applied to a shaft of 100mm diameter. The permissible shear stress and the allowable twist are respectively $200N/mm^2$ and 3^0 per 10 diameter length of the shaft. Take $C = 1\times10^5 N/mm^2$. (10)

(b) In a close-coiled spring, the diameter of each coil is to be 10 times that of wire of the spring, and the maximum shear stress is not to exceed $60N/mm^2$. Maximum permissible deflection under a load of 400N is 10cm. Taking the rigidity modulus as $9\times10^4 N/mm^2$, determine the number of coils, the diameter of the coil and energy stored in the coil. (10)

VIII. (a) What are the assumptions made in Euler's Theory? What is the limitation of this theory? (8)

(b) A hollow cylindrical cast iron column of 150mm external diameter and 15mm thickness, 3m long and is hinged at one end and fixed at the other. Find
  (a) the ratio of the Euler's and Rankine's load
  (b) for what length, the critical load by Euler's and Rankines formula will be equal?
  Take $E = 8\times10^4 N/mm^2$, $f_c = 550 N/mm^2$ and $\alpha = 1/1600$. (12)

IX. (a) A hollow cylinder has an external diameter of 250mm and the thickness of the wall is 50mm. The cylinder is subjected to an internal fluid pressure of 35MPa and external pressure of 3.5MPa. Calculate the minimum and maximum circumferential stresses and plot the variation of the same across the wall thickness. (16)

(b) What are the assumptions made in the Lame's theory for thick cylinders. (4)

OR

X. (a) Explain the significance of maximum principal stress theory in elastic failure. (4)

(b) A bolt is subjected to an axial pull of 12KN together with a transverse shear force of 6KN. Determine the diameter of the bolt by using.
  (i) Maximum principal stress theory
  (ii) Maximum strain theory
  (iii) Maximum shear stress theory.

Elastic limit in tension = $300N/mm^2$
Factor of Safety = 3
Poisson's ratio = 0.3 (16)

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