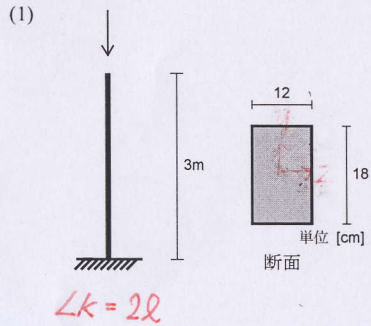


問1. 下記断面における断面積 A 、強軸に関する断面2次モーメント I_1 と、弱軸に関する断面2次モーメント I_2 を求めなさい。また、鉛直荷重を受ける下記構造物の座屈長さ L_k 、座屈荷重 P_{cr} 、座屈応力度 σ_{cr} を求めなさい。ただし、ヤング係数 E の値を $2.05 \times 10^5 \text{ N/mm}^2$ とし、解答はN, cmを用い、有効数字3桁で答えよ。



$$A = 12 \times 18 = 216$$

$$I_z = \frac{12 \times 18^3}{12} = 5832 \quad I_y = \frac{18 \times 12^3}{12} = 2592$$

$$I_z > I_y \text{ より } I_z = I_1 \quad I_y = I_2$$

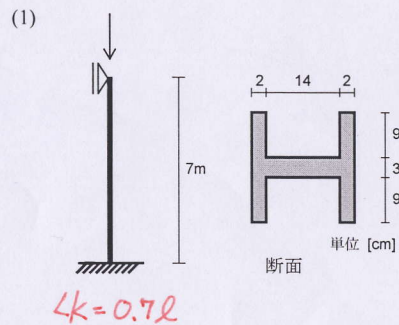
$$L_k = 2 \times 300 = 600$$

$$P_{cr} = \frac{\pi^2 E I_1}{L_k^2} = \frac{\pi^2 \times 2.05 \times 10^7 \times 5832}{600^2} = 14552.76.96$$

$$\sigma_{cr} = \frac{P_{cr}}{A} = \frac{1455276.96}{216} = 6737.39$$

$$A = 216 \text{ cm}^2, I_1 = 5830 \text{ cm}^4, I_2 = 2590 \text{ cm}^4$$

$$L_k = 600 \text{ cm}, P_{cr} = 1.46 \times 10^6 \text{ N}, \sigma_{cr} = 6740 \text{ N/cm}^2$$



$$A = (2 \times 21) \times 2 + 14 \times 3 = 126$$

$$I_z = \frac{2 \times 21^3}{12} \times 2 + \frac{14 \times 3^3}{12} = 3118.5$$

$$I_y = \frac{21 \times 18^3}{12} - \frac{9 \times 14^3}{12} \times 2 = 6090$$

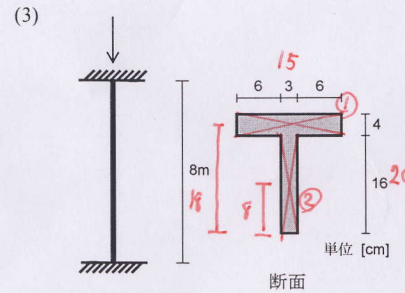
$$L_k = 0.7 \times 700 = 490$$

$$P_{cr} = \frac{\pi^2 \times 2.05 \times 10^7 \times 3118.5}{490^2} = 2625226.29$$

$$\sigma_{cr} = \frac{2625226.29}{126} = 20835.12$$

$$A = 126 \text{ cm}^2, I_1 = 6090 \text{ cm}^4, I_2 = 3120 \text{ cm}^4$$

$$L_k = 490 \text{ cm}, P_{cr} = 2.63 \times 10^6 \text{ N}, \sigma_{cr} = 20800 \text{ N/cm}^2$$



$$A_1 = 15 \times 4 = 60 \quad A_2 = 3 \times 16 = 48$$

$$A = 60 + 48 = 108$$

$$S_{x0} = 60 \times 18 + 48 \times 8 = 1464$$

$$y_0 = \frac{1464}{108} = 13.5556$$

$$I_z = \frac{15 \times 4^3}{12} + 60 \times (18 - 13.5556)^2 + \frac{3 \times 16^3}{12} + 48 \times (8 - 13.5556)^2$$

$$= 3770.67$$

$$I_y = \frac{4 \times 15^3}{12} + \frac{16 \times 3^3}{12} = 1161$$

$$L_k = 0.5l$$

$$L_k = 0.5 \times 800 = 400$$

$$P_{cr} = \frac{\pi^2 \times 2.05 \times 10^7 \times 1161}{400^2} = 146646.31$$

$$\sigma_{cr} = \frac{146646.31}{108} = 13580$$

$$A = 108 \text{ cm}^2, I_1 = 3770 \text{ cm}^4, I_2 = 1160 \text{ cm}^4$$

$$L_k = 400 \text{ cm}, P_{cr} = 1.47 \times 10^6 \text{ N}, \sigma_{cr} = 13600 \text{ N/cm}^2$$