

※ 考生請注意：本試題 可 不可 使用計算機

1. (20%) For the truss and loading shown in Figure 1, determine the average normal stress in member DF, know that the cross-sectional area of that member is 2500 mm^2 .

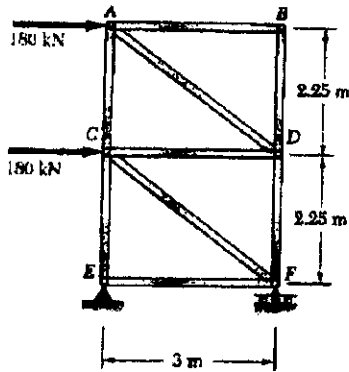


Figure 1

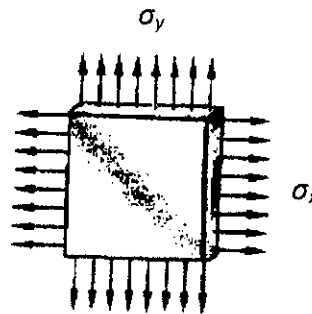


Figure 2

2. (20%) In many situations it is known that the normal stress in a given direction is zero, for example $\sigma_z = 0$ in the case of the thin plate shown in Figure 2. For this case, which is known as plane stress, show that if the strain ϵ_x and ϵ_y have been determined experimentally, we can express σ_x , σ_y and ϵ_z as follows:

$$\sigma_x = E \frac{\epsilon_x + \nu \epsilon_y}{1 - \nu^2} \quad \sigma_y = E \frac{\epsilon_y + \nu \epsilon_x}{1 - \nu^2} \quad \epsilon_z = -\frac{\nu}{1 - \nu} (\epsilon_x + \epsilon_y)$$

3. (20%) For the beam and loading shown in Figure 3, design the cross section of the beam, knowing that the grade of timber used has an allowable normal stress of 12 MPa.

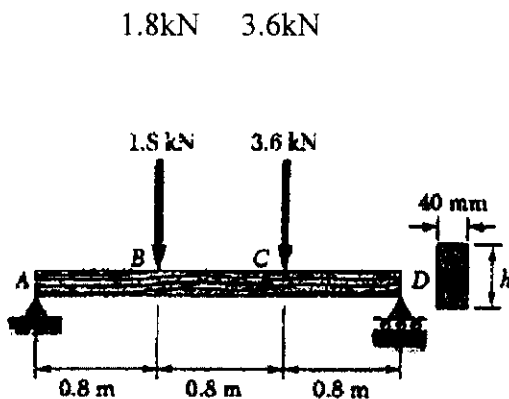


Figure 3

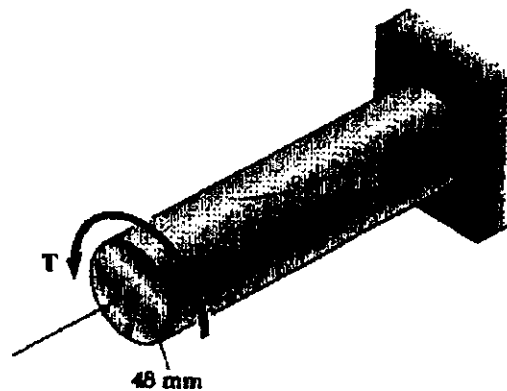


Figure 4

4. (20%) A single strain gage (Figure 4) is cemented to a solid 96-mm-diameter aluminum shaft at an angle $\beta = 20^\circ$ with a line parallel to the axis of the shaft. Knowing that $G = 27 \text{ GPa}$, determine the torque T corresponding to a gage reading of 400μ .
5. (20%) Explain the following terminology: a) yield strength, b) elasticity, c) tensile stress, d) Mohr's circle, e) Hooke's law