R09

Code No: C8903

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.TECH I SEMESTER EXAMINATIONS, APRIL/MAY-2012
ADVANCED MECHANICS OF SOLIDS
(ENGINEERING DESIGN)

Time: 3hours **Max.Marks:60**

Answer any five questions
All questions carry equal marks

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1.a) Explain Unsymmetrical bending in beams.

b) A simply supported beam of length 1.6 m carries a central load of 2.8 KN inclined at 40^0 to the vertical and passing through the centroid of the section a shown in fig.1. Determine:

a) maximum tensile stress b) maximum compressive stress and

c) deflection due to the load.

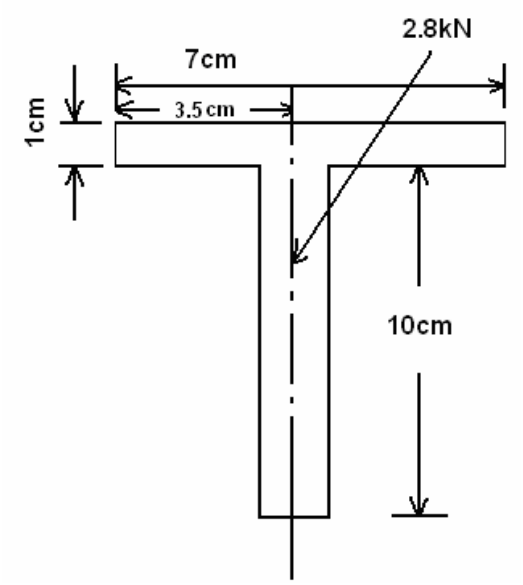

Fig .1

2.a) Define clearly the shear centre.

b) Locate shear centre for the section shown in fig.2 .

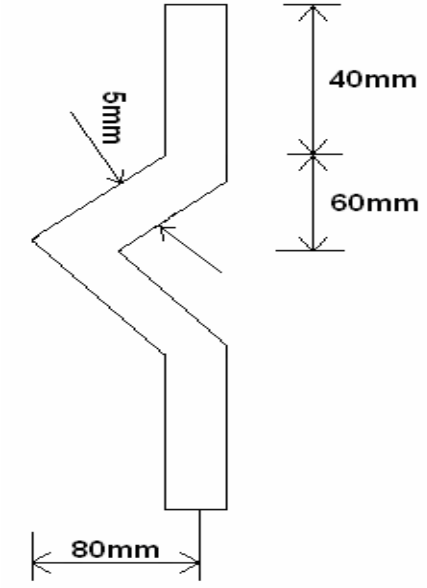

Fig .2

Cont…2

3.a) State the assumptions and limitations in Winkler Bach theory.

b) Determine the load carrying capacity of a hook of rectangular cross section 80x60mm. The thickness of the hook is 60mm, the radius of the inner fiber is 150mm while that of outer fiber is 230mm. The line of action of force passes at a distance of 75mm from the inner fibers. The allowable stress is 70N/mm^2.

4.a) Explain the Prandtl Elastic membrane analogy.

b) A shaft of hollow square section of outer side 34mm and inner side 28mm is subjected to twisting such that the maximum shear stress developed of 230N/mm^2. What is the torque acting on the shaft and angular twist if the shaft is 1.0 m long. Take G = 8x10^5 N/mm^2.

5. Determine the maximum shear stress and angle of twist when the section (fig.3) is subjected to a torque of 80 KN – m. All walls are 12 mm thick. Take G = 80 Gpa.

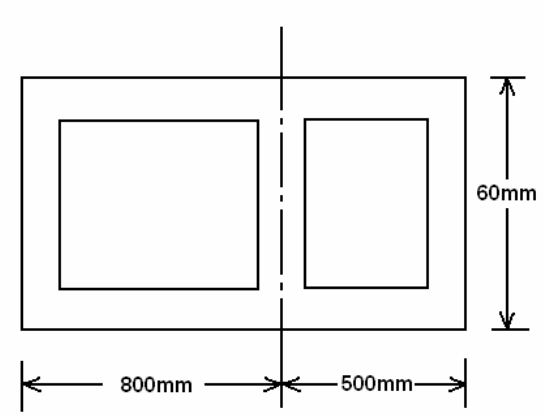

Fig .3

6. A plate made of mild steel has a thickness 10 mm and covers a circular opening having a diameter of 200 mm. The plate is fixed at the edges and is subjected to a uniform pressure ‘p’.

i) Determine the magnitude of the yield pressure and deflection at the center of the plate.

ii) Determine the working pressure based on a factor of safety 2. For mild steel, take E = 200 Gpa, μ = 0.29, yield stress = 315 Gpa.

