

109 學年度四技二專第二次聯合模擬考試

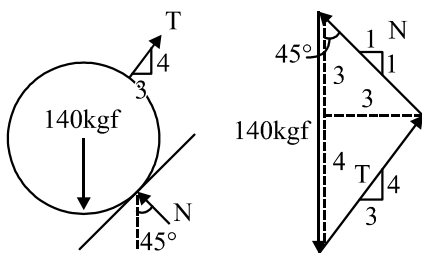
土木與建築群 專業科目(一) 詳解

109-2-06-4

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

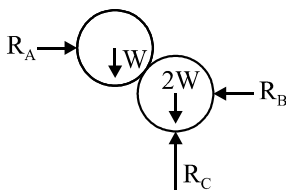
第一部分：工程力學

2. 繪製自由體圖如下

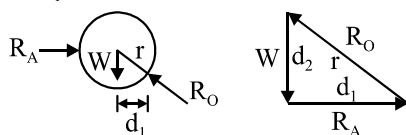


$$\frac{140}{7} = \frac{N}{3\sqrt{2}} = \frac{T}{5} \quad \therefore N = 60\sqrt{2} \text{ kgf}, T = 100 \text{ kgf}$$

3. 繪製其自由體圖



$$R_C = 3W; R_A = R_B$$

取 O_1 自由體圖討論

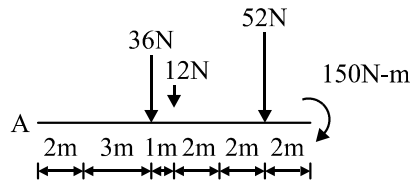
$$d_1 = \frac{2R - 2r}{2} = R - r, \quad d_2 = \sqrt{r^2 - (d_1)^2} = \sqrt{R(2r - R)}$$

$$\frac{W}{d_2} = \frac{R_A}{d_1} \quad \therefore R_A = \frac{W}{d_2} \cdot d_1 = \frac{R - r}{\sqrt{R(2r - R)}} W$$

$$4. +\curvearrowright \Sigma M_O, 35 \times (1 \times 2) + 100 \times (0.7) = 140 \text{ N}\cdot\text{m}$$

$$100 \cdot \frac{7}{25} x = 140 \quad \therefore x = 5 \text{ m}$$

5.

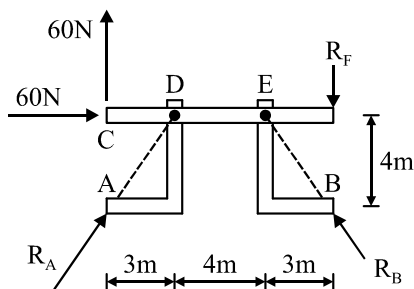


$$\text{合力 } R = 12 + 36 + 52 = 100 \text{ N}$$

$$+\curvearrowright \Sigma M_A, 36 \cdot 5 + 12 \cdot 6 + 52 \cdot 10 + 150 = 922 \text{ N}\cdot\text{m}$$

$$R \cdot x = 922 \quad \therefore x = \frac{922}{100} = 9.22 \text{ m}$$

6. 繪製自由體圖，AD 及 BE 構件為二力桿件



$$+\rightarrow \Sigma F_x = 0, 60 + R_A \left(\frac{3}{5}\right) - R_B \left(\frac{3}{5}\right) = 0$$

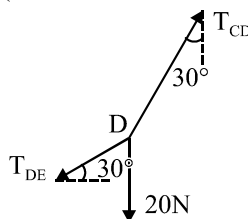
$$+\uparrow \Sigma F_y = 0, 60 + R_A \left(\frac{4}{5}\right) + R_B \left(\frac{4}{5}\right) - R_F = 0$$

$$+\curvearrowright \Sigma M_B = 0, 60 \cdot 4 + 60 \cdot 10 + R_A \left(\frac{4}{5}\right) \cdot 10 = 0$$

$$\therefore R_A = -105 \text{ N}, R_B = -5 \text{ N}, R_F = -28 \text{ N}$$

(負值表力的方向與原假設方向相反)

7.

