

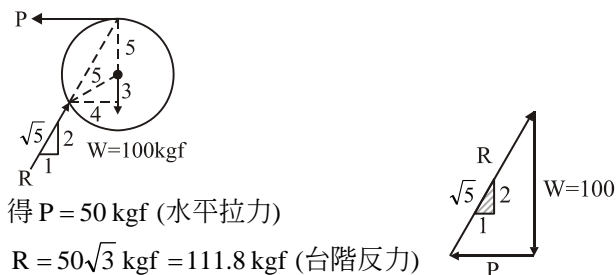
# 100 學年四技二專第三次聯合模擬考試 土木與建築群 專業科目 (一) 詳解

100-3-06-4

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
D	A	A	A	A	B	B	A	C	D	C	D	C	B	D	D	B	B	C	C
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
B	A	A	B	C	C	A	D	B	C	A	D	B	D	C	D	C	A	B	D

## 第一部份：工程力學

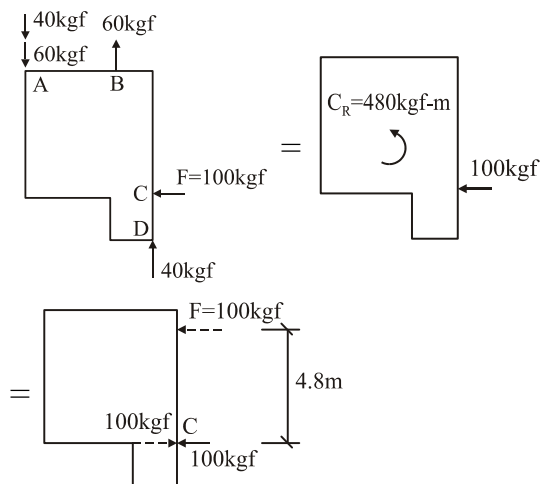
2. 由三力平衡，繪力的多邊形



得  $P = 50 \text{ kgf}$  (水平拉力)

$R = 50\sqrt{3} \text{ kgf} = 111.8 \text{ kgf}$  (台階反力)

3.



$$C_1 = 40 \times 6 = 240 \text{ kgf-m (}\curvearrowright\text{)}$$

$$C_2 = 60 \times 4 = 240 \text{ kgf-m (}\curvearrowright\text{)}$$

$$C_R = 240 + 240 = 480 \text{ kgf-m (}\curvearrowright\text{)}$$

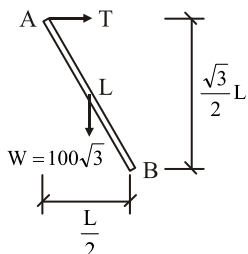
所以力 100 上移 4.8 m

4. 繪 AB 桿自由體圖

$$\Sigma M_B = 0$$

$$T \times \frac{\sqrt{3}}{2} L = 100\sqrt{3} \times \frac{L}{4}$$

$$T = \frac{100}{2} = 50 \text{ kgf}$$



5. 由座標差得

$$f_x = 520 \times \frac{3}{\sqrt{3^2 + 4^2 + 12^2}} = 120 \text{ kgf (}\rightarrow\text{)}$$

$$f_y = 520 \times \frac{4}{\sqrt{3^2 + 4^2 + 12^2}} = 160 \text{ kgf (}\uparrow\text{)}$$

$$f_z = 520 \times \frac{12}{\sqrt{3^2 + 4^2 + 12^2}} = 480 \text{ kgf (}\swarrow\text{)}$$

6. 先求  $R_A = 30 \text{ kgf (}\uparrow\text{)}$

$$R_{Cy} = 60 \text{ kgf (}\uparrow\text{)}$$

$$R_{Cx} = 40 \text{ kgf (}\leftarrow\text{)}$$

利用節點法求各桿件應力

7. 利用斷面法取自由體圖

$$\Sigma M_J = 0, 10 \times 2 = 6 S_{DE}$$

$$S_{DE} = 3.3 \text{ tf (C)}$$

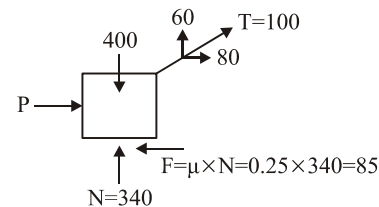
$$\Sigma F_y = 0$$

$$S_{IJ} = 3.3 \text{ tf (T)}$$

取節點 D 平衡  $S_{CD} = 13.3 \text{ tf (C)}$

8. 取物體自由體圖，由  $\Sigma F_x = 0$

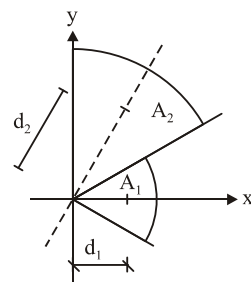
$$P + 80 = 85, P = 5 \text{ kgf (}\rightarrow\text{)}$$



$$9. A_1 = \frac{\pi \cdot 6^2}{6} = 6\pi, A_2 = \frac{\pi \cdot 12^2}{6} = 24\pi$$

$$d_1 = x_1 = \frac{r \sin \theta}{\theta} = \frac{6 \sin 30}{\frac{\pi}{6}} = \frac{18}{\pi}$$

