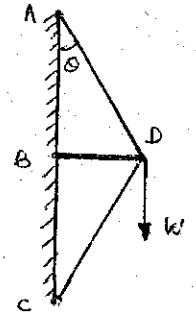
B. Tech Degree V Semester Examination, November 2008

ME 503 ADVANCED MECHANICS OF SOLIDS

(2002 Scheme)

Time : 3 Hours Maximum Marks : 100

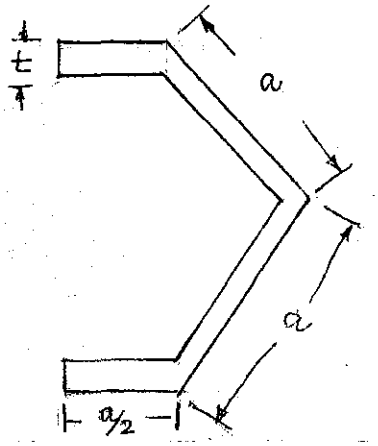
I.	a.	With neat sketch, explain the term octahedral stresses.	(6)
	b.	Define the term stress function. Derive the expression for stress function for a plane stress problem.	(14)
		OR	
II.	a.	Describe various types of strain rosettes and their relative advantages.	(6)
	b.	The displacement field for a body is given by $u = (x^2 + y)I + (3 + z)j + x^2 + 2y)\,k$. Determine the principal strains at (3,1,-2) and the direction of the minimum principal strain.	(14)
III.	a.	Derive the stress equilibrium equations in polar coordinates.	(10)
	b.	A steel shaft 100 mm in dia has a 500 mm diameter steel disc shrunk on it. Permissible shrinkage strain is 0.0008. Find the (a) radial and tangential stresses at stand still (b) speed at which the disc will be loosend? (c) shrinkage pressure at half the speed arrived in (b)? Given $E = 2 \times 10^6$ kg/cm^2, $\mu = 0.3$, $\delta = 8$ gm/cm^3.	(10)
		OR	
IV.	a.	Derive the expression for stresses in a rotating disc with central hole.	(12)
	b.	A steel turbine disc is to be designed so that between the radii of 25 cm and 40 cm the radial and circumferential are to be constant and both equal to 600 kg/cm^2 when running at 3000 rpm. If the axial thickness is 12 mm at the outer edge of this zone, what should be at the inner edge? Assume wt/cm^3 = 8 gm.	(8)
V.	a.	Explain the term stress ellipsoid.	(5)
	b.	Given the following state of stress at a point. $\sigma x = 120$ MPa, $\sigma y = -55$ MPa, $\sigma z = -85$ MPa, $\tau xy = -55$ MPa, $\tau yz = 33$ MPa, $\tau zx = -75$ MPa. Determine the three principal stress and their directions.	(15)
		OR	
VI.		Derive the differential equations of equilibrium and compatibility equations for 3D problems.	(20)
VII.	a.	State and explain Castigliano's theorems.	(10)
	b.	Three elastic members AD,BD and CD are connected by smooth pins as shown below. All members have same cross sectional area and are of same material. BD is 100 mm long and members AD and CD are each 200 cm long. What is the deflection of D under load w.	(10)



(turn over)

OR

VIII. Explain the term 'shear centre'? Locate the shear centre of the member shown below. (20)

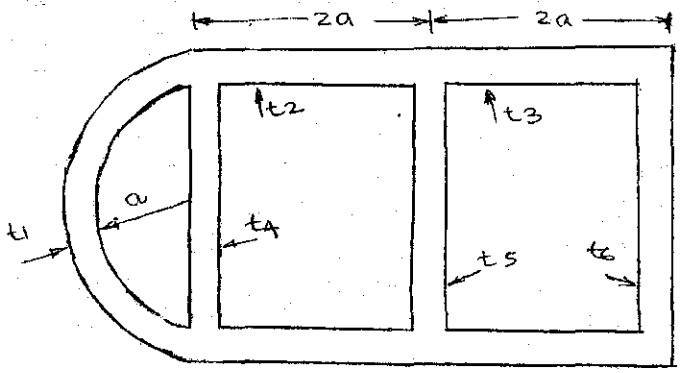


IX. a. With neat sketches, clearly explain the term 'Membrane Analogy'. (6)

b. Derive the torsion equation for a shaft with elliptical cross section. (14)

OR

X. The thin walled tube is subjected to a torque T = 113 KN is shown below. Determine the shear stresses in the walls of the section.



a = 12.7 cm, t_1 = 0.06 cm, t_2 = 0.08 cm, t_3 = 0.08 cm, t_4 = 0.13 cm, t_5 = 0.08 cm, t_6 = 0.10 cm. (20)

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