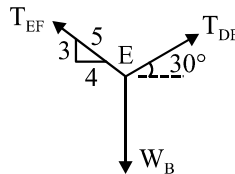


$$+\rightarrow \Sigma F_x = 0$$

$$T_{CD} \sin 30^\circ - T_{DE} \cos 30^\circ = 0 \quad \therefore T_{CD} = \sqrt{3} T_{DE}$$

$$+\uparrow \Sigma F_y = 0$$

$$T_{CD} \cos 30^\circ - T_{DE} \sin 30^\circ - 20 = 0 \quad \therefore T_{DE} = 20 \text{ N}$$



$$+\rightarrow \Sigma F_x = 0, T_{DE} \cos 30^\circ - \frac{4}{5} T_{EF} = 0 \quad \therefore T_{EF} = \frac{25}{2} \sqrt{3} \text{ N}$$

$$+\uparrow \Sigma F_y = 0$$

$$T_{DE} \sin 30^\circ + \frac{3}{5} T_{EF} - W_B = 0 \quad \therefore W_B = \frac{20 + 15\sqrt{3}}{2} \text{ N}$$

8. 由圖(七)得知各點座標如下

A(0, 0, 0)、B(1, 3, 2)、C(3, 4, 0)

$$\vec{CB} = (-2, -1, 2)$$

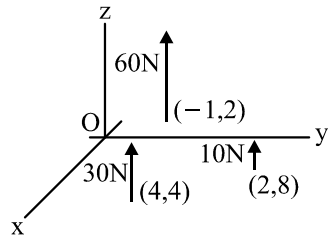
$$\vec{F} = 90 \cdot \frac{(-2, -1, 2)}{\sqrt{(-2)^2 + (-1)^2 + 2^2}} = (-60, -30, 60)$$

$$\vec{r}_{AB} = (1, 3, 2)$$

$$\vec{M}_A = \vec{r}_{AB} \times \vec{F} = \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ 1 & 3 & 2 \\ -60 & -30 & 60 \end{vmatrix} = 240\vec{i} - 180\vec{j} + 150\vec{k}$$

故 $M_x = 240 \text{ N}\cdot\text{m}$

9.



合力 $R = 100 \text{ N}$

$$30(4, 4) + 10(2, 8) + 60(-1, 2) = 100(\bar{x}, \bar{y})$$

$$(\bar{x}, \bar{y}) = (0.8, 3.2)$$

10. 為對稱結構，故 $T_{DA} = T_{DB} = T_{DC} = T$

各點座標如下

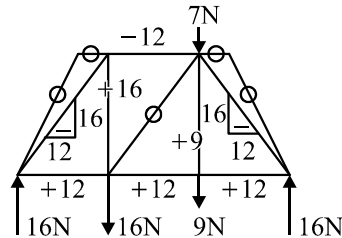
$O(0, 0, 0)$ 、 $A(0, 0, -30)$ 、 $B(-15\sqrt{3}, 0, 15)$ 、

$C(15\sqrt{3}, 0, 15)$ 、 $D(0, 30, 0)$

$$T_{AD} = T \cdot \frac{(0, 30, 30)}{\sqrt{0^2 + 30^2 + 30^2}} = T(0, \frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}})$$

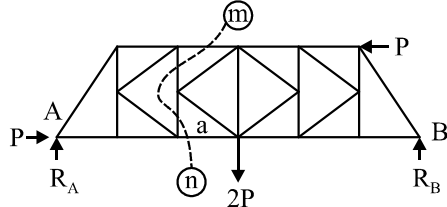
取 F_y 合力討論， $3T(\frac{1}{\sqrt{2}}) = 27\sqrt{2}$ $\therefore T = 18 \text{ kN}$

12.



零桿數為 5

13.

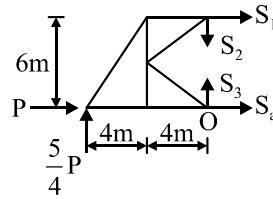


$$+\circlearrowleft \Sigma M_A = 0$$

$$2P \times 12 - P \times 6 - R_B \times 24 = 0 \quad \therefore R_B = \frac{3}{4}P$$

$$+\uparrow \Sigma F_y = 0, R_A + R_B - 2P = 0 \quad \therefore R_A = \frac{5}{4}P$$

取 (m) - (n) 截面左半部討論



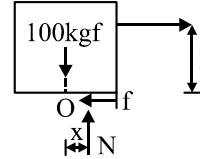
$$+\circlearrowleft \Sigma M_O = 0, \frac{5}{4}P \cdot 8 + S_1 \cdot 6 = 0$$

$$\therefore S_1 = -\frac{5}{3}P = \frac{5}{3}P(C)$$

$$+\rightarrow \Sigma F_x = 0, P + S_1 + S_a = 0 \quad \therefore S_a = \frac{2}{3}P(T)$$

(C 表壓力, T 表拉力)

14.

