

Answers to Selected Problems: Chapter 6

6.1

1

$$\sigma_{xx} = 15.92308 \text{ MPa}, \sigma_{yy} = 11.07692 \text{ MPa}, \sigma_{xy} = 2.42308 \text{ MPa}$$

$$\sigma_1 = 16.927, \sigma_2 = 10.073, \sigma_3 = 0$$

4.

$$(a) \varepsilon_{xx} = \sigma_0 / E, \varepsilon_{yy} = \varepsilon_{zz} = -\nu\sigma_0 / E, \varepsilon_{xy} = \varepsilon_{xz} = \varepsilon_{yz} = 0$$

$$(b) \varepsilon_1 = \sigma_0 / E, \varepsilon_2 = \varepsilon_3 = -\nu\sigma_0 / E$$

$$6. 3.1 \times 10^{-6} \text{ rads}$$

6.2

1.

$$\text{normal strains: } 0, -\sigma_o(1-\nu^2)/E, \sigma_o\nu(1-\nu)/E$$

$$\text{normal stresses: } -\nu\sigma_o, -\sigma_o, 0, (b) \sigma_o/2$$

2

$$\text{normal strains: } 0, -\sigma_o(1-2\nu)(1+\nu)/(1-\nu)E, 0$$

$$\text{normal stresses: } -\nu\sigma_o/(1-\nu), -\sigma_o, -\nu\sigma_o/(1-\nu)]$$

6.3

$$1. \quad \varepsilon_1 = \frac{1}{E_1}\sigma_1, \quad \varepsilon_2 = -\frac{\nu_{12}}{E_1}\sigma_1, \quad \varepsilon_3 = -\frac{\nu_{13}}{E_1}\sigma_1, \quad \varepsilon_4 = \varepsilon_5 = \varepsilon_6 = 0$$

$$2. \quad \sigma_2 = -0.6969 \text{ MPa}, \quad \sigma_3 = -0.5360 \text{ MPa}, \quad \varepsilon_1 = -8.463 \times 10^{-5}$$

$$3. \quad \sigma_2 = -p \frac{\nu_t(1+\nu_f)}{1-\nu_t\nu_f}, \quad \sigma_3 = -p \frac{\nu_f(1+\nu_t)}{1-\nu_t\nu_f}$$

4.

$$(a) \quad \sigma_1 = 48.25, \sigma_2 = 36.75, \sigma_6 = -4.82$$

$$(b) \quad \varepsilon_1 = 0.0317, \varepsilon_2 = 0.1623, \varepsilon_6 = -3.4486 \times 10^{-5}$$

$$(c) \quad G = 69.9 \text{ kPa}, E_2 = 200 \text{ Pa}, \nu_{21} = 0.0904$$

$$(d) \quad \text{principal stresses } (\theta = 0): 50, 35, 0$$

$$\text{principal strains } \theta = 20.02): \varepsilon_{p1} = 0.1623, \varepsilon_{p2} = 0.0317$$

$$(e) \quad \text{No.}$$

5. $\theta \approx 48.2^\circ$.