7. Two semicircular disks are made of steel (E_1= E_2 = 200 Gpa and V_1 = V_2 = 0.3) The radii of curvature of the two surfaces at the point of contact are R_1 = 60mm, R^1_1 = 130 mm, R_2 = 80 mm and R^1_2 = 200mm. The angle α between the planes of minimum curvature is $\frac{\Pi}{3}$ rad. If the load P = 4.50 KN, determine the maximum principal stress, maximum shear stress using fig. 4.

Cont…3

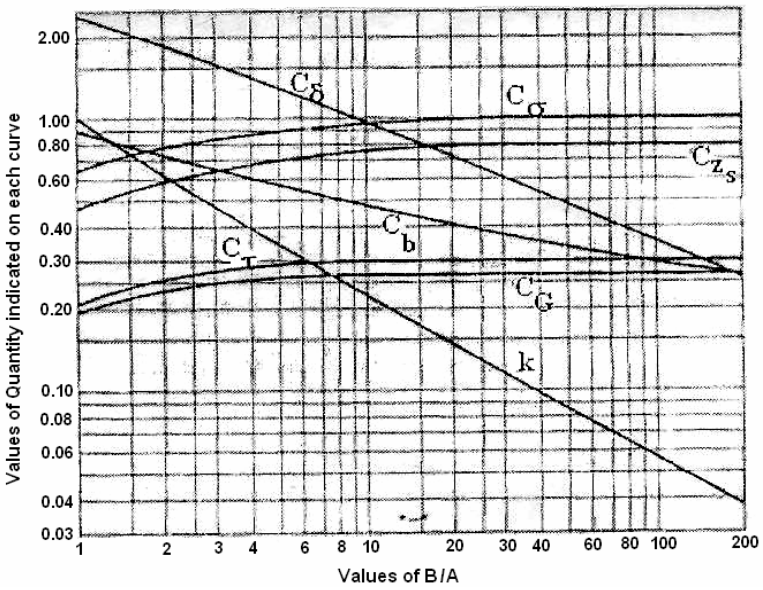

Fig.4

8. A fatigue testing machine has two identical steel disks (E = 200 GPa and v = 0.29) rolling together. The identical disks have a radium of curvature of 40 mm and width h = 20 mm for rolling without friction, a load P = 24.1 kN produces the following stresses $\sigma_{\max} = 1445 MPa$, $\tau_{\max} = 433 MPa$, and $\tau_{oct(\max)} = 361 MPa$.

Let the cylinders be subjected to a load P = 24.1 kN and be rotated at slightly different speeds so that the roller surfaces slide across each other. If the coefficient of sliding friction is 0.111, determine $\sigma_{\max}$ (compression). Using the following table.

Kind of stress and its location	Values of stress in terms of b/Δ corresponding to the friction coefficients below				
	0	0.083	0.111	0.17	0.333
Maximum tensile principal stress that occurs in surface at x = -b	0	$2/12\, b/\Delta$	$2/9\ b/\Delta$	$2/6\ b/\Delta$	$2/3\ b/\Delta$
Maximum compression principal stress that occurs in the surface between x = 0 and x = 0.3b	$-b/\Delta$	$-1.09\ b/\Delta$	$-1.13\ b/\Delta$	$-1.19\ b/\Delta$	$-1.09\ b/\Delta$
Maximum shear stress [a]	$0.300\ b/\Delta$	$0.308\ b/\Delta$	$0.310\ b/\Delta$	$0.339\ b/\Delta$	$0.300\ b/\Delta$
Maximum octahedral shear stress [a]	$0.272\ b/\Delta$	$0.265\ b/\Delta$	$0.255\ b/\Delta$	$0.277\ b/\Delta$	$0.368\ b/\Delta$

[a] Note: These stresses occur at the surface when the friction coefficient is 0.10 or larger.

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