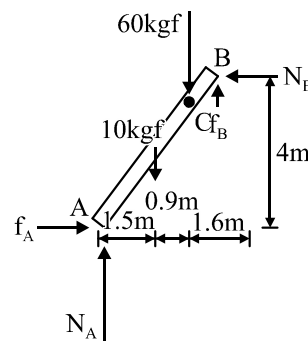


$$P = f = \mu N = 0.2 \times 100 = 20 \text{ kgf}$$

$$+\circlearrowleft \Sigma M_O = 0$$

$$P \cdot h - N \cdot x = 0, 20(4) - 100x = 0 \quad \therefore x = 0.8 \text{ cm}$$

15.



$$f_B = 0.2N_B$$

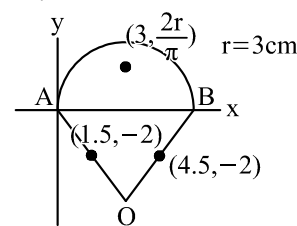
$$+\circlearrowleft \Sigma M_A = 0, 10 \times 1.5 + 60 \times 2.4 - N_B \times 4 - f_B \times 3 = 0$$

$$\therefore N_B = 34.57, f_B = 6.91$$

$$\Sigma F_x = 0 \quad \therefore f_A = N_B = 34.57$$

$$\Sigma F_y = 0 \quad \therefore N_A = 63.09 \quad \therefore \mu = 0.55$$

16.



$$(\bar{x}, \bar{y}) = \frac{\pi(3)(3, \frac{6}{\pi}) + 5(1.5, -2) + 5(4.5, -2)}{10 + 3\pi}$$

$$= (3, -0.10)$$

$$17. I_x = I_y = \frac{\pi(6)^4}{64} - \frac{2 \times 2^3}{12} = 62.28 \text{ cm}^4$$

$$I_x' = I_y' = 62.28 + A \cdot d^2 = 62.28 + (3^2 \pi - 2^2) \cdot 3^2 = 280.75 \text{ cm}^4$$

$$J_O = I_x' + I_y' = 561.5 \text{ cm}^4$$

$$18. P_{\text{鋼}} + P_{\text{混}} = 15.5 \text{ tf}$$

$$A_{\text{鋼}} = 20^2 \pi - 10^2 \pi = 300\pi \quad ; \quad A_{\text{混}} = 10^2 \pi = 100\pi$$

$$\delta_{\text{鋼}} = \delta_{\text{混}} \Rightarrow \frac{P_{\text{鋼}} \cdot L}{\cancel{A_{\text{鋼}} \cdot E_{\text{鋼}}}} = \frac{P_{\text{混}} \cdot L}{\cancel{A_{\text{混}} \cdot E_{\text{混}}}}$$

$$\therefore P_{\text{鋼}} = 30P_{\text{混}} \quad \therefore P_{\text{混}} = 0.5 \text{ tf}$$

$$\sigma_{\text{混}} = \frac{P_{\text{混}}}{A_{\text{混}}} = \frac{500 \text{ kgf}}{100\pi \text{ cm}^2} = 1.59 \text{ kgf/cm}^2$$

19. $\sigma_x = 0$, $\sigma_y = 200 \text{ MPa}$, $\sigma_z = 400 \text{ MPa}$, $\nu = 0.2$

$E = 100 \text{ GPa}$ 代入

$$\varepsilon_x = \frac{\sigma_x}{E} - \nu \left(\frac{\sigma_y + \sigma_z}{E} \right) = -0.0012$$

$$\varepsilon_y = \frac{\sigma_y}{E} - \nu \left(\frac{\sigma_x + \sigma_z}{E} \right) = +0.0012$$

$$\varepsilon_z = \frac{\sigma_z}{E} - \nu \left(\frac{\sigma_x + \sigma_y}{E} \right) = +0.0036$$

$$\varepsilon_V = \varepsilon_x + \varepsilon_y + \varepsilon_z = +0.0036$$

$$\Delta V = \varepsilon_v \cdot V = (+0.0036)(10^3) = 3.6 \text{ cm}^3$$

20.  A horizontal bar is shown with three points labeled A, B, and C from left to right. At point A, a force of 1000N is applied to the left. At point B, a force of 2000N is applied to the left. At point C, a force of 3000N is applied to the right.

