Quiz - 7 Solution

Que-1

$$\varepsilon_x = \frac{\varepsilon_x+\varepsilon_y}{2} + \frac{\varepsilon_x-\varepsilon_y}{2}\cos 2\theta + \frac{\gamma_{xy}}{2}\sin 2\theta.$$

Rosette are arranged @ 45° interval

$$\varepsilon_\theta\Big|_{\theta=0} = \frac{\varepsilon_x+\varepsilon_y}{2} + \frac{\varepsilon_x-\varepsilon_y}{2}\cos\theta = 1200\times10^{-6}$$

$$= \boxed{\varepsilon_x = 1200\times10^{-6}}$$

$$\varepsilon_\theta\Big|_{\theta=45} = \frac{\varepsilon_x+\varepsilon_y}{2} + \frac{\gamma_{xy}}{2} = 400\times10^{-6}$$

$$\varepsilon_\theta\Big|_{\theta=90} = \frac{\varepsilon_x+\varepsilon_y}{2} - \frac{\varepsilon_x-\varepsilon_y}{2} = 60\times10^{-6}$$

$$= \boxed{\varepsilon_y = 60\times10^{-6}}$$

So $$\frac{1200\times10^{-6}+60\times10^{-6}}{2} + \frac{\gamma_{xy}}{2} = 400\times10^{-6}$$

$$\boxed{\gamma_{xy} = -460\times10^{-6}}$$

$$\varepsilon_{1,2} = \frac{\varepsilon_x+\varepsilon_y}{2} \pm \sqrt{\left(\frac{\varepsilon_x-\varepsilon_y}{2}\right)^2 + \left(\frac{\gamma_{xy}}{2}\right)^2}$$

$$= \frac{(1200+60)\times10^{-6}}{2} \pm \sqrt{\left(\frac{1140\times10^{-6}}{2}\right)^2 + (-230)^2\times10^{-12}}$$

$$= 630\times10^{-6} \pm 614.65\times10^{-6}$$

$$\boxed{\varepsilon_1 = 1244.65\times10^{-6}} \quad \& \quad \boxed{\varepsilon_2 = 15.34\times10^{-6}}$$

Que-2

$$\varepsilon_{xx} = -800 \times 10^{-6}$$
$$\varepsilon_{yy} = -200 \times 10^{-6}$$
$$\gamma_{xy} = -600 \times 10^{-6}$$

max. shear strain Condition

$$\theta = \frac{1}{2}\tan^{-1}\left(\frac{\gamma_{xy}}{\varepsilon_x - \varepsilon_y}\right)$$

$$\theta = \frac{1}{2}\tan^{-1}\left(\frac{-600}{-800+200}\right) = \frac{1}{2}\tan^{-1}(1)$$

$$\boxed{\theta = 45}$$

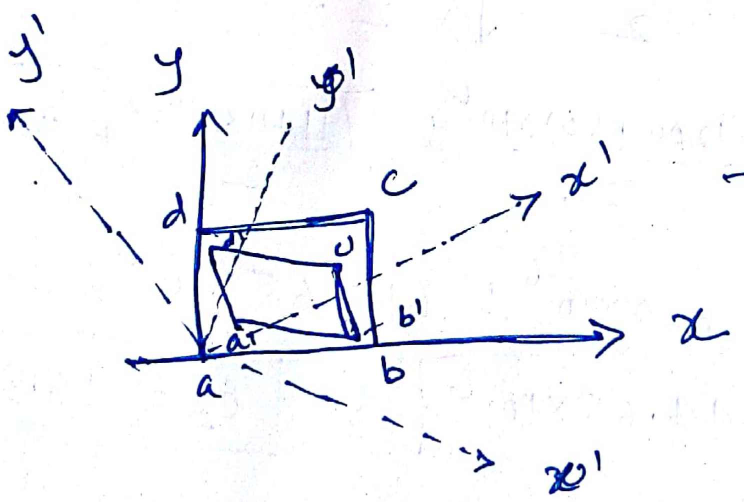
Principal strains ; $\varepsilon_{1,2} = \left(\frac{-800+200}{2}\right)\times 10^{-6} \pm \sqrt{\left(\frac{-600}{2}\right)^2 + \left(\frac{-600}{2}\right)^2}$

$$\varepsilon_{1,2} = -300 \times 10^{-6} \pm 300\sqrt{2} \times 10^{-6}$$

$$\boxed{\varepsilon_1 = 124.26 \times 10^{-6}} \;\&\; \boxed{\varepsilon_2 = -724.26 \times 10^{-6}}$$

In mohr circle θ is drawn as 2θ ; so

$2\theta = 45$; $\boxed{\theta = 22\frac{1}{2}^\circ}$



-ve strains compression.