ESO 202A/204: Mechanics of Solids (2016-17 II Semester)
Assignment for Practice
(Not for Submission)

4.1 In a state of plane strain in the x-y plane, the strain components associated with x-y axes are

$\varepsilon_{xx} = 900\times10^{-6}$, $\varepsilon_{yy} = 100\times10^{-6}$, $\gamma_{xy} = -800\times10^{-6}$

Find the principal strains and the orientation of the principal strain directions.

4.2 The readings of a 45^0 strain-rosette are

$\varepsilon_a = 100\times10^{-6}$, $\varepsilon_b = 200\times10^{-6}$, $\varepsilon_c = 900\times10^{-6}$

Find the magnitude of the principle strains.

4.3 A 60^0 strain-rosette recorded following normal strains:

$\varepsilon_{0^0} = 500\times10^{-6}$, $\varepsilon_{60}0 = 800\times10^{-6}$, $\varepsilon_{120}0 = -600\times10^{-6}$

Determine the strains in x-y plane if $\varepsilon_0 0$ coincides with ε_{xx} . Also determine the principal strains.

4.4 Show that for plane strain, the various strain components in polar coordinates (r, θ) are

$$\varepsilon_{rr} = \frac{\partial u}{\partial r};\ \varepsilon_{\theta\theta} = \frac{1}{r}\frac{\partial v}{\partial \theta} + \frac{u}{r};\ \gamma_{r\theta} = \frac{\partial v}{\partial r} + \frac{1}{r}\frac{\partial u}{\partial \theta} - \frac{v}{r}$$

4.6 Using the results of 4.4, show that if a general three dimensional deformation is to be described in cylindrical co-ordinates (r, θ, z) in which the displacement components are u, v and w, respectively, the strain components (other than those given in 4.4) are

$$\varepsilon_{zz} = \frac{\partial w}{\partial z};\ \gamma_{rz} = \frac{\partial u}{\partial z} + \frac{\partial w}{\partial r};\ \gamma_{\theta z} = \frac{1}{r}\frac{\partial w}{\partial \theta} + \frac{\partial v}{\partial z}$$