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Code No: A5202

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M.Tech I Semester Examinations, March-2011

ADVANCED MECHANICS OF SOLIDS

(DESIGN OF MANUFACTURING)

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

Answer any five questions

All questions carry equal marks

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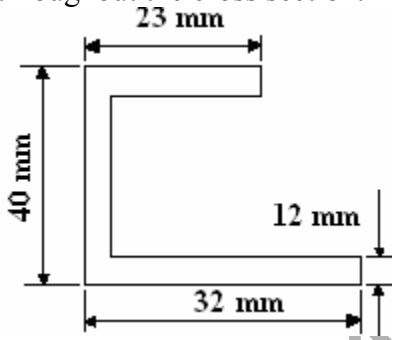
1. a) State and explain the significance of shear center.
   b) Determine shear center of the unsymmetrical section shown in the figure. Take same thickness throughout the cross section.



[12]

2. A simply supported beam of length 2.5 m carries a central load of 10 kN inclined at an angle 35^0 to the vertical and passing through the Centroid of the section. Determine i)Maximum tensile stress ii) Maximum compressive stress
   iii) Deflection due to load and Direction of the neutral axis. Take E = 2 x 10^5 $N/mm^{2.}$ [12]

3. A chain link is subjected to a pull of 40 kN. It is composed of steel 3.5 cm diameter and has a mean radius of 5 cm. Its semicircular ends are connected by straight pieces 4 cm long. Estimate the maximum compressive stress in the link and tensile stress at the same section. [12]

4. a)Explain membrane analogy for torsion of non-circular shafts.
   b) A shaft of hollow square section of outer side 60 mm and inner side 45 mm is subjected to twisting such that the maximum shear stress developed is 350 N/mm^2. What is the torque acting on the shaft and angular twist if the shaft is 1.2 m long. Take G = 8.1 x 10^5 N/mm^2. [12]

5. a) Derive an expression for torsion of bars with rectangular cross section
   b) Explain in brief about the stresses developed when the two bodies in line contact. [12]

Contd…..2

6. a)Explain the phenomenon of finding deflection of straight beams due to non – symmetrical bending
   b) A ring made of 35 mm diameter steel bar carries a pull of 40 kN. Calculate the maximum tensile and compressive stresses in the ring. The mean radius of the ring is 240 mm. [12]

7. A square plate is simply supported on all edges and is loaded by sand such that

$$P(x,y) = P_0 \sin\frac{2\pi x}{a}\sin\frac{2\pi y}{b},\ a = b$$

   a) Determine the maximum deflection and its location.
   b) Determine the maximum values of the moments. [12]

8. a) Write short notes on contact stresses.
   b) A fatigue testing machine has two identical steel disks (E = 210 GPa and μ = 0.3) rolling together. The identical disks have a radius of curvature of 70 mm and width h = 40 mm for rolling without friction, a load P = 30 kN produces the following stresses: σ_{max} = 1550 MPa, τ_{max} = 530 MPa, and $\tau_{oct\ (max)}$ = 380 MPa. Let the cylinders be subjected to a load P = 50 kN and be rotated at slightly different speeds so that the roller surfaces slide across each other. If the coefficient of sliding friction is 0.132, determine σ_{max} (tension), σ_{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	0.167	0.333
Maximum tensile principal stress that occurs in surface at x = -b	0	2/12 b/Δ	2/9 b/Δ	2/6 b/Δ	2/3 b/Δ
Maximum compressive principal stress that Occurs in the surface between x = 0 and x = 0.3b	-b/Δ	- 1.09b/Δ	- 1.13b/Δ	- 1.19b/Δ	- 1.09b/Δ
Maximum shear stress [a]	0.300b/Δ	0.308b/Δ	0.310b/Δ	0.339b/Δ	0.300b/Δ
Maximum octahedral sheer stress [a]	0.272b/Δ	0.265b/Δ	0.255b/Δ	0.277b/Δ	0.368b/Δ

[a] Note that these stresses occur at the surface when the friction coefficient is 0.10 or larger. [12]