

[5.4절]

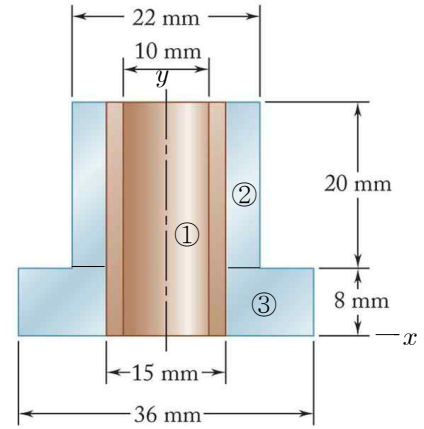
5.119 $\rho_b = 8,800 \text{ kg/m}^3 = 8.80 \times 10^{-6} \text{ kg/mm}^3$
 $\rho_s = 7,860 \text{ kg/m}^3 = 7.86 \times 10^{-6} \text{ kg/mm}^3$
 $d_1 = 10 \text{ mm}, d_2 = 15 \text{ mm}, d_3 = 22 \text{ mm},$
 $d_4 = 36 \text{ mm}, h_1 = 20 \text{ mm}, h_2 = 8 \text{ mm}$

S; 대칭구조 $\bar{X} = \bar{Z} = 0$

$$W = mg = \rho Vg \Rightarrow m = \rho V$$

$$\bar{Y} = \frac{\Sigma(\bar{y}W)}{\Sigma W} = \frac{\Sigma(\bar{y}m)}{\Sigma m}$$

M;



A; ① 구리 원통 + ② 철 원통 상부 + ③ 철 원통 하부

① $h = h_1 + h_2 = 28 \text{ mm}$

$$V = \frac{\pi}{4} (d_2^2 - d_1^2) h = \frac{\pi}{4} [(15 \text{ mm})^2 - (10 \text{ mm})^2] (28 \text{ mm}) = 2,749 \text{ mm}^3$$

$$m = \rho_b V = (8.80 \times 10^{-6} \text{ kg/mm}^3)(2,749 \text{ mm}^3) = 24.19 \times 10^{-3} \text{ kg}$$

$$\bar{y} = \frac{1}{2} h = \frac{1}{2} (28 \text{ mm}) = 14.0 \text{ mm}$$

② $V = \frac{\pi}{4} (d_3^2 - d_2^2) h_1 = \frac{\pi}{4} [(22 \text{ mm})^2 - (15 \text{ mm})^2] (20 \text{ mm}) = 4,068 \text{ mm}^3$

$$m = \rho_s V = (7.86 \times 10^{-6} \text{ kg/mm}^3)(4,068 \text{ mm}^3) = 31.98 \times 10^{-3} \text{ kg}$$

$$\bar{y} = h_2 + \frac{1}{2} h_1 = (8 \text{ mm}) + \frac{1}{2} (20 \text{ mm}) = 18.0 \text{ mm}$$

③ $V = \frac{\pi}{4} (d_4^2 - d_2^2) h_2 = \frac{\pi}{4} [(36 \text{ mm})^2 - (15 \text{ mm})^2] (8 \text{ mm}) = 6,729 \text{ mm}^3$

$$m = \rho_s V = (7.86 \times 10^{-6} \text{ kg/mm}^3)(6,729 \text{ mm}^3) = 52.89 \times 10^{-3} \text{ kg}$$

$$\bar{y} = \frac{1}{2} h_2 = \frac{1}{2} (8 \text{ mm}) = 4.0 \text{ mm}$$

$$\Sigma m = [24.19 + 31.98 + 52.89] \times 10^{-3} \text{ kg} = 109.06 \times 10^{-3} \text{ kg}$$

$$\Sigma(\bar{y}m) = [(14.0)(24.19) + (18.0)(31.98) + (4.0)(52.89)] \times 10^{-3} \text{ kg}\cdot\text{mm}$$

$$= 1,125.5 \times 10^{-3} \text{ kg}\cdot\text{mm}$$

$$\bar{Y} = \frac{\Sigma(\bar{y}m)}{\Sigma m} = \frac{1,125.5 \times 10^{-3} \text{ kg}\cdot\text{mm}}{109.06 \times 10^{-3} \text{ kg}} = 10.320 \text{ mm} \Rightarrow \text{중심} = (0, 10.32 \text{ mm}, 0)$$

R; (과정의 타당성 검토) (가령, 원통의 부피 및 질량 계산 과정)

T; (결과의 의미 검토) (가령, 중심의 위치)