DEPARTMENT OF CIVIL ENGINEERING, IIT BOMBAY

CE 201 Solid Mechanics

Tutorial Sheet = 7 Instructor : Siddhartha Ghosh

1. For the engineering structures shown in Fig. 1 determine the normal and shear stresses at the point shown. Sketch an element in each case showing the magnitude and sense of the stresses on each face.
2. For the elements illustrated in Fig. 2 calculate the stress components on the inclined planes.
3. Find the principal normal and maximum shearing stresses and show their sense on a properly oriented element for the state of stress (in MPa) shown in Table 1. by (a) analytically and (b) Mohr's circle of stresses.
4. A chemical pressure vessel is to be manufactured from glass fibres in an epoxy matrix. If the optimum orientation of fibre is that in which the fibres are subjected to tensile stress with no transverse or shear stresses, determine the optimum value of α.
5. Draw Mohr's circle of strain and determine principal normal and shear strains and their directions for the elements having the strains as in Table 2. Verify your results analytically. Also, determine principal normal and shearing stresses. Take E=200 GPa and ν=0.3.
6. Data from rectangular strain rosette glued to steel plate are as follows ε_{0^o} = -0.00022, ε_{45^o} = 0.00012 and ε_{90^o}= 0.00022. What are the principal stresses and in which direction do they act? E=200 GPa and ν=0.3.
7. Data from equiangular strain rosette attached to aluminium alloy are as follows ε_{0^o} = 0.0004, ε_{60^o} = 0.0004 and ε_{120^o} = -0.0006. What are the principal stresses and their directions. E=70 GPa and ν=0.25

Table - 1

Element.	σ_x	σ_y	τ_{xy}
1.	60	20	0
2.	-30	50	-40
3.	200	0	80
4.	20	30	20

Table - 2

Element.	ε_x	ε_y	γ_{xy}
1.	-0.00012	0.00112	-0.0002
2.	0.0008	0.0020	0.0008

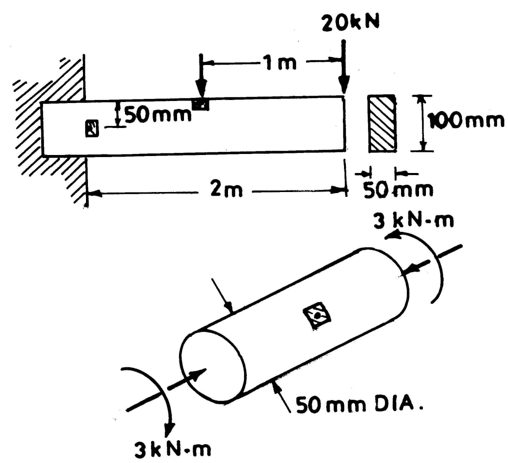

Fig. 1

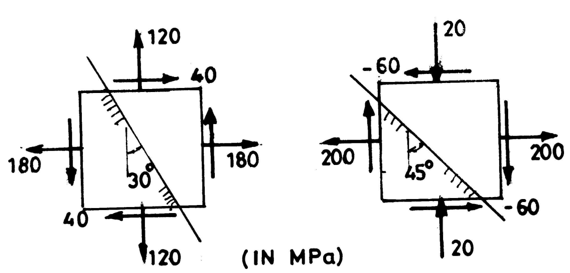

Fig. 2