$$P_{AB} = +1000 \text{ N} \quad , \quad P_{BC} = +3000 \text{ N}$$

此題問 B 點的位移僅需討論 AB 段變形量

$$\delta_{AB} = \frac{P_{AB} \cdot L_{AB}}{A \cdot E_{AB}} = \frac{1000 \text{ N} \cdot 400 \text{ mm}}{200 \text{ mm}^2 \cdot 200 \text{ MPa}} = 10 \text{ mm (右移)}$$

第二部分：工程材料

21. (B) 第五型卜特蘭水泥，適用於港灣、汙水下水道工程
22. (A) 安山岩：火成岩
(B) 大理石：變質岩
(D) 輝長岩：火成岩
23. (A) 最常使用之速凝劑是氯化鈣(CaCl_2)，最大用量不得超過水泥重量的 2%
24. (A) 兩材料比重均 > 1 ，都會沉於水中
(B) 乙硬度大於甲，所以乙可以在甲上劃出刻痕
(C) 兩材料含水率皆非為 0，均為含水狀態
- 25.

篩號	停留率(%)	累積停留率(%)
3"	0	0
3"/2	0	0
3"/4	0	0
3"/8	10	10
#4	0	10
#8	30	40
#16	10	50
#30	0	50
#50	30	80
#100	10	90
底盤	10	100

$$FM = \frac{(10+10+40+50+50+80+90)}{100} = 3.3$$

26. $\frac{200 \text{ cm}}{5.3+1 \text{ cm}} \times \frac{500 \text{ cm}}{9.5+1 \text{ cm}} \times 1.1 \approx 1663 \text{ 塊}$
27. 布蘭式氣透儀式利用比表面積法來測定水泥細度，期試驗原理是先以一已知表面積的標準水泥試料為壓實層，經由氣透儀測定空氣透過水泥試料所需的時間、空氣壓力及孔隙率等關係，而後再用欲求比表面積的水泥試樣作為壓實層，得到另一組時間、空氣壓力及孔隙率的關係，二者相比較即可求水泥試樣的比表面積
28. 吸水率 = $\frac{(1030-980)}{980} \times 100\% = 5.1\%$
29. (A) 拌合水量是影響新拌混凝土工作性的最主要因素，水量適量就好
(B) 粒料表面光滑會比表面粗糙，有更佳的工作性
(C) 熱天加減水劑，冬天加速凝劑，有助於提升工作性
30. $100 \times (0.3 \times 0.15 \times 0.15 \times 36) \times 500 = 12,150 \text{ 元}$
31. (角材) $20 \times 1 \times 1 \times 1 +$ (板材) $30 \times 10 \times 0.3 \times (0.4 + 0.1) = 65 \text{ 才}$
32. 此敘述為筒板瓦，又稱為中國瓦或琉璃瓦
33. (A) 熱氣乾燥法：將木材放在密閉的乾燥室內，用送風機送入熱風，促進木材乾燥的方法
34. 丙、軟玻璃指的是玻璃受熱熔解之難易，及黏度之大小
丁、鉛玻璃的比重大大於石英玻璃
35. 炎熱的地區須採用針入度較小的瀝青，寒冷的地區則採用針入度較高的瀝青
36. 水泥砂漿抗拉強度試驗：8 字形試體
37. 甲、絕緣玻璃可以讓光線的通過。它是利用降低熱傳導，達到隔熱的效果
乙、毛玻璃是利用氫氟酸溶蝕而製成的
38. (B) 石油瀝青的黏結性較焦油來得強
39. (B) 木材含水率在纖維飽和點(FSP)以上時，不發生收縮與膨脹
(C) 木材的收縮與樹種、鋸木方向、木材部位，及乾燥方式有關
(D) 邊材較心材的收縮率大，比重大的木材，收縮率也較大
40. (C) 油溶瀝青依照石油溶劑種類及揮發速度，可分為 RC、MC、SC