BTS (C - L) - III-03 - 503 (D)

B.Tech. Degree III Semester (Lateral Entry) Examination, April 2003

CE 303 STRENGTH OF MATERIALS

Time: 3 Hours Maximum Marks: 100

I. (a) Differentiate between:
(i) Primary strain and lateral strain.
(ii) Direct stress and thermal stress (6)

(b) A railway line is so laid that the rails are free of stresses at temperature of 20°C. Calculate -
(i) the stress in the rails at 40°C if all expansion is prevented.
(ii) If an expansion allowance of 5mm per rail of length 30m.
(iii) Minimum clearance required to avoid any stresses at a temperature of 60°C.

$\alpha_s = 11\times10^{-6}$ $E_s = 200 kN/mm^2$ (14)

OR

II. (a) Explain strain rosettes and different types. (5)

(b) A bar of steel is under a tensile stress of $60MN/m^2$ and at the same time under a shear stress of $20MN/m^2$. Find the principal stresses and their planes. If the Poisson's ratio is 0.25 find the stress acting alone would produce the same maximum strain. (15)

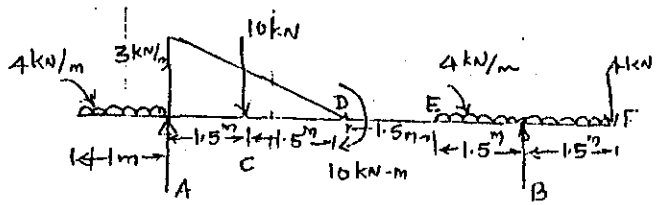
III. (a) Prove that the maximum bending moment occurs at a section where the shear force shows a discontinuity on a loaded beam. (8)

(b) A beam of length L carries a udl and rests on two supports. How far from the ends must the supports be placed if the greatest bending moment is to be as small as possible? (12)

OR

(Turn over)

IV. For the beam loaded as shown below, draw SFD and BMD and mark the salient points. (20)



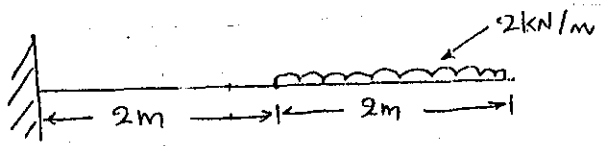
V (a) Derive the equation of the elastic curve of a member subjected to bending. (10)

(b) The cross section of a beam is square. In one case its orientation is such that the sides are vertical. In the second case one diagonal is horizontal. The bending takesplace about the horizontal axis in both cases. For the same allowable stress, determine the ratio of maximum allowable bending moments. (10)

OR

VI (a) State and epxlain moment area theorems. (8)

(b) Calculate the slope and deflection at the free end of the cantilever shown below, by moment area method. The beam is having uniform flexural rigidity. (12)



VII (a) Derive Rankine's formula of critical load for columns. (8)

(b) A hollow cast iron column 5m long is fixed at both ends and has an external dia of 300mm. The column supports an axial load of 1200KN. Find the internal dia of the column. Take Factor of safety = 5, $f_c = 550N/mm^2$ and the coefficient 'a' for fixed ends = 1/1600. (12)

OR

Contd.....3.

VIII (a) Compare the weight of solid shaft with that of a hollow shaft to transmit a given power at a given speed with a given max. shearing stress, the outside dia of the hollow shaft being 1.5times the internal dia. (10)

(b) A weight of 2600N is dropped on a closely coiled helical spring consisting of 16 turns. Find the height by which the weight is dropped before stretching the spring so that the spring may be compressed by 220mm. The coils have a mean radius of 120mm and the dia of the rod of the spring is 30mm. Take $N = 9\times10^4\ N/mm^2$. (10)

IX. A steel tube of external diameter 200mm is to be shrunk on to another steel tube of 60mm int. dia. After shrinking, the dia. at the junction is 120mm. Before shrinking on, the difference in diameter at the junction is 0.08mm. Find the hoop stresses developed in the two tubes after shrinking on. And the radial pressure at junction E=200GPa. (20)

OR

X. A cylindrical drum 600mm diameter has to withstand an internal pressure of $1.8N/mm^2$. Calculate the necessary wall thickness for a factor of safety of 3 if the criteria for failure is the maximum strain energy and the elastic limit in pure tension is $237N/mm^2$. Take Poissons ratio 0.3. (20)

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