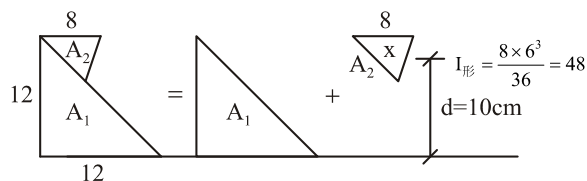
$$d_2 = \frac{12 \sin 30}{\frac{\pi}{6}} = \frac{36}{\pi}, \therefore x_2 = \frac{d_2}{2} = \frac{18}{\pi}$$



$$\bar{x} = \frac{A_1 x_1 + A_2 x_2}{A_1 + A_2} = \frac{6\pi \cdot \frac{18}{\pi} + 24\pi \cdot \frac{18}{\pi}}{6\pi + 24\pi} = \frac{18}{\pi}$$

$$10. I_x = \frac{12 \times 12^3}{12} + I_{\text{形}} + \left(\frac{8 \times 6}{2}\right) \times (10)^2$$

$$= 12^3 + 48 + 24 \times 100 = 4176 \text{ cm}^4$$



11. 由  $G = \frac{E}{2(1+\mu)}$  得  $E = (8 \times 10^5) \times 2 \times (1 + 0.25)$   
 $= 2 \times 10^6 \text{ kgf/cm}^2$

再由  $\delta = \frac{Pl}{AE} = \frac{2000 \times 300}{\frac{\pi \times 2^2}{4} \times 2 \times 10^6} = \frac{3}{\pi} \text{ cm}$

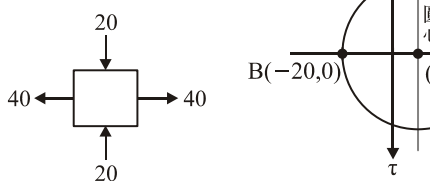
13.  $G = \frac{E}{2(1+\mu)} = \frac{150 \times 10^9}{2(1+0.25)} = 60 \text{ GPa}$

$K = \frac{E}{3(1-2\mu)} = \frac{150 \times 10^9}{3(1-2 \times 0.25)} = 100 \text{ GPa}$

14. 由莫耳圓得

A(40, 0)

B(-20, 0)



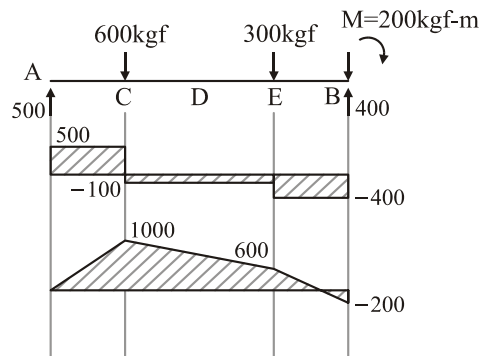
由莫耳圓得

$\sigma_{1P} = 40 \text{ kgf/cm}^2$ ,  $\sigma_{2P} = -20 \text{ kgf/cm}^2$

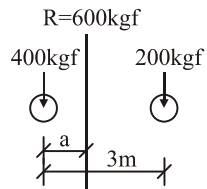
$\tau_{\max} = \frac{AB}{2} = \frac{40 - (-20)}{2} = 30 \text{ kgf/cm}^2$

15.  $M_D = 1000 - (2 \times 100) = 800 \text{ kgf-m}$

$V_D = -100 \text{ kgf}$ ,  $M_B = -200 \text{ kgf-m}$ ,  $V_A = 500 \text{ kgf}$



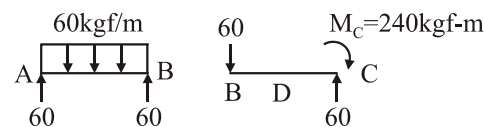
16.



