

2008.04.01 (二) 材料力學 1B 第一次小考解答

I.

(a) 大小、方向、作用點

(b)

$$\sigma = \frac{P}{A} = \frac{1000 \text{ kg} \times 9.81 \text{ N/kg}}{0.01 \text{ m} \times 0.01 \text{ m}} = \underline{\underline{98.1 \text{ MPa}}}$$

$$\varepsilon = \frac{\sigma}{E} = \frac{98.1 \text{ MPa}}{75000 \text{ MPa}} = \underline{\underline{0.001308}}$$

II.

(a)

$$\sigma = \frac{P}{A} = \frac{20 \text{ kN}}{\frac{\pi}{4} \left[20^2 - \left(20 - \frac{20}{4} \right)^2 \right]} = 0.146 \text{ MPa}$$

$$\varepsilon = \frac{\delta}{L} = \frac{0.2 \text{ mm}}{50 \text{ mm}} = 0.004$$

$$E = \frac{\sigma}{\varepsilon} = \frac{0.146 \text{ MPa}}{0.004 \text{ MPa}} = \underline{\underline{36.5 \text{ MPa}}}$$

(b)

$$\nu = -\frac{\text{側向應變}}{\text{軸向應變}} = -\frac{\varepsilon_l}{\varepsilon_a} = -\frac{(20 \text{ mm} - 0.01 \text{ mm}) - 20}{0.004} = \underline{\underline{0.125}}$$

III.

$$A = \frac{\pi}{4} \left[d^2 - \left(d - \frac{d}{4} \right)^2 \right] = \frac{7\pi d^2}{64}$$

$$P = \sigma_{allow} A = \frac{\text{降伏強度 } \sigma_y}{\text{降伏安全因子 } SF} \times \frac{7\pi d^2}{64}$$

$$d^2 = \frac{64P}{7\pi\sigma_{allow}}$$

$$d_{min} = 8 \sqrt{\frac{P}{7\pi\sigma_{allow}}} = 8 \sqrt{\frac{1500 \text{ kN} \times 1000 \text{ N/kN}}{7\pi(200 \text{ MPa})}} = \underline{\underline{148 \text{ mm}}}$$