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SF-8191

B. E. - II (Sem. IV) (Civil) Examination

May / June - 2011

Advanced Strength of Materials

Institute Elective - I

Time : **3** Hours] [Total Marks : **100**

Instruction :

(1)

નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fillup strictly the details of ☛ signs on your answer book.

Name of the Examination :

☛ B. E. - 2 (SEM. 4) (CIVIL)

Name of the Subject :

☛ ADVANCED STRENGTH OF MATERIALS

☛ Subject Code No. : 8 1 9 1 ☛ Section No. (1, 2,.....) : NIL

Seat No. :

Student's Signature

(2) Programmable calculator is not permitted.

(3) Figures to the right indicate full marks.

(4) Assume suitable data wherever required.

1 A uniform rod of cross sectional area A, length L hangs vertically. Derive the expression for strain energy due to self weight. Assume Young's Modulus of elasticity E and mass density p. **10**

2 Attempt any **two** :

(a) State and explain Castigliano's first theorm. **10**

(b) Derive the expression for deflection of a quarter elliptical leaf spring. **10**

(c) A closed-coiled helical spring is made out of a 15 mm diameter steel rod, the coils having 12 complete turns and a mean diameter of 120 mm. Calculate the maximum shear stress induced in the section of the rod when the spring is subjected to an axial load of 400 N. If the Modulus of Rigidity of the material is 84 GN/m^2. Determine the extension of the spring under the axial pull of 400 N. **10**

3 Attempt any two :

(a) Derive the expression for stresses in bars with initial large curvature (Winkler Bach formula). **10**

(b) A curved beam of rectangular cross section 30 mm × 60 mm has its centre line curved to a radius of 60 mm. The beam is subjected to a bending moment of 5 kNm. Find stresses developed in the beam and plot bending stress variaiton for the section. **10**

(c) A crane hook carries a load of 10 kN, the centre line of load being at a horizontal distance of 40 mm from the inside edge of a horizontal section and through the centre of curvature, the centre of curvature being in load line. The horizontal section is atrapezium whose parallel sides are 15 mm and 25 mm and height is 35 mm. Find the stresses developed in the hook and also draw stress diagram. **10**

4 (a) Attempt the following : **6**

(i) In thick cylinder, in order to shrink the inner diameter of the outer cylinder should be slightly _____ the outer diameter of the inner cylinder.
- (a) less than
- (b) more than
- (c) equal

(ii) For a rectangular section, the maximum shear stress is _____ the average shear stress.
- (a) 4/3
- (b) 1/2
- (c) 3/2

(iii) In disc of uniform strength the radial stress is _____ to the hoop stress through the disc.
- (a) equal
- (b) less
- (c) more

(iv) Shear strain energy theory does not apply to _____ material.
- (a) brittle
- (b) ductile
- (c) none of above

(v) The maximum principal stress theory is given by_____
   (a) Lame Rankine
   (b) St. Venant
   (c) Guest and Tresca

(vi) In thick cylinder, the longitudinal strain at any point in the section is _____.
   (a) constant
   (b) zero
   (c) none of above

(b) Attempt the following (any three) **6**
   (i) Define shear centre
   (ii) Write the assumption made in Lame's theory of thick cylindrical shell.
   (iii) What is a rotational stress ?
   (iv) Define centrifugal force.

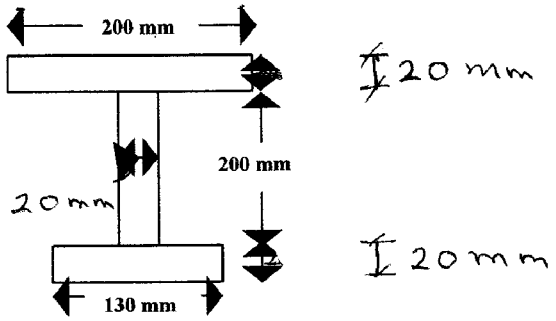
5 (a) The stress induced to a critical point in a machine component mode of steel are as follows, $\sigma_x = 120$ N/mm^2, $\sigma_y = 50$ N/mm^2, $\tau_{xy} = 90$ N/mm^2. **8**

Calculate the factor of safety by :
(i) Maximum shear stress theory
(ii) Maximum distortion theory

OR

(a) Find the diameter of a shaft, if it is subjected to maximum B.M. of 10 kN.m and a maximum torque of 15 kN.m at a particular section. The elastic limit stress in simple tension is 180 N/mm^2. Use maximum shear stress theory. **8**

(b) The shear force acting on a beam at an I-section with unequal flanges is 50 kN. The section is shown in a figure 1. The moment of inertia of a section about N.A. is 2.849×10^4 mm^4. Calculate the shear stress at the N.A. and also draw the shear stress distribution over the depth of the section. **8**



(b) When a point load of 120 kN applied at centre of its span, span of beam is 6m. Size of the beam is 230 mm × 460 mm. Find the maximum shear stress and ratio of maximum and average shear stress. Plot stress distribution diagram. 8

(c) Derive the expression for thick cylindrical shell subjected to internal fluid pressure only. 6

OR

(c) Derive the equation for distribution of shear stress throughout the rectangular section of width B and depth. 6

6 Attempt any two from the following : **16**

(i) The pressure at the outer and inner surface of a thick cylinder are 25 MPa (gauge) and atmospheric (i.e. zero gauge) respectively. If the hoop stress at the inner surface is 65 MPa (compressive). Determine hoop stress at the outer surface.

(ii) A cylinder of a hydraulic ram is of 180 mm internal diameter. Find the thickness of shell to withstand an internal pressure of 80 N/mm^2. The maximum tensile stress is limited to 90 N/mm^2 and maximum shear stress is 80 N/mm^2.

(iii) A flywheel rim of 2.4 m diametr is rectangular in section 300 mm x 180 mm and has six arms. The flywheel rotates at 200 r.p.m.
Find : (i) the hoop tension, (ii) Bending stress in the rim of flywheel
Assume that due to flexibility of arms the actual bending stress is 2/3 of the bending stress found on the assumption that the rim segments behave as fixed straight beams between the arms.
Take rho = 7000 kg/m^3.