$600 \times a = 200 \times 3$   
 $a = 1 \text{ m}$

M 最大為 1215 kgf-m

17. 計算反力, 求 V-M 圖



$M_D = 60 \times 2 = 120 \text{ kgf-m}$

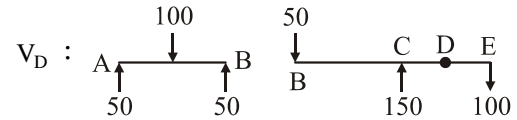
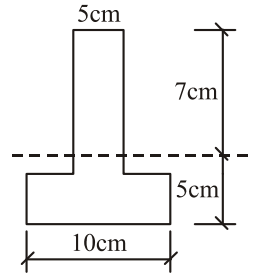
由  $\sigma_o = \frac{My}{I} = \frac{120 \times 100 \times (5-2)}{6 \times 10^3} = 72 \text{ kgf/cm}^2$

18. 梁彎曲最大剪應力  $\tau = \frac{VQ}{bl}$

$y = \frac{40 \times 2 + 40 \times 8}{80} = 5$

$Q = A \cdot y = 35 \times 3.5 = 122.5$

$I = \frac{5 \times 7^3}{3} + \frac{10 \times 5^3}{3} - \frac{5 \times 1^3}{3} = 986.7$



得  $V_D = 100 \text{ kgf}$ ,  $b = 5 \text{ cm}$

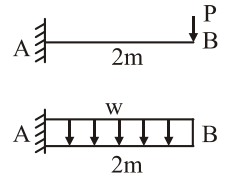
代入  $\tau_{\max} = \frac{VQ}{bl} = \frac{100 \times 122.5}{5 \times 986.7} = 2.5 \text{ kgf/cm}^2$

19. 利用重疊法

$\delta_{B1} = \frac{PL^3}{3EI} = \frac{3(2)^3}{3EI} = \frac{8}{EI} (\downarrow)$

$\delta_{B2} = \frac{wL^4}{8EI} = \frac{8(2)^4}{8EI} = \frac{16}{EI} (\downarrow)$

得  $\delta_B = \delta_{B1} + \delta_{B2} = \frac{24}{EI} (\downarrow)$



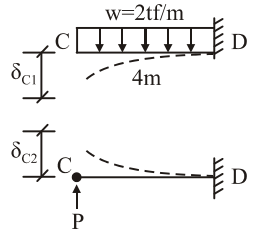
20. 由 CD 梁, 如右圖

得  $\delta_{C1} = \frac{wl^4}{8EI} = \frac{2 \times 4^4}{8EI} = \frac{64}{EI} (\downarrow)$

由公式得

$\delta_{C2} = \frac{Pl^3}{3EI} = \frac{P \times 4^3}{3EI} = \frac{64P}{3EI} (\uparrow)$

從上得知  $\frac{64}{EI} = \frac{64P}{3EI}$ ,  $P = 3 \text{ tf}$



所以工作人員甲  $\downarrow 2 \text{ m} \uparrow 2 \text{ m} \downarrow$   
 甲 6tf 3tf=P

需拉 3 tf, C 點才不產生撓度

## 第二部份：工程材料

21. 物理性質：比重、比熱、含水率、分貝、軟化點  
 力學性質：應變、硬度、脆性、疲勞
23. (B) 標準稠度用費開針  
 (C) 水泥的檢驗項目有比重、抗壓、抗拉強度、抗彎強度...等  
 (D) 水泥吸收空氣中水分, 會增加風化作用, 強度減少
24. 欲使用巨積混凝土, 可降低 C<sub>3</sub>A 與 C<sub>3</sub>S, 提高 C<sub>2</sub>S
25. 水泥凝結時間採用「費開針」, 直徑 1 mm 之貫入針, 每隔 5 分鐘作一次貫入試驗
26. 氯化鈣會增加水化熱
28. 細度模數：凡殘留於標準篩上骨材百分率累積總和除以 100 所得之值

29. 混凝土 3 天強度約為  $\frac{1}{3}f_c'$ ，7 天強度約為  $\frac{2}{3}f_c'$
31. 牆面鋪貼以硬底工法較佳，地坪鋪貼以軟底工法較佳
32. 基礎放腳寬度為牆身厚度 2 倍，每次放腳寬  $\frac{1}{4}B$
34. 炎熱地區應使用低針入度瀝青，寒冷地區應使用高針入度瀝青
36. 木材之防腐以藥劑注入法較佳
37. 材積計算：  
 $3 \text{ 組} \times (2 \text{ 支} \times 2.5 \times 1 \times 0.4 + 2 \text{ 支} \times 2.5 \times 2.5 \times 0.6) = 28.5 \text{ 才}$
38. 聚胺基甲酸酯樹脂(PU)
39. 金屬材料中鐵材以紅丹漆防鏽佳，鋁材則應使用鉻酸鋅系塗料
40. 鋼含碳量增加，